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The Panama Route for an Isthmian Canal.

The selection of the Panama route for an Isthmian Canal to be constructed by the United States is, in fact, so successful a piece of engineering as properly to be called a triumph for that profession. The selection, it is true, is to a certain extent qualified. The Spooner amendment of the Hepburn Bill authorizes the President to construct a canal on the Panama route if he can secure a satisfactory title from the New Panama Canal Company to its property and rights on the Isthmus, the sum to be paid not to exceed $40,000,000. His authorization for the construction of a canal is further conditioned upon securing from the Republic of Columbia for such sum as may be agreed upon, "perpetual control of a strip of land, the territory of the Republic of Columbia, not less than six miles in width, extending from the Caribbean Sea to the Pacific Ocean, and the right to use and dispose of the waters thereon." If he should find the title offered by the French Company unsatisfactory, or if the Columbian Government should prove to be obdurate or unreasonable in its demands for compensation for the rights and privileges necessary to the United States, he is authorized to select the Nicaragua route for the canal provided satisfactory terms can be made with the governments of Nicaragua and Costa Rica. As a matter of fact the constitution of the Republic of Costa Rica must be changed before the desired rights and privileges can be secured by the United States. This difficulty could probably be overcome without great delay, but it requires a public action not yet taken by the government of Costa Rica.

There is little or no reasonable doubt that the government of the Republic of Columbia will without material delay enter into the necessary treaty agreements, and it has been shown by the Isthmian Canal Commission, confirmed by the most careful examination of the matter as disclosed by the arguments in the Senate, that the title offered by the New Panama Canal Company is in every way valid and satisfactory. There are practically two parties on the French side in the purchase of the new Panama Canal Company's property and rights, i. e., the New Panama Canal Company and the liquidator of the old company, the latter being a large holder of the shares of the New Company. The liquidator represents all the claims which the shareholders of the old company can have on the new property. He can act in the disposal of those claims only under the direction of the French Court called the Tribunal Civile de la Seine, and he has the authorization of that court to assent to the sale of the property and rights of the new company to the United States. The New Panama Canal Company is a corporation with power to dispose of its property after due process as prescribed by the French law, and its action has been taken comformably to that process. There can therefore be no reasonable doubt of the validity of the transfer, but under the act passed by both Houses of Congress, the President is to satisfy himself beyond doubt that the title is of such a nature as to be valid and as to shut off all claims whatsoever from either the old shareholders or the new.

There is obviously a possibility of difficulties or delays in dealing with any or all of the Central American governments in interest. Indeed, there is just the possibility of concerted action through secret agreement between them to secure, to their mutual advantage, an extortionate amount from the United States Government for the requisite concessionary rights. Although this is too remote a development to need serious present consideration, should it arise there are conceivable methods available by which the United States could meet it in an effective and conclusive manner. Aside from that feature of the matter, which will probably not arise, the President is now in a position of great advantage in dealing with the whole question. He can proceed with absolute freedom in meeting every possible exigency of the case. There is neither disposition nor desire on the part of the United States Government to take any advantage of any of the three Central American Governments whose territories include the land required for these two routes, but on the other hand there is no intention whatever of being imposed upon by an attempt to exact exorbitant terms for the requisite concessions, and that is one element of the question on both routes which might as well be recognized at once.

The people of the United States have determined to build an Isthmian canal. When the Isthmian Canal Commission was appointed to make an absolutely thorough and complete examination of both routes in a fair spirit and without prejudice, the sentiment of the country was without doubt almost entirely in favor of the Nicaragua route. Indeed, it is probably correct to state that the great majority of engineers qualified to pass judgment upon such questions, who had given much attention to the Isthmian Canal problem, would also have declared against the Panama route and in favor of that in Nicaragua. Many strong influences of various kinds had operated to bring about this result until in one way or another the impression had become firmly lodged in the minds of the great majority of the American people that the construction or ultimate completion of the Panama Canal was beset with difficulties practically insurmountable. Among other things it was supposed that the floods of the Chagres River were substantially uncontrollable and certain to work destructive damage to the canal, either in stages of construction or as completed. The exceptionally complete and thorough examination of the Isthmian Canal Commission, both in the field and by the aid of analytical engineering procedures, have shown with the conclusiveness of actual demonstration that every supposed insurmountable difficulty of construction on the Panama line is imaginary; that construction by that route as a whole, taking every item and every feature of environment, is actually more simply feasible than construction by the Nicaragua route. A number of the principal quantities are far larger in amount on the latter than on the former, and the total cost is correspondingly greater, as is also the time required for completion. The time of passage through the Canal and annual costs of maintenance and operation are largely in favor of the Panama route. In short, the engineering work of the commission has been done with such completeness and fairness as to guide the sentiment and choice of the American people to the wisest and best interoceanic waterway, and that result may well be termed a triumph of civil engineering. It is to be hoped that the construction of the canal may be begun as early as practicable and that the way may be opened to an early completion of this great engineering work.

Stoppages of Sewers by roots of trees made it necessary to relay over 19,500 feet of clay pipes in the system at Berlin, Germany, in 1900. The joints are now made with oakum and asphalt in order to avoid such trouble on new lines.

The Paper on Reinforced Concrete Beams by Professor Hatt, printed in The Engineering Record of June 28, contained an important error, not detected until the edition was printed. The first sentence at the top of the middle column of 603 should read: "This fact has been determined by M. Considére, who says that plain concrete breaks in tension with an elongation of 1 part in 10,000, while reinforced concrete breaks with an elongation of 1 part in 1,000." The author has also added a seventh conclusion to the paper, as follows: "The tensional strength of the concrete is an important factor in the computation of deep beams of reinforced concrete."

The Minnesota Drainage Commission has charge of a system of ditches in the Red River valley which has been the means of reclaiming a large amount of swamp and meadow land of little value except when drained. The work of the Commission, of which Prof. W. R. Hoag is chief engineer, is well told in its last report, which also contains a brief memorandum of a creditable act of the chairman, Mr. Ezra G. Valentine, deserving wider circulation than the report gives. The maintenance of these ditches requires a considerable annual sum, and as the State neglected to appropriate the needed money, this gentleman himself gave for the work the amount the Legislature was asked to grant.

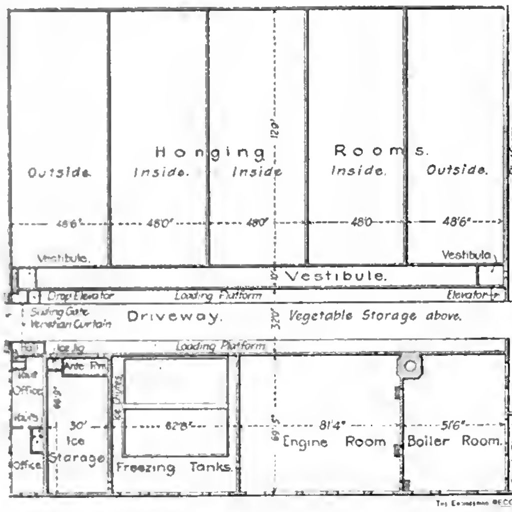
The U. S. Refrigerating Plant at Manila, P. I.

The War Department of the United States has now in operation at Manila, P. I., a large ice-making and refrigerating plant of unusual interest, erected to supply the army and navy stationed in the Philippines with practically the same food they would get if on duty in this country. It was erected at a cost of about $250,000, and has a capacity of 5,000 dressed cattle, 7,000 dressed sheep, 100 tons of bacon, 50 tons of butter and 100 tons of vegetables, besides a plant for making 40 tons of ice daily. The building is about 245 feet square and two stories in height, a higher structure not being advisable on account of the prevalence of earthquakes in that region. In its exterior, an effort has been made to give the architecture as pleasing an effect as possible, and a tall chimney that was adopted to produce draft and carry away the gases of combustion is surmounted with a statue of the Goddess of Liberty and the shaft finished to represent a lofty column.

The plant comprises a boiler room, an engine room, the freezing room, and an ice storage room, extending in line on one side of the building, and two floors of refrigerated, or, as they are termed, hanging rooms, with a driveway between them and the mechanical plant on the ground level, a vegetable room over the driveway and a loft above for insulation from the heat of the sun by means of the air space. The hanging rooms are thus well separated from the boiler and machine rooms, with their necessarily high temperature, and are reached from a corridor or vestibule, parallel with the driveway on each floor, and are not directly open with the outer air. The vestibules at one end are served by an electric elevator built by the Eaton & Prince Company, of Chicago, and at the other end by a hand-controlled drop elevator for lowering material from the hanging rooms. The building is built of red and yellow brick trimmed with stone.

The boiler plant consists of three 200-horse-power Babcock & Wilcox water-tube boilers, two in one battery and the third in an independent setting. Each boiler has a total heating surface of about 2,000 square feet and is fitted with Culver Corliss grates of 40 square feet of grate surface, for burning Japan coal. The coal is stored in a shed extending from the boiler room and dumped in piles in front of the boiler as needed, the firing space or distance from the front of the boilers to the building wall being about 21½ feet, or sufficient to remove any of the tubes. Besides the boiler there are two fire pumps and a boiler feed pump in the engine room, which is 51.5x69.5 feet in plan.

Natural draft is provided for the boilers by means of the ornamental stack mentioned. This is a combination brick and self-supporting steel stack, the brick portion extending through the building and the steel part rising clear above it. The total height of the chimney proper from the boiler-room floor line is 152 feet, while from the arc lamp held in the hand of the Goddess to the boiler room floor is 170 feet. The stack is lined with firebrick to within 25 feet of the top, and the inside diameter throughout the lower part is 5 feet, while that above the lining is 6 feet. The lower part of the brick portion is 14.5 feet square and the upper part octagonal. The steel portion rests on a sectional cast-iron ring and is anchored against it to the brickwork by means of 16 1¾-inch anchor bolts spaced around on a 10½-foot circle. These are 62 feet 4 inches long except at the smoke inlet from the boiler breeching. The firebrick lining through this part of the stack is 8 inches thick and separated from the main brickwork by 4 inches of air space.

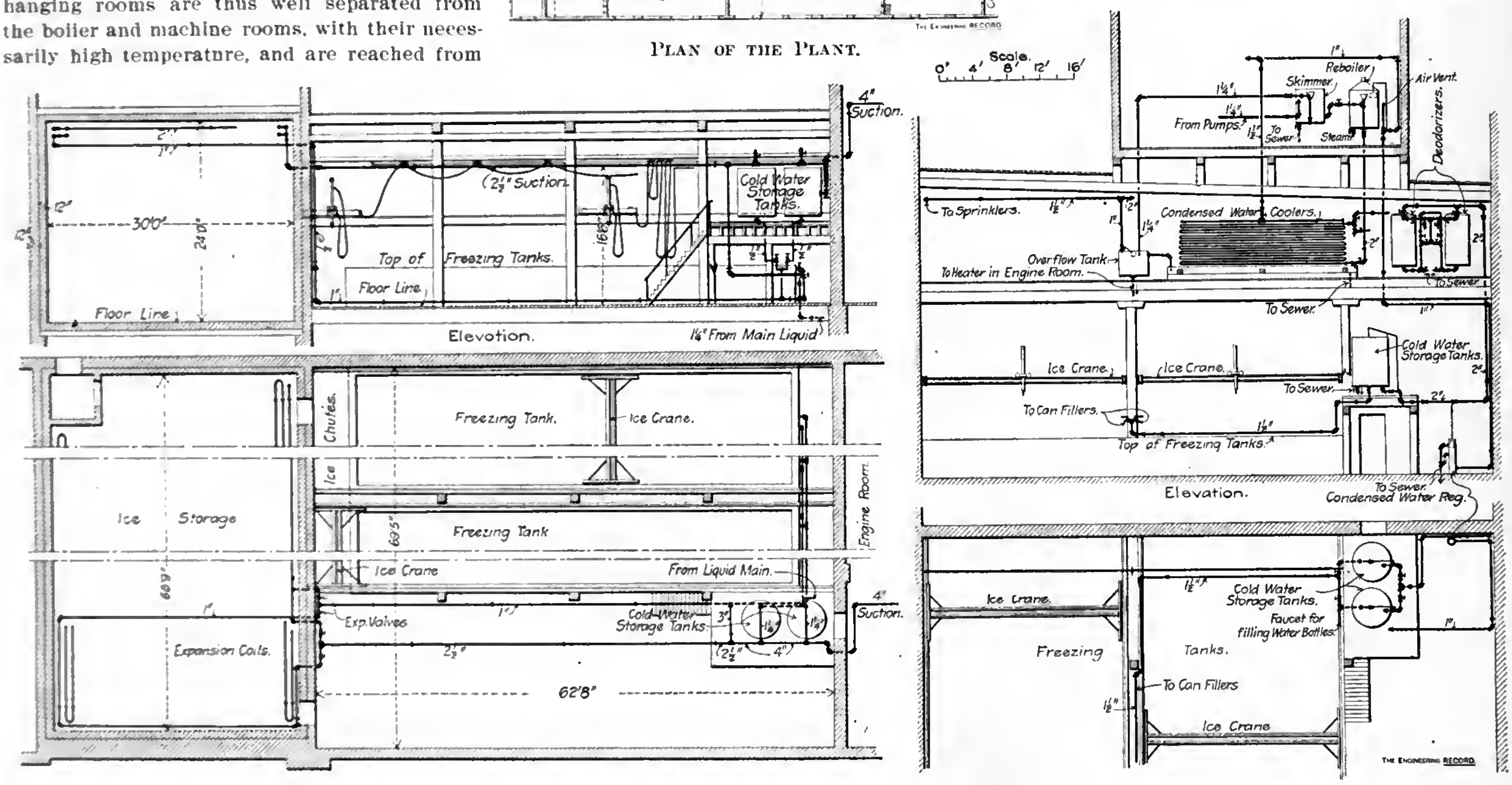


PLAN OF THE PLANT.

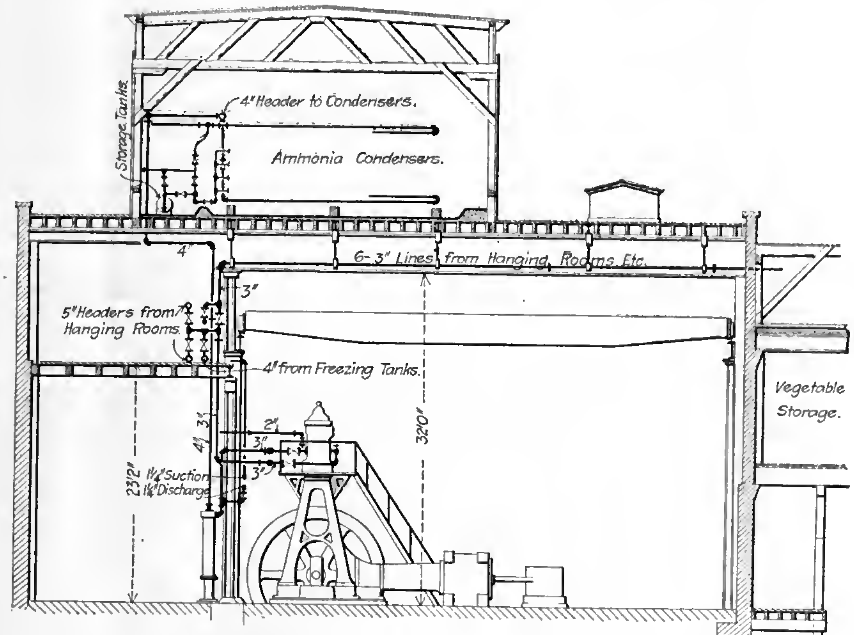
Above the brick portion the steel flue has the usual flaring bottom and the firebrick lining continues through it 4 inches in thickness, leaving 2 inches air space between it and the steel work. About 35 feet of the lower part is hidden in an elaborate covering of No. 16 galvanized iron formed to represent the bottom of a column, and for this part of the structure the regular lap joint seams are employed in connecting sections of the steel work. Above that, however, in order to leave the exterior free from any projections, butt joints were employed with cover plates inside and rivets countersunk flush with the surface. The steel plates are $^7/_{16}$ and ¼-inch thick at bottom and top, respectively. For the support of the statue a skeleton globe of tee iron immediately surmounts the stack; at its equator is attached a 3-inch 6-pound I-beam which acts as a track for a man hoist. The hoist comprises a trolley from which is suspended a 6-inch pulley carrying the rope by which the man is lifted up and down.

Steam is generated at 160 pounds pressure and is carried from each boiler in 8-inch copper pipe built to withstand that pressure, and bent in a 4½-foot radius. These connections feed into a 10-inch main overhead in the rear of the boilers. Each connection has a single stop valve in the horizontal portion and is suspended from the roof beams of the boiler room by long rods carrying hangers with rollers for the easy movement of the pipes. Steam is taken from the 10-inch main from each end, at which point is a Cochrane separator. At one end it feeds the two pumps in the boiler room and from the other the other pump in that room and a 10-inch main which is carried below the floor of the engine room for the ammonia compressors and auxiliary machinery.

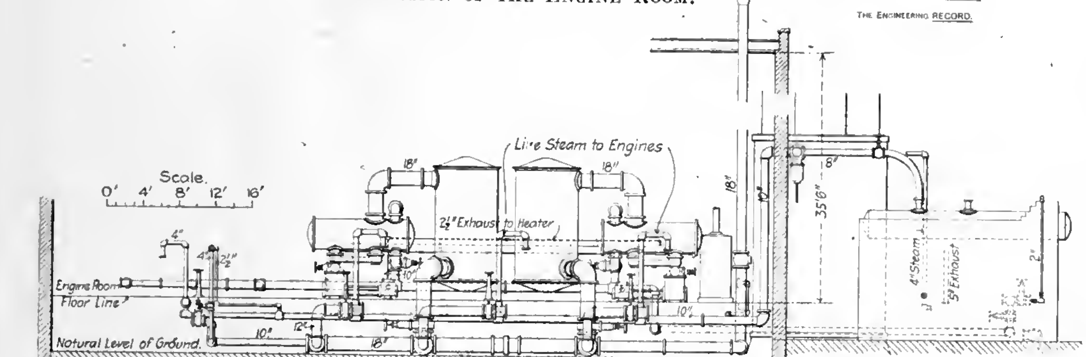
The engine room contains three 125-ton refrigerating machines, a 5-ton auxiliary refrigerating machine, a 150-horse-power steam engine, an equipment of power pumps driven by means of shafting from the steam engine, a 40-kilowatt direct-connected and a 30-kilowatt belt driven electric generator, a duplicate system of coke filters and condensing apparatus for the exhaust steam and a feed-water heater. The refrigerating apparatus is of the compression



THE FREEZING AND ICE STORAGE ROOMS, SHOWING THE WATER-DISTILLING PLANT.



Cross-Section of the Engine Room.



Plan and Elevation of the Boiler and Engine Rooms.

type. Each of the large compressors have tandem, compound, horizontal, Corliss, steam ends, 19 and 38x32 inches in cylinder dimensions and double acting vertical ammonia ends, 14½x32 inches in size, the cylinders side by side. The machines were built by the De la Vergne Refrigerating Machine Company, of New York City, and are of their standard type, employing vertical A frames for the support of the ammonia compressors, and a flywheel 13 feet 4 inches in diameter. The small compressor has a 6½x11-inch double-acting ammonia cylinder and a 10½x7¼-inch steam cylinder.

The 150-horse-power steam engine is of the tandem compound Corliss type built by De la Vergne Company. It runs at 80 revolutions per minute and has a 12-foot flywheel which is used as the driving wheel carrying two belts passing to two jack shafts. To avoid obstructing the floor any more than necessary, the jack shafts are supported overhead. As already stated the various pumps in the room are belt driven, the type being chosen to obtain a number of comparatively small units, which would be more or less expensive in the amount of the steam consumption if steam actuated, and their adoption was also made to secure a compact arrangement without the complexity of numerous steam, exhaust and drip connections. In the one case the engine drives a counter shaft to which are belted three 7x8-inch double-acting pumps to deliver water to the ammonia condensers and a smaller single-acting boiler feed pump; in the other case, it operates three circulating pumps for the condensers of the steam engine and a 2½x4-inch fresh water pump. The pumps were all built by the Stilwell-Bierce & Smith-Vaile Company, and the circulating pumps are run at 250 revolutions per minute, the speed of the counter shafting. In addition to the pumps the 30-kilowatt electric unit is driven by belt from one of the shafts. This is a General Electric direct-current machine to supply current for lighting and for various motors. This dynamo and all the pumps are connected to the jack shafts by means of clutch pulleys.

Although the various pumps mentioned are all belt driven and thus dependent on the continuous operation of the 150-horse-power steam engine, provision has been made by cross-connecting the piping for the fire pumps in the boiler room to take the place of the circulating pumps and the boiler feed pump in the boiler room to substitute for the power feed pump. The fire pump at one end of the boiler room is connected to the ammonia condenser system and that at the other end to the steam condenser system. They are 18x10x12-inch duplex Stilwell-Bierce & Smith-Vaile pumps and have a rated capacity of 1,000 gallons per minute. The steam boiler feed pump is 8x5x10 inches in size. The belt driven generator is likewise accompanied by the independent 40-kilowatt unit, which is a general electric marine type direct-current set, arranged to feed the system supplied by the belt-driven machine. The engine room is served from a hand power traveling crane of 25,000 pounds capacity, built by Maris Brothers of Philadelphia, having a span of nearly 48 feet and leaving a clear height from the floor of the engine room of 24½ feet.

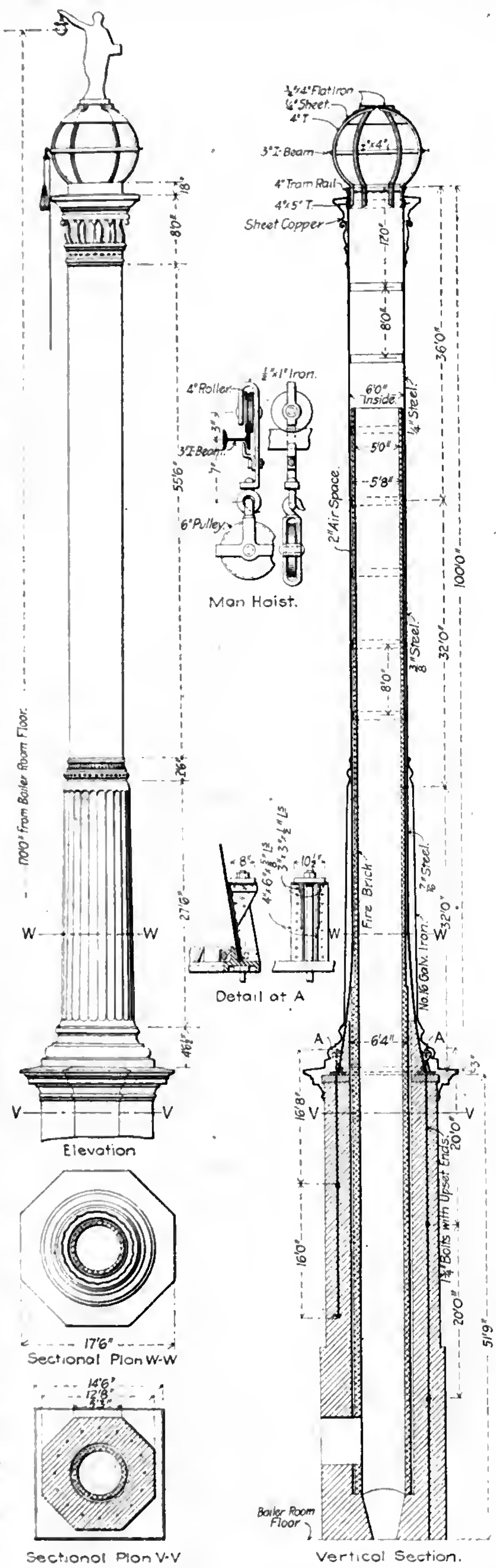
Both steam and exhaust connections to the machines in the engine room are made under the floor, the valves having extended stems and ordinary floor stands. The exhaust is collected into an 18-inch header, passes through two 18-inch connections to two coke filters and thence reaches the condensers, one connected to each filter. Arrangements have been made in the disposition of the condensed steam to return all or part to the boilers for conversion into steam again or into a distilling plant for use in cans in the freezing tank room, the can system of ice making being employed, which requires water free from air to make transparent blocks of ice. The coke filters, which contain Connellsville coke, are 7 feet in diameter and 15 feet high. The condensers are Wainwright surface condensers made by the Taunton Locomotive Manufacturing Company and each has about 1,400 square feet of cooling surface which was calculated on a factor of 2.6 square feet of cooling surface per horse-power, each horse-power being defined as the equivalent of 15 pounds of steam per hour. Each condenser is operated in connection with a 10x16x18-inch Deane direct-acting steam air pump. Water from the Rio Pasig is used for condensing purposes and is received at an average temperature of 85 degrees Fahrenheit. An equipment of triplex pumps is installed for the condensing water, as stated, with provision to use one of the fire pumps when necessary, and the water is drawn from a settling well or cistern 12 feet in diameter and 14 feet deep. In the proportions of the condensing system, a temperature range in the condensing water of 30 degrees was allowed for.

The feed water may be delivered to the boilers by means of a direct-acting steam pump in the boiler room or a triplex pump in the engine room, both drawing from the feed-water heater, which is a Cochrane feed-water heater, made by the Harrison Safety Boiler Works, of Philadelphia. The triplex feed pump is also cross-conected with a sweet water pump, likewise of the triplex type, alongside the steam condenser pumps, for furnishing water for the freezing cans, the suction connections for this purpose coming from the condensers before the water passes to the heater. As stated, the condensed steam that is drawn from the condenser and frozen in the cans is distilled for the removal of air and impurities in order to produce ice as transparent as possible. The distilling apparatus is located in the freezing room and consists of a skimmer in which the impurities are floated off, of a reboiler the office of which is principally to expel the air, a cooler to condense the re-evaporated water, a deodorizer containing hardwood charcoal for the purpose that its name indicates, and cold water storage tanks from which the freezing tanks are filled as needed.

This apparatus is distributed on three floors in the freezing room. The fresh water pump in the engine room delivers to the skimmer, which, with the reboiler, occupies the highest position. The overflow from the skimmer, which carries off the foreign substances, is led to an overflow tank on the floor below. In this the water has a further chance to clarify itself, and it is then led back to the feed-water heater for use in the boilers. The tank is provided with an overflow to the sewer, and a constant water level is maintained by means of a float valve admitting fresh water whenever necessary. From the reboiler, which is equipped with submerged steam coils and a vent to the atmosphere for the escape of air, the steam flows to the cooler on the floor below, which is a pipe condenser of 640 feet of 2-inch pipe. The condensed water then passes through the deodorizers and thence to two cold-storage tanks immediately above the freezing tanks. Each of these contains a submerged ammonia coil for cooling the water before emptying it into the cans.

The ammonia distributing system represents the standard practice of the De la Vergne company. The ammonia condensers are located in a room above the engine room the full length of the latter and about 32½ feet wide. There are altogether three sets of 13 condensers each, corresponding to the three compressors, each condenser consisting of 2-inch pipe 24 pipes high and 20 feet long. The ammonia gas from the compressors is carried into a header from which each condenser is supplied and which can be divided into three sections by valves. The condensing water is delivered in an 8-inch pipe feeding a 6-inch header passing in opposite directions across the condensers with 1¼-inch pipes for each condenser. Fresh water is used in this condensing system and the warm water is utilized partly for sprinkling the ice cans to remove the frozen cake and partly being sent to the feed-water heater through the overflow tank in the distilling plant.

The freezing room contains two tanks capable of a daily output of 20 tons of ice each. The can system is employed, as stated, with the cans immersed in brine which is cooled by the direct expansion of ammonia. The tanks are 52.5 feet long, 23¾ feet wide and 4 feet deep, and each contains 112 lengths of 2-inch pipe 49 feet 3 inches long. The pipes are connected by return bends and are placed in rows 16 inches on centers and six pipes high in general, forming 16 alleys or longitudinal spaces in which the cans are placed. The coils in each tank are supplied with liquid ammonia at four points and the suction from them at four intermediate points. A propeller fan is provided for each tank to circulate the brine, each driven from a 3-horse-power motor. Each tank is spanned by a crane 24 feet 2½ inches span, carrying a pneumatic hoist for handling the ice. The compressed air for this purpose is furnished by two New York air brake air compressors. At the far end the ice is dumped from the can upon an ice chute by which it is delivered to the ice storage room adjoining,



DETAILS OF THE CHIMNEY.

where it can be loaded on wagons or kept indefinitely.

The proportions of the refrigerated rooms of the plant are as follows: The ice storage has two levels of 2-inch pipes on the ceiling and the ratio of cubical contents in cubic feet to cooling surface in square feet is 16 to 1. The vegetable room, which is over the driveway, 30 feet 4 inches wide, 128 feet long and 11 feet high, has four lines of pipe on each side wall toward the ceiling, and seven lines, each four pipes deep, on the ceiling; the ratio is 16 to 1. Each of the hanging rooms, which are 47x129x11 feet in dimensions, have the pipes arranged above the usual false ceiling to set up an internal circulation of air. In the case of the four outside hanging rooms, that is those at each end of the building on the first and second floors, the ratio is 8 to 1; and in the case of the six inside rooms it is 10 to 1. The hanging rooms are entered from a long vestibule in which the valves to the cooling coils are all controlled.

Each room is fitted with overhead tracking with the main lines running down the vestibules. The entire tracking system comprises 25,000 feet of track, 15,000 hangers, 12,000 trolleys and 1,000 ball-bearing switches furnished by the New Jersey Foundry and Machine Company, of New York City.

The original plans for the plant, which is known as the Insular Cold Storage and Ice Plant, were drawn under the supervision of the Quartermaster Department of the U. S. Army, for which Messrs. Frank L. Strong and Edward Barrath, of Chicago, were consulting engineer and consulting architect, respectively. The general contract was awarded to the De la Vergne Refrigerating Machine Company, of New York, which designed the details of the plant as described. Maj. Leon S. Roudiez, U. S. A., under whom the work was completed, is in charge of the plant.

Standard Cement Specifications.

A paper read by Mr. R. W. Lesley, Assoc. Am. Soc. C. E., before the American Section of the International Association for Testing Materials.

Of the making of specifications, there is no end. This, at least, is the experience of the cement manufacturer, whose material, instead of being tested according to lines thoroughly well settled, as in the iron and steel business and tested at the place of manufacture, as is the practice in other businesses, is subjected to endless variations of tests, which are frequently made thousands of miles away from the point at which the goods are produced. The material tested is not the material that leaves the works, as its form and character are changed by making it into briquettes, test pieces, etc., neat and with sand, and it is subjected to all sorts of manipulations, so that the results obtained frequently vary materially from those made under similar conditions at the place of manufacture. Consequently, there is no industry worse off, for definite specifications, than the cement industry, and none has suffered more than that industry from the lack thereof.

It is with pleasure, therefore, that I am here to address an Association the purpose of which is the standardizing of testing and methods of testing, and it is my pleasure in addressing it to state, in a very general and brief way, some of the disadvantages that the cement industry has labored under during the formative period of tests which has been going on in this country, and some of the many advantages that would accrue as well to the manufacturer, the user, and the engineer and architect, by the adoption of standard methods and the correlation of different standards and specifications adopted by the various classes of engineers and consumers using the material.

In my office, I have a large fireproof safe containing many volumes of filing cases, solely devoted to the embalming in fireproof receptacles of specifications that have come to me at various times during my business career. These specifications are of all kinds and of all characters, mostly good but some few bad and indifferent, containing elements of every imaginable description, both as to the requirements and as to methods of handling the material in arriving at the requirements suggested. This is the mere literary side of cement specifications that I have in my office.

The practical side of this business is at our laboratory at our works. This laboratory, quite a large room, say, 20x20 feet, a few years ago was entirely papered on its four walls with cement specifications. One wall was devoted to the specifications of the army engineers of the United States Government, well considered, well thought out and well reasoned specifications, all of them. Another side was almost covered with specifications of the United States navy engineers of the Bureau of Yards and Docks and other bureaus of the same department; all specifications thoroughly thought out, well planned, well conceived. At the other end of the room, the pattern varied somewhat, and there were gathered the requirements as to quality and the methods of manipulation of cement testing to be done by the various railroads of the country. They were more concise, more brief and more to the point, but all of them intelligent, able and well drawn. On the other side of the room, surrounding the door, were grouped a more general gathering of these interesting documents, and embraced what the city engineers all over the country and the engineers of large municipal works in the United States thought should be required of cement, and how it should be handled in arriving at these requirements. Needless to say, this series of patterns embraced a larger variety and covered a larger area of territory, and, like the others, represented careful, hard work, and well conceived and well balanced requirements.

Individually, almost any one of the specifications on the four sides of that room, could be picked out at random, as a fair, reasonable specification of what Portland cement should be. Almost any one of them could be used with advantage and with success and, with few exceptions, any one of them could be carefully scrutinized and nothing seriously ill-judged or unbalanced could be found within its lines.

It is a remarkable tribute to the engineering ability of our country that when all these specifications which covered the four sides of a room and running into the hundreds in number, are gone over carefully, that there are so few which will not stand the test of careful examination and scrutiny, and the conclusion is to be clearly drawn from the facts above stated, that it is not so difficult for intelligent engineers to make a specification containing the proper requirements for fineness, tensile strain, time of setting, constancy of volume and specific gravity and for proper manipulation of the several tests described. Yet with all these facts before us, it is actually possible that within a single year, a single large cement establishment like our own, receives no less than 100 to 150 of different kinds of specifications, varying in most all their elements.

Taking an assortment of specifications at random and in examining all of them to see just how they did vary, I find that taking the four great classes, the army, the navy, the railroads and the various cities, there were:

In some 25 specifications of various cities of the United States, 7 variations in the item of fineness alone, 14 variations in the requirements of tensile strain, and 6 variations out of 9 requirements in reference to setting-time. In the specifications of the army, some 68 in number, I find some 14 variations in tensile strain, 11 variations in fineness, 7 variations in time of setting, and 4 in constancy of volume. In the specifications of the navy, some 7 in number, there were 3 variations in fineness, 5 in tensile strength, with no variation in the time of setting. Among the railroads, of which 8 specifications were found, there were 5 variations in fineness, 5 variations in tensile strain and 3 variations in the time of setting.

As to boiling and hot tests, I took some 35 requirements of these tests gathered from my specifications, and out of these 35, in 10 the pats go into water after 24 hours, in 14 the pats go into water after no specified time, and in 11 the pats go into water after setting. Again, out of these 35, in 6 the pats go into steam for 3 hours, in 14 the pats go into hot water for no specified time, in 1 the pat goes into hot water for 3 hours, in 2 the pats go into hot water for 30 minutes, in 1 the pat goes into hot water from 24 to 36 hours, in 8 the pats go into hot water for 24 hours, in 1 the pat goes into hot water for 10 hours, and in 2 the pats go into hot water from 24 to 48 hours. Again, out of these 35, in 21 the pats go into boiling water, in 4 the pats go into a temperature of 212 degrees, in 6 the pats go into a temperature of 176 degrees, in 1 the pat goes into a temperature of 170 degrees, in 1 the pat goes into a temperature of 100 degrees. Finally, out of these 35 specifications, in 13 the pats are to boil for time not specified, in 2 the pats are to boil 30 minutes, in 1 the pat is to boil 3 hours, in 1 the pat is to boil 24 to 36 hours, in 3 the pats are to boil 24 to 48 hours, in 1 the pat is to boil 10 hours, in 5 the pats are to boil 24 hours, in 1 the pat is to steam 3 hours, then stay in hot water 48 hours, and finally to boil one hour; in 1 the pat is to steam 3 hours and to boil 48 hours, in 4 the pats are to steam 3 hours and remain in hot water 48 hours, in 2 the pats stay in hot water 48 hours, in 2 the pats stay in hot water at 176 degrees for 24 hours, and in 1 the pat stays in hot water at 110 to 115 degrees for 24 hours. From this it can readily be seen, from the manufacturer's standpoint, that not only the pat, but the manufacturer himself is in "hot water" for all sorts of indefinite periods of time.

Now, just for one moment, imagine the manufacturer's plight while trying to make a cement during the course of a short period in which these specifications were received, which would meet all these different requirements and conditions, and then you can see at a glance, how important it is, not only that there should be a standardizing of methods, but that there should be a standardization of specifications. I am happy to say that two departments of our Government have already taken this step, and where one wall was formerly covered with the specifications of the United States army, that wall is a blank with the exception of the one specification [see The Engineering Record of September 14 and 21, 1901], recommended by the army board, composed of Major W. L. Marshall, Major Smith L. Leach, and Captain Spencer Cosby, and approved by the United States Engineer Corps. This shows the result of the good work of a very capable force of good engineers.

The other wall, formerly having as its decoration the productions of the engineers of the navy, is to-day practically a blank space, with a single ornament in its center, namely, the small frame containing the specification of Rear Admiral M. T. Endicott, U. S. N., giving the requirements for all the work of the United States navy, [see The Engineering Record of February 4, 1899]. These two Government specifications are not quite alike but in many of their elements are at least within "shooting range" and it is possible to meet them, without performing the gymnastic feats in manufacturing which were requisite to meet the requirements of the many varieties of predecessors they had on our walls.

We still have with us the railroads and the municipalities. The railroads are taking a step in the same direction as these two branches of the Government, and while there has not been a formally adopted specification of all the railroads in this part of the country, the last convention of the American Railway Engineering and Maintenance of Way Association adopted a tentative specification [see The Engineering Record of April 12, 1902], which represents much good work and is in the line of standardization in that department.

The cities and commonwealths of the country, in the execution of their large work, have not yet arrived at the standardization of specifications, but we have hopes that it will come next.

Now what I want to make clear, after having gone through this underbrush of discussion, is that this Society of ours has within its hands a golden opportunity in the field of cement specifications. The army, the navy and the railroads have all gone forward in the proper lines and are practically committed to forms of specifications embracing requirements for the various elements and properties and for methods of manipulation giving reliable results by the respective tests suggested. The American Society of Civil Engineers has appointed a committee to determine upon the proper manipulations of tests of cement, and this committee, several of whose distinguished members are with us to-night, has been laboring with this subject for several years and I understand will shortly report.

Now our Society cannot, with loyalty to itself or regard for its fellow society and the engineers of the Government and the railroads, undertake to undo or criticize the work that these bodies have done. It cannot with propriety adopt new methods of manipulation while so distinguished a body as the American Society of Civil Engineers has this subject under consideration. It cannot of its own motion set up new standards and new requirements, while the army, the navy, and the railroads have come to conclusions of their own on this subject. But this Society of ours, international in its features, can at a time when the export trade in this country in cement is increasing at the rate of five hundred per cent. a year, take steps in co-operation with army and navy engineers and the American Society of Civil Engineers and in co-operation with scientific bodies abroad, to arrive at some method by which a correlation of the specifications of this country and Europe may be reached and results obtained whereby cement manufactured at any point of the world may be tested under similar methods of manipulation and subjected to similar tests at any point where it may be delivered. This cannot be done by independent action, but it must be done by suggestive and persuasive action, and with the support and cooperation of the bodies who have preceded us in the field and have carried out independent investigations on their own lines. It can be best done by the organization, under the auspices of this body, of a cement section, which shall have among its membership representative engineers of the principal consumers of cement, distinguished testing engineers representative of the various well known testing laboratories, and also representatives of the leading manufacturers. Such a section, comprising in itself representatives of the consumer, the producer and the inspecting engineer, would soon arrive at proper methods for the accomplishment of the object and the work would redound to the credit of all concerned, as well as to the Society of which they are members.

The New England Cotton Manufacturers' Association will hold its seventy-third meeting at 12 West 31st St., New York, Sept. 30-Oct. 2.

Some Features of the Works of the Stanley Electric Mfg. Co.

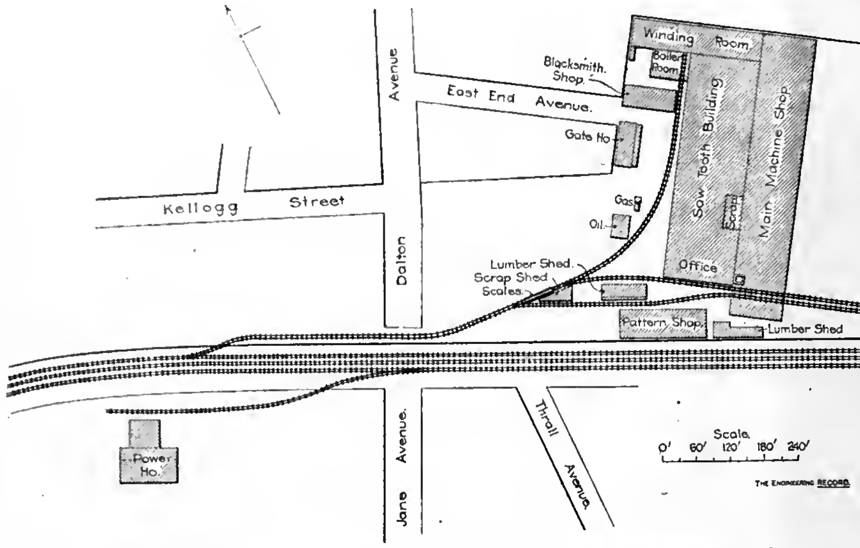
About a year ago the Stanley Electric Manufacturing Company, of Pittsfield, Mass., moved the main portion of its works into a new group of buildings situated about a mile and a half from the center of that city. Notwithstanding an ordinary provision for a gradual increase in business, however, the works have been crowded for space since their occupation; and although additions have constantly been made, operations have for some time been carried on both night and day.

The shops are electrically driven and are equipped with traveling and stationary cranes, overhead tracking with both pneumatic and hand hoists, compressed air and gas for brazing, etc. The buildings are in general lofty, well lighted by side windows and roof skylights and are painted white inside. For artificial illumination both arc and incandescent lamps are used, the latter held by brackets and floor standards, as well as by pendant wires. Automatic sprinklers are provided, connected with a system of fire mains running about the grounds with outside hydrants at different points. All departments are connected by the Clark automatic telephone system and the Rochester employes' time recording system is used.

An accompanying plan of the works shows the relative location of the different buildings. There is a main shop, 92.5 feet wide and 500 feet long, and extending laterally from this sawtooth roof building 128 feet wide. The latter is to be occupied by different departments, sections corresponding to one, two or three divisions of the roof being partitioned off for the purpose. One of these departments, devoted to coil winding, has been extended to a total length of nearly 235 feet. The main entrance to the works is located between the blacksmith shop and the gate house, the latter being a three-story structure containing general toilets on ground level, a recreation room and library for the technical information of the employes on the second floor and offices for the works' manager and others above. The plant is located alongside the Boston & Albany Railroad with sidings as shown. The power-house is situated about 1,000 feet from the center of the works, on the bank of the lake from which it draws both feed and condensing water. It is located also alongside the railroad, providing at once good railroad facilities and proximity to water.

The main building is a machine and erecting shop, about 60 feet wide in the main part with a lofty interior and a central skylight in the roof. Extending from the side bay on the first floor is the sawtooth building. The main building and bay are of steel construction, built by the Boston Bridge Works, while the sawtooth building is of brick with timber roof trusses, the skylights facing in the usual way toward the north. The main shop has two electric traveling cranes of 60-foot span, built by the Whiting Foundry Equipment Company, one of 30 tons capacity and the other of 15 tons. The longitudinal tracks are about 45 feet above the floor. Along both sides of the shop are arranged 17 pneumatic hoists mounted on swinging jib cranes. These hoists vary from 1 to 3 tons capacity. The floor is of $1\frac{1}{8}$-inch maple laid on $2\frac{7}{8}$ North Carolina pine matched plank, the latter on 4x4-inch chestnut timbers, 4 inches on centers, on 4 inches of tar concrete.

The first floor of the side bay is largely taken up with the machine shop, the largest machine tools, however, being distributed toward one end of the main building. The other end is given up to erecting and shipping work, and at about the center of the building is located the testing department. The shop contains in this portion a cast-iron floor plate on which large machine parts are finished by means of portable tools. The gallery of the bay contains most of the stamping machinery for the formation of the armature laminations and a long storeroom, besides a portion of the office, which had to find room for additional drafting space. For testing work a line of heavy shafting, to allow a motor to drive a generator and vice versa, has been erected against a longitudinal girder, as shown in the accompanying interior view of the main shop.



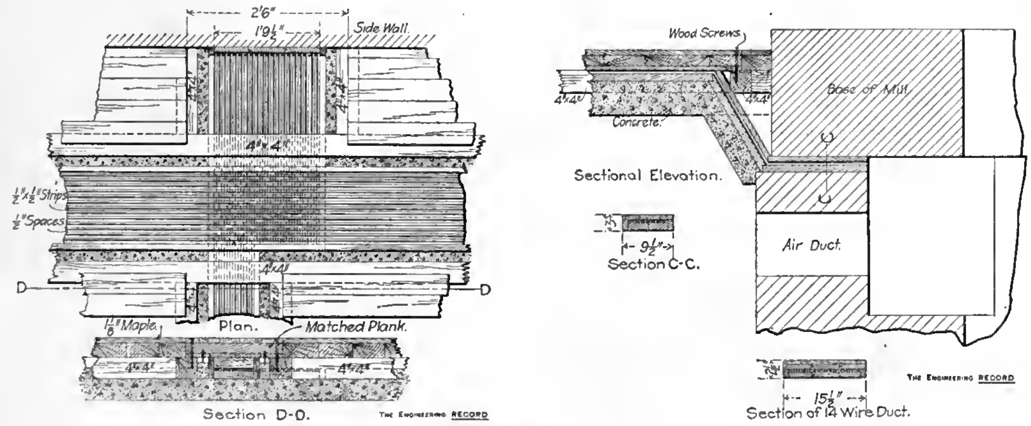
THE WORKS OF THE STANLEY ELECTRIC MANUFACTURING CO.

VIEW OF THE MAIN MACHINE SHOP.

At present castings are made outside of the works, the foundry for which ground space has been provided not yet having been built. The largest castings are brought into the main shop on the two tracks running through it at the shipping end and are lifted from the cars and carried to the desired point for machining by means of the traveling cranes. For shifting cars and storing material in the yard outside, a combination steam hoist and locomotive, built by the Brown Hoisting Machinery Company, has been provided. The locomotive hoist has a lifting capacity of 10 tons. For handling material in the gallery, there are two or three platforms extended from the gallery floor, which the large cranes can readily reach, and a 2-ton electrically operated crane furnished by Maris Brothers, of Philadelphia, which travels practically the entire length of the gallery. Its motors are controlled from the floors by means of drop cords. For passing heavy articles from the gallery floor to the first floor, there are two 4,000-pound direct-acting hydraulic elevators made by the Plunger Elevator Company, of Worcester, Mass.

The larger machine tools are, of course, driven by individual electric motors. In the case of the lathes, the grouping system is used, with ceiling motors. In one or two instances, two motors drive together a line of shafting. Each motor has four drop ropes within easy reach for its control from the floor. Wires to the machine-tool motors are in general carried in conduits under the floor, each wire having an independent duct formed by wood strips between the conductors. As indicated in the accompanying illustrations, a main conduit extends along the outside wall, and opposite each machine a number of wires are tapped; these usually run upward on the side of the wall to the controlling switches and then down to the underfloor duct leading to the machine motor.

In assembling and finishing the machinery, a large amount of chipping and drilling is done by means of pneumatic tools, and electric connections are brazed and soldered together by means of portable gas burners. For this work there are three lines of piping extending around the main shop about 25 feet above the floor level, from which are tapped branch pipes, to outlets near the floor where flexible hose connections are made. One of the pipes is for the compressed air, which is maintained at 80 pounds pressure, and the other two are for the gas, one for the gasoline vapor, brought from the gas house, so called, located in the open near the gate house, and the other for air under about 5 pounds pressure, the air being mixed with the gasoline in the flexible connections for combustion in the burners. The pneumatic tools were furnished largely by the Standard Pneumatic Tool Company, of Chicago. The air is compressed by a two-stage horizontal Ingersoll-Sergeant compressor, direct-connected to a 40-horse-power alternating-current motor. The compressor plant is located in a room partitioned off in the first story of the bay. Above its roof, it has a 3x10-foot reservoir or air-storage tank. The compressed air is also used in numerous direct-acting pneumatic traveling hoists suspended from overhead tracking; these were furnished by the Pedrick & Ayer Company, of Philadelphia.



METHOD OF CARRYING WIRES FROM MAIN CONDUIT UNDER THE FLOOR.

For artificial illumination, in addition to arc lamps, pendant incandescent lamps are used wherever convenient, but a large number of floor supports are also employed for this type of lamp, the supports consisting of vertical pipe standards, through which the wires are carried, and an adjustable rod at the top, to which the lamp is attached and held in any convenient position. Some of the lamp rods are fastened to wall brackets by a ball and socket joint. For heating, exposed lines of 2-inch pipe are used, and in the main shop, they are carried around underneath the working benches, which line the walls. For offsetting down-drafts from the roof skylight, six lines of pipe, supported by the roof trusses, run the entire length of the shop, the pipes spaced over 5 feet apart. Thus for the 13,500 square feet of skylight surface, there are about 1,875 square feet of steam pipe surface, a ratio of 7.2 to 1.

The blacksmith shop is a separate brick building, 40x94 feet in plan. In addition to the usual forge work, large transformer cases are built in this shop, constructed of riveted sheet steel. The shop equipment includes seven Buffalo down-draft forges and a Gilles & Jones bending roll electrically driven. The shop has an unusually good appearance; it has a monitor roof, and the lower parts of the brick walls inside are painted black, while above they are white.

The boiler house, adjoining the winding department, is provided to supply steam for various baking ovens and for general heating purposes, and is depressed considerably below ground surface, so that coal cars on the siding dump directly into a coal bunker underneath the track and level at the bottom with the boiler-room floor. This coal bunker is of concrete, as is the lower portion of the boiler-house walls, and has a capacity of 200 tons. There are three boilers in place, with space for a fourth, of the return tubular type, hand fired. One was built by the D. M. Dillon Steam Boiler Works, of Fitchburg, Mass., and two by the E. Keeler Company, of Williamsport, Pa. Steam is generated at 100 pounds pressure and there are two steam mains. Two Worthington pumps are installed in the room to feed the boilers, operated automatically by floats in receivers, one for the high-pressure condensation that cannot return directly to the boilers and the other for the low-pressure returns, which flow back to the receiver by gravity, as made possible by the lower level of the boilers. A single steel stack serves all boilers, which are equipped with the Spencer automatic damper regulator. An electric motor is also installed in the boiler room to operate a pump for draining a sump, to compress air at 5 pounds gauge for the brazing gas system and to actuate an ash hoist which lifts the ashes to wagons outside. The steam piping is covered with H. W. Johns asbestocel covering.

The power-house, located 1,000 feet from the shops, consist of a 54x50-foot boiler room, a 62x100-foot engine and generator room and a pump pit or basement under the latter. The plant is operated condensing and the boilers are equipped with induced draft. The jet type of condenser is used and fresh feed water is constantly taken from the lake and purified in a very interesting manner. The power house is considerably lower than the railroad, so that coal is dumped from cars on a trestle siding directly against the boiler room.

The boiler equipment is of the horizontal return tubular type, comprising four Dillon boilers, of 72-inch diameter shells 19½ feet long. A steam pressure of 140 pounds is carried. The water from the lake was found on analysis to be satisfactory for feedwater with the exception that it contained a good proportion of lime. It was therefore arranged to heat it to a high temperature before delivery to the boilers, to bring about a deposition of the lime, and for this purpose, the water is sprayed at the top of the steel cylinder into a jet of high-pressure steam taken directly from the boilers. The cylinder is 42 inches in diameter and 16 feet high, and is filled with cobble stones which present a large surface upon which the lime may deposit. The water arrives at the lime separating tank at about 200 degrees and is heated by the steam jet to about 360 degrees, at which temperature it is delivered to the boilers. The separating tank, or purifier, is of course insulated, being covered with 2 inches of asbestos. The induced draft apparatus, which includes a 60-inch fan and a direct-connected vertical engine, was furnished by the B. F. Sturtevant Company. The boilers supply steam into a header supported back of the boilers. Alongside this as an overhead walk for controlling the angle-stop valves in the steam connections and for reaching the feed-water purifier. The blow-off steam valves on the boilers are provided with pipes to the atmosphere for the escape of steam above the roof.

The engine room contains three steam engines arranged to drive a jack shaft and from that numerous electric generators. Belted generators were adopted to obtain both direct and alternating current and different frequencies of the latter by different machines, but it is intended later to replace the comparatively small units with larger machines and install frequency changers at the testing department in the main shop. The three engines are of the following manufacture: one 300 horse-power McIntosh & Seymour tandem componnd, one 100 horse-power tandem-compound engine built by the Ball Engine Company, of Erie, Pa., and one 180 horse-power Ball & Wood simple engine. The engine room is spanned by a 60-foot hand-power crane built by the Stanley Company. In the pump pit is a National feed-water heater placed in the exhaust of the large engine, a 12x18x24-inch Blake condenser, and a secondary feed-water heater for the utilization of the exhaust of the rest of the machinery. An 18x10x12-inch Knowles duplex underwriters pump is also located in the pit, having a rated capacity of 1,000 gallons per minute at 70 revolutions per minute, two 6x4x6-inch feed pumps furnished by the Warren Steam Pump Company, of Warren, Mass., and a pump for the return of clean high-pressure drips to the boilers. The live steam connections to the engines are fitted with Direct steam separators, and a Worthington meter is introduced in the feed-water line for keeping a record of the evaporation, in connection with a daily log that is taken.

In the works described, the Stanley Electric Manufacturing Company make direct-current machines as well as alternating current machines, chiefly of the well known inductor type of machine, peculiar to the company's S. K. C. system, in sizes as large as 2,500 kilowatts and for voltages as high as 12,000 volts. Transformers are also manufactured at the new works and the Stanley hot-wire indicating instruments. Switchboards and instruments in general are still made at the old works, on Clapp Avenue, Pittsfield.

The officers and heads of departments of the company are as follows: Dr. F. A. C. Perrine, president and general manager; Mr. W. W. Gamwell, treasurer; Mr. John H. Noble, assistant general manager; Mr. C. C. Chesney, chief electrician and head of engineering department; Mr. John F. Kelly, consulting electrician and head of legal department; Mr. F. R. Whittlesey, purchasing agent and head of cost department; Mr. J. H. Kelman, general superintendent; Mr. D. S. Kimball, works engineer; Mr. C. C. Morgan, manager supply department; Mr. R. W. Power, head of draughting department; Mr. W. J. Lloyd, engineer of instrument department; Mr. Gilbert Wright, engineer of switchboard department, and Mr. Ray D. Lillibridge, the technical advertising expert in charge of advertising details.

The North German Lloyd Pier-Sheds, Hoboken.—III.

The erection of the steel superstructure of the pier-sheds was commenced at the shore end of pier 2, and after all but two bents of its principal members and the fire walls had been assembled the erection traveler was shifted and resumed work at the river end of pier 1. The steel was delivered on the pier deck by two lighters with long derrick-booms which assembled the three sections of the roof trusses in blocking in a horizontal plane at a convenient height above the pier deck where the field splices were riveted up complete before erection. The brackets were also field-riveted to the columns before the latter were erected. The full-length columns, weighing about 8,400 pounds each, were first erected and temporarily held in place by two 35-foot side-booms of the traveler which extended across the end of the shed and receded before it as the successive bents of the framework were erected.

The completed roof trusses, weighing about 25,000 pounds each, were lifted by the two 40-foot center-booms of the traveler and by tackles suspended directly from the masts, and were seated on the column brackets and temporarily bolted there. The suspenders were inserted and bolted and the second-story floor-beams, each in three 10,000-pound sections, were lifted up and seated on the column brackets and bolted to them and to the suspenders from the roof trusses. The purlins and floor joists were then assembled to connect the last bent with the preceding one, and finally the monitor was erected on top of the roof trusses.

The first pair of columns were temporarily braced, just below the roof trusses on the shore side, by inclined longitudinal 12x12-inch spliced timbers about 45 feet long, and just above the top chord of the roof truss each column was guyed by two ⅞-inch wire cables in opposite directions in longitudinal planes. The bent being thus secured, the columns were released from the side booms and the traveler receded 18 feet towards the river and erected the second bent in the same way and then assembled all the principal longitudinal members connecting them, including the eaves girders and all diagonal rods. The connected benta formed a stable tower able to resist ordinary horizontal stresses, and the successive bents were erected and added to it at the rate of about nine bents in a week when there was no delay for materials.

In order to provide abundant security against possible violent winds the structure was additionally braced in the longitudinal planes of the columns by diagonal timbers and rods in occasional panels of the first and second story, and by about a dozen ⅞-inch wire-rope diagonal guys which reached across four panels horizontally and were occasionally shifted forward as the erection advanced. Ten gangs of riveters followed the erectors as closely as possible, keeping usually about four bents behind, and were in turn followed by men building the floor and roof arches and laying roof and monitor planks.

The contractor's power plant is located on shore, about 1,500 feet from the most distant part of the work, and has two horizontal tubular boilers with a combined rating of 125 horsepower. The boiler feed-water is delivered at about 50 pounds city pressure and is first used to cool the cylinders of the air compressors. This raises its temperature to 50 or 60 degrees, and it is afterwards raised in the feed-water heater to about 190 degrees before delivery to the boilers. There is a Laidlaw-Dunn-Gordon duplex air compressor with 12x12x18-inch cylinders having a rated capacity of 535 cubic feet of free air per minute. These discharge into twin cross-connected receivers from which the air is piped the full length of each pier and is delivered at 95 pounds pressure to a maximum of 18 hammers, 2 reamers and 2 oil furnaces on each pier. All field riveting, reaming and drilling was done by pneumatic tools, which were found satisfactory, rapid and economical, one gang being able to average daily 240 ⅞-inch rivets up to 5 inches long, besides building and moving their own scaffolds.

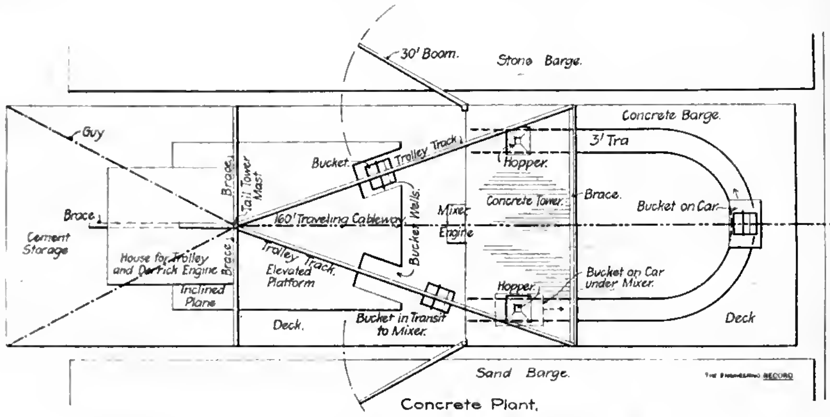
The traveler is similar in general design to that used a few years ago by the same contractors for the erection of Pier No. 13, North River, New York, and described in The Engineering Record of January 18, 1896, but differs materially from it in details. It is built entirely of timber and has two vertical braced masts and four 5-ton booms. There is a 28x74-foot trussed base, 14 feet deep, which is elevated on corner posts to clear materials stored on the deck of the dock, and supports the masts, which are set about 46 feet apart in its rear face and rise about 76 feet above the deck of the pier. The masts are carried between a pair of lattice-girder trusses about 1 foot apart in vertical planes transverse to the axis of the pier-shed, and their feet are seated on steps attached to the bottom chords of the trusses. The tops of the masts are connected by another lattice-girder truss in the same plane, and are each braced to the opposite side of the base of the traveler by a pair of divergent, stiff-legs which are connected by X-brace planks, omitted in the elevation to avoid confusion.

About 24 feet below their tops the masts are each braced by four 8x8-inch stiff-legs, two in the plane of the lattice girders and two in an inclined plane. Seats are bolted to the masts at the tops of these stiff-legs to receive the booms which have horizontal pin connections to vertical shouldered pivots. Floor platforms, about 7 feet above the pier-shed deck, are built on the lower chords of the front and rear trusses of the traveler base, and support the two three-drum hoisting engines, boilers, coal bins, etc. The vertical end-posts of the transverse trusses extend below their lower chords and are stiffened by kneebraces at their connection to longitudinal sills seated at each end on the axles of two pairs of wide-faced flangeless wheels 18 inches in diameter which roll on the longitudinal side timbers of the pier-shed deck.

The four-part boom tackles were all rove with manila rope and the fall lines of the topping lifts on the inner booms were operated by three-part tackles. At the foot of each pair of booms a nine-part wire rope fixed tackle was suspended from the mast for use in hoisting the heavy roof trusses. When the traveler was in service the tops of the masts were X-braced by wire rope guys to snubbing posts on the edges of the pier deck, several panels in advance of the traveler. These guys were tightened by hand tackles at their lower ends and were of course shifted every time the traveler advanced.

After the first pier-shed was erected the traveler on the river end of pier 2 was lifted by four nine-part steel rope tackles attached to the corners of its tower at the bottom. On each side the two tackles were suspended from the boom of a lighter derrick brought up close alongside the pier. The lighters lifted the 60-ton traveler bodily 2 or 3 feet clear of the pier and then were towed across to pier 1 and deposited the traveler on it ready to commence erection there. The traveler was out of service only about 3 hours while being moved from one pier to the other. The pier-sheds have been painted with silica-graphite paint made by the Joseph Dixon Crucible Company.

There are about 30,000 yards of concrete in the bulkhead sea-wall and in the footings of the bulkhead house. For mixing and handling this concrete a special plant was installed with a capacity to mix and handle to position about 200 yards in ten hours. The concrete had to be distributed all over the site of the bulkhead house, which is a rectangular structure 130 feet wide and 850 feet long parallel to the shore line. A large quantity of the concrete was laid in the bulkhead wall and cribs and the remaining 9,000 yards was laid in the transverse walls about 20 feet apart and perpendicular to the shore line. The plant included a special concrete barge, which was moored at any point close to the front of the sea wall, and an attached traveling cableway of 5 tons capacity and 160 feet span, which had the head-tower movable on a shore track parallel with the bulkhead line, and the tail-tower on the concrete barge.



Barge and Tail Tower for Building Foundations.

The concrete barge, about 30 feet wide and 100 feet long, was arranged as shown in the general plan. Near the shore end was a tower about 25 feet high which extended across the full width of the barge and contained two 1-yard cubical concrete mixers driven by an independent steam engine. The tower was three stories high with the concrete mixers set in the second story and discharging into special 1-yard steel dump buckets set on flat cars on the deck in the first story. The tower had four corner posts extending about 10 feet above the top of the third floor and two intermediate posts on each long side. On the shore side the intermediate posts extended up to the cap across the corner posts, on which were seated the ends of two horizontal trolley tracks. These tracks extended over the mixer hoppers and the measuring platform, and were supported at the opposite ends on the tail-tower of the cableway.

The tail-tower had a vertical mast with inclined longitudinal and transverse braces and wire rope guys to the corners of the barge. Between these braces was built a house for a 4-

drum Lidgerwood hoisting engine which operated the trolley hoists and two boom derricks, one on each rear corner of the tower.

Cement was stored on deck in the rear of the engine house and carried up inclines to the measuring platform. There were two wells in the measuring platform, and in each of them was set a 1-yard steel bucket with an eccentric bail latched in a vertical position. A steel bucket on castors was filled with sand from the deck of a barge moored alongside and was delivered to the measuring platform by one of the boom derricks and its contents dumped in the large bucket; then the requisite number of bags of cement were poured in on top of the sand and top of that was dumped a bucket of broken stone delivered by the other derrick boom from the barge on the opposite side.

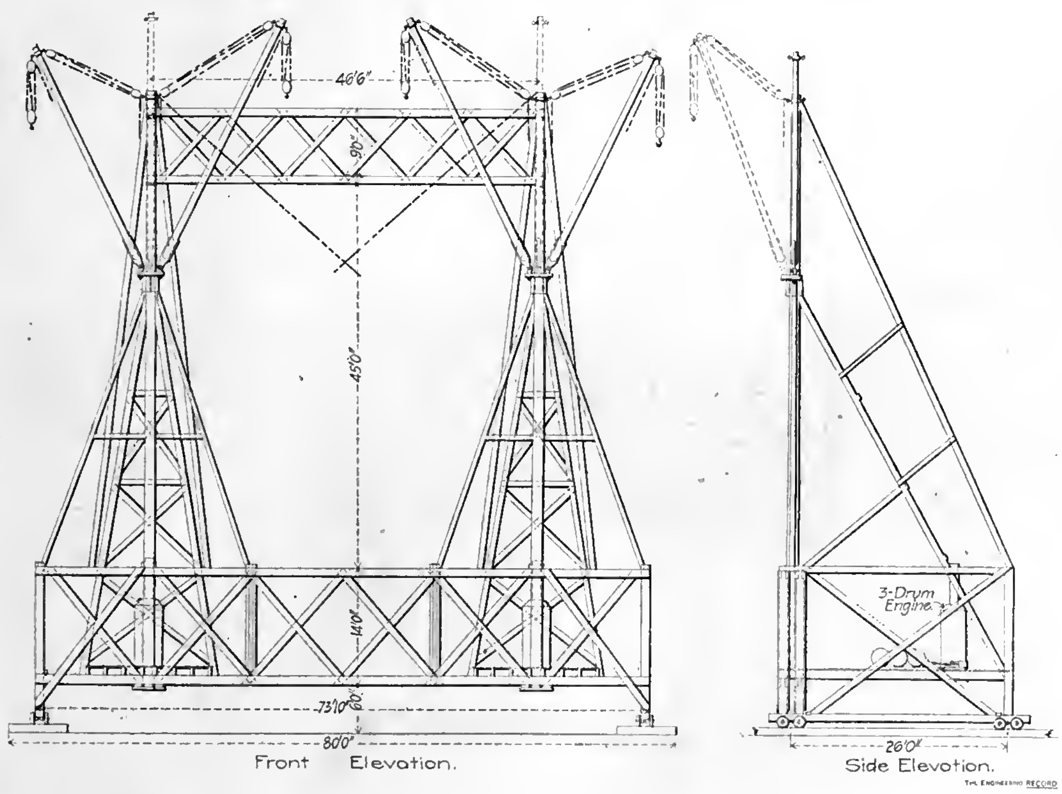
The bucket was then hoisted out of the well by the trolley hoist, which carried it over the upper platform of the tower, where it was dumped into the mixer hopper by releasing the bail-latch, which allowed the unstable bucket to revolve bottom up around the bail pivots. The materials were discharged from the hopper through a slide valve into the mixer and river water was admitted from an elevated tank. The amount of water was observed through a gauge glass, controlled by a valve and introduced into the mixer through a hollow trunnion and an inside perforated pipe parallel with the axis of the mixer.

The concrete hoppers in the top of the tower are 4 feet square with vertical sides 2½ feet high and an inclined bottom 18 inches deep with a 12x12-inch hole in the vertical spout 9 inches long. It is closed by a horizontal 12x20x ⅝-inch steel plate sliding on two 1-inch horizontal guide rods to which it is attached by bent straps riveted to the under side of the plate and running free on the rods. The mixer discharged into a special automatic dumping bucket which was designed for this work by the contractors.

The ends of a horse-shoe-shaped track on the barge deck passed under the concrete mixers and across the plane of the cableway. The concrete bucket was set on a flat car which was pushed by hand to the center of the track and there lifted by the cableway hoist, which carried it out across the bulkhead wall and dumped it wherever required. While a bucket of concrete was being removed from one mixer, the other was being charged, so that the operation of the plant was continuous and the concrete was mixed as fast as it could be handled. The cableway was operated by an engine in the head-tower where there was a 40-foot boom derrick for handling the large rocks which were carefully bedded in the concrete masses. About thirty men were required to operate the barges, mixers and cableway.

The footings for the transverse walls and column rows in the bulkhead house were laid on top of piles cut off about 1 foot above mean low tide, and several hundred piles had been driven and about 500 yards of concrete laid when reports were received of the recent discovery of piles which had decayed between high and low water levels under similar conditions. It was decided to cut the pile tops down to 1 foot below low tide and deposit the concrete on top of and around the pile heads, and methods were considered for lowering the water below low-tide behind the sea wall so that the work could be done dry and at any stage of the tide.

Obviously the river water must be excluded by cofferdams and although the sea wall was not designed for such a purpose nor supposed to be absolutely water-tight, it had been very carefully constructed and it was thought it might serve for the river side of the cofferdam and that the attempt should be made to pump out behind it. If the leakage was found to be very large it was intended to add pumps to as great an extent as should prove economical, and if necessary to divide the area into smaller sections with short sea wall fronts by making additional transverse cofferdams reaching to the shore line. These methods were to be exhausted before attempting to construct new cofferdams on the river front. Accordingly two sheet-pile cross walls were made about 400 feet apart, at the extremities of the first section of the bulkhead building, and one 10-inch centrifugal pump between them proved able to remove the water down to the required level and to maintain it there without working all the time to its full capacity, although the maximum difference of head inside and outside the cofferdam was 8 feet. The old concrete was blasted out, the piles cut down and the remainder of the site excavated to the required level and the foundations built there on the revised plan.



Traveler for Erecting Pier-Sheds.

The submerged part of the sea wall consists of a caisson 22 feet high with solid timber walls and filled with concrete. This rests on a 2-foot solid timber grillage on piles driven through 10 to 20 feet of cobblestones which had been deposited in a trench dredged 60 feet wide to hard clean bottom. Gravel was filled in around the pile tops and up to the grillage, and after the caissons were sunk was farther compacted by a quadruple row of piles driven close to the inside of the caisson. The transverse wall cofferdams were single rows of 10x12-inch yellow pine sheet piles grooved on each of the 10-inch faces to receive 2x4-inch spruce splines which were spiked to one pile before driving. Guide piles 8 feet apart, in two rows about 18 inches apart in the clear were first driven parallel to the center line of the cofferdam and two horizontal waling pieces were gained into the inside of each row, about 4 feet apart vertically. The planed inner faces of the waling pieces were 10 inches apart so as to fit snug against the sheet piles and the latter were driven with beveled lower ends so as to draw up close to the previously driven ones. Cross pieces were set against the guide piles on top of the waling pieces, packing blocks were wedged up between them and the piles as the latter were driven to keep them snug in line, and by these means the wall was made so tight that scarcely any leaks were developed when the water was pumped out.

The work was designed, as before stated, in the office of Mr. W. F. Whittemore, chief engineer of the North German Lloyd Steamship Company, and is being executed under his supervision. Messrs. R. P. & J. H. Staats are the general contractors for both substructures and superstructures. The Pennsylvania Steel Company furnished the structural steel for the three pier sheds and the American Bridge Company will furnish that for the bulkhead house, the erection of which has just been commenced.

An Electrically Operated Pumping Plant at Whitehall, Ill., belonging to the town, but operated by a private electric company, is located about a mile from the central station and provided with a number of special fittings which render an attendant unnecessary. Single-phase 220-volt current is delivered at the pumping station to a 25-kilowatt transformer which reduces the voltage to 208 volts for a 25-horsepower Wagner motor. This is geared to a Smith-Vaile triplex pump having a capacity of 15,000 gallons per hour. Oil is furnished to those bearings not fitted with ring lubricators by means of tubes running from the top of a cylinder placed horizontally over the top of the pump. Inside the cylinder there is a rod revolved by a sewing machine belt from the main shaft of the pump. This rod has a number of projecting arms tipped with wicking, which pick up oil from the bottom of the cylinder and press it into the ends of the tubes. In order to start the machinery, the brushes of the special starting commutator of the motor are fitted with a device for operating a hydraulic by-pass valve. When the machinery is started this valve is opened automatically and allows the water passing the pumps to flow directly back to the reservoir without subjecting the plant to any appreciable load. As soon as the motor comes to speed, the same motion of the brushes that throws the starting commutator out of service allows the hydraulic valve to close gradually and thus turn the pump discharge into the force main. This plant was recently described in the "American Electrician."

Moving a Long Railroad Bridge at New Brunswick, N. J.

The main line of the Pennsylvania Railroad crosses the Raritan River and the Delaware and Raritan Canal at New Brunswick, N. J., on a six-span steel bridge supported by masonry piers in the river and canal, and by abutments on either bank. The New York Division, on which this bridge, No. 26, is located, has now only two tracks at this point, but the plans for elevation of tracks through New Brunswick, now being carried out, contemplate the erection of a four-track arch masonry bridge to replace the present steel structure, and at an elevation which will raise the line about 14½ feet.

The center line of the new masonry bridge coincides with that of the present steel structure, and in order to proceed with the work, and at the same time provide for movement of the regular traffic, it was decided to move the present bridge 14½ feet south, to build the northerly half of the new bridge and then transfer to it the two main running tracks, after which the steel bridge could be taken down and the southerly half of the new bridge built.

Five of the spans, those over the river, were deck Pratt trusses, built by the Pencoyd Iron Works in 1895, each measuring about 150 feet in length and weighing, inclusive of track, 329 short tons, while the sixth span, over the canal, and to the west of the river, was a deck plate girder built by the New Jersey Steel & Iron Company, in 1898, measuring about 150 feet in length and weighing inclusive of track and draw center, 412 tons, making the total length of bridge to be moved about 900 feet and the weight 2,057 tons. The fixed spans were made up of two trusses under each track braced together and supported by pedestals engaging the end lower chord pins, making eight bearings on each pier, and four on each abutment. The distance from base of rail to bridge seat was 21 feet, and from bridge seat to high water about 22 feet additional. The problem was to move the 900 feet of bridge bodily southward 14½ feet, and the time allowed was thirty minutes, which was to cover disconnecting and connecting track, and changing signals. The date fixed upon for the work was Sunday, May 25.

Tracks were laid on each shore to connect with the new location of the bridge, this involving the erection of a trestle some 600 feet in length, and from 18 to 30 feet in height, on the westerly bank, and extensive changes in the platforms, shelters, etc., at the New Brunswick passenger station, about 850 feet west of the bridge. The southerly ends of the piers and abutments were prepared to receive the superstructure when the same should be moved, and on Wednesday, May 21, the canal was closed to the navigation of all vessels requiring more than 33 feet headroom.

The entire bridge was jacked up 4 inches, the bearing plates removed, and three standard 85-pound steel rails, or pieces of bar steel, were laid longitudinally on top of the piers under each transverse set of four pedestals. On each set of rails or bar steel were then placed nests of sixty or more steel rollers, the rollers measuring 1½ inches in diameter and 30 inches in length, spaced 6 inches center to center, the axis of the rollers being at right angles to the long axis of the pier. Flat steel shoe plates 2 feet in length, with the forward end curved slightly upward were placed on the rollers and under each pedestal, after which the bridge was lowered to a firm bearing. On the center pier of the drawspan a similar method was followed except that larger rollers were used.

The drawspan after being put out of service for canal navigation was rigidly fastened to the fixed span adjacent to it on the east. The use of the rollers, rails and shoes was merely to bring the dead weight of the bridge into a shape for easy handling and had nothing to do with the application of the power.

A hoisting engine was erected on a platform built at the foot of each river pier to the south, also at each end of the fixed spans and at the center fender pier of the drawspan, the level of the platforms being only 2 feet above the water. The engines were securely braced against the southerly faces of the piers. Seven engines in all were used, varying according to their position from 14 to 25 nominal horse-power, each engine having at least two spools.

Six long 12x12-inch timbers were anchored against the southerly face of each pier, extending from the river bed to about five feet above the top of the coping, and across the top of these was bolted a heavy crosspiece. From the crosspiece eight-part tackles were run to the southerly trusses under the north track, where the other end of the tackle was fastened to a timber connecting the end posts of adjacent spans. One eight-part tackle was furnished for the end posts of adjacent spans and also between the trusses under the north track and those under the south. The initial strain came on the trusses under the north track, which as they moved southward pushed the trusses under the south track before them, while any exceptional resistance to moving on the part of the south trusses would be immediately overcome by a strain on the equalizer block, which latter served also to secure uniform tension and operation of both sets of blocks and falls, and consequent uniform movement of the adjacent span ends. Stop blocks were set to a measurement of 14½ feet.

As the track on the bridge was not broken between the several spans, and was to be immediately used on the new line, and also in order to avoid any straining of the superstructure, it was essential that the bridge should be kept in good line during the moving, that is, for the entire length of 900 feet the movement should be uniform at every part. To gain this end a wire was led from a point on the superstructure opposite each place where the power was to

MOVING THE PENNSYLVANIA RAILROAD BRIDGE AT NEW BRUNSWICK.

each nest of rollers, i. e., one for each transverse set of pedestals. An equalizer, consisting of two fixed sheaves in a heavy piece of timber was rigidly fixed to the adjacent ends of the northerly trusses under the south track at each pier, the two sheaves being so spaced as to bring one over each of the roller nests on the pier.

One continuous 1½-inch manila line was carried from the engine to the south face of the pier, through single direction sheaves up the face of same to the eight-part tackle on one side, thence through the corresponding sheave of the equalizer to the equalizer sheave on the opposite side of the pier, thence through the other eight-part tackle, down the face of the pier by another set of direction blocks across the platform to the engine. The two ends of the line were then attached to separate spools on the engine.

In order to hold the trusses in the same relative position when the strain was put on the tackle, blocking pieces were inserted between be applied, to the pier or abutment below, around a sheave and along the bridge to a large tell-tale frame at the center span. The frame was hung out over the river and the wires connected to boxes strung vertically on the same. The boxes were then numbered to correspond with numbered indicator boards fixed to the bridge opposite each engine. Before the movement started all boxes were at the foot of the tell-tale frame, and as the bridge moved over to its new location they gradually rose. So all that an engineman had to do, was to have his engine running fast enough to keep his particular box even with the others, and from an indicator board on the tell-tale frame itself, he could also tell how far his portion of bridge had moved.

All preparations were completed at the time decided upon, the connections with the shore rails were cut, the last train left the bridge at 12.10 P. M., and at 12.12.03 one whistle was blown as a signal for the hoisting engines to take up the slack on the tackles. At 12.13.30 two whistles signalled the engines to go ahead, and as steam was put on the bridge moved south, while the tell-tale boxes began to ascend. White flags were waved from each pier to indicate that all was working smoothly, and the tell-tales moved upward evenly and uniformly. The west end of the bridge reached the required position, 14½ feet from the starting point, at 12.15.13 P. M., and the east end at 12.16.20, making the actual time of the operation two minutes and fifty seconds.

At 12.25 report was made that the track was in service and at 12.44 P. M. the first train crossed the bridge in its new location.

In the preparation of the work, the draw span had been set in its closed position, but it was swung open and ready for the passage of boats at 4.45 P. M. An inspection of the superstructure immediately after moving showed that none of the members had been in way strained.

The work was executed by the employees of the Pennsylvania Railroad Company and was planned and directed by the engineering department, Mr. W. H. Brown, chief engineer; Mr. W. A. Pratt, engineer of bridges; Mr. L. H. Barker, principal assistant engineer; Mr. F. P. Abercrombie, superintendent of the New York division, and Mr. A. M. Parker, supervisor of the local section. Master Carpenter G. W. Mershon and his assistant, W. R. M. Mershon, were in direct charge of the moving.

For several years bridge spans have been moved bodily in a transverse direction by American engineers to facilitate their replacement, as has been described in The Engineering Record in several cases, including the five-span Fort Wayne bridge, Pittsburg, which was illustrated in the issue of May 31. Recently it appears that this method has been used abroad, and one of the last issues of the "Engineer" describes the much slower and comparatively more costly operation of moving a single-span railroad bridge near London. An old bridge over a highway was to be replaced by a longer skew through plate girder span with a solid steel trough floor weighing over 100 tons. This was built on a falsework alongside of the old bridge and extending under and beyond it. Each bridge was jacked up and set on four 25-ton hydraulic rams with 18-inch stroke. Each ram was seated in a special heavy steel four-wheel truck, and a double acting pump was provided for each pair of rams. The track was disconnected at 2:25 A. M. Sunday morning, at 3:25 the spans had been successively moved to the new positions by hand windlasses, so that the new one occupied the former position of the old one which was displaced, and at 5 A. M. train service was resumed over the bridge. This shows an interruption of service of 2½ hours to move one 50-foot 100-ton girder span, while at New Brunswick a five-span 2,000-ton trussed structure 900 feet long was moved with a 34-minute interruption to traffic.

The Coke Oven Blowers in the Buffalo plant of the Lackawanna Iron & Steel Company are to be operated by direct-connected 75-horse-power Westinghouse induction electric motors. Four induction motors of 100 horse-power each will be used for operating the gas cleaning plant and the machine shop will likewise be driven by induction motors.

The Portland Cement Industry in the United States in 1901 is reported by the U. S. Geological Survey to have turned out a little over 12,710,000 barrels, an increase of about 4,230,000 barrels over the product of 1900. The imports during 1901 were a little under 940,000 barrels. The production of natural cement in 1901 was about 7,850,000 barrels, and the output of slag cement was about 273,000 barrels.

Underpinning a Tall and Narrow Brick Building.

The method of underpinning the south wall of the main part of the Decker Building, on Union Square, New York, was described in The Engineering Record of May 10, and affords an illustration of one of the tallest and heaviest walls ever supported on needlebeams while long sections of its foundations were removed. More than 2,000 tons of the lofty structure were supported on double tiers of long span steel beams several feet above the excavation, where pits had been dug in sand for adjacent new footings. Although this work was of considerable interest and much importance it conformed to ordinary conditions in that the wall underpinned formed one integral side of a large building with sufficient width to afford abundant transverse stability. It was also thoroughly braced and tied to the rest of the structure by the iron columns and floorbeams which were built into it and bonded it securely with the main framework.

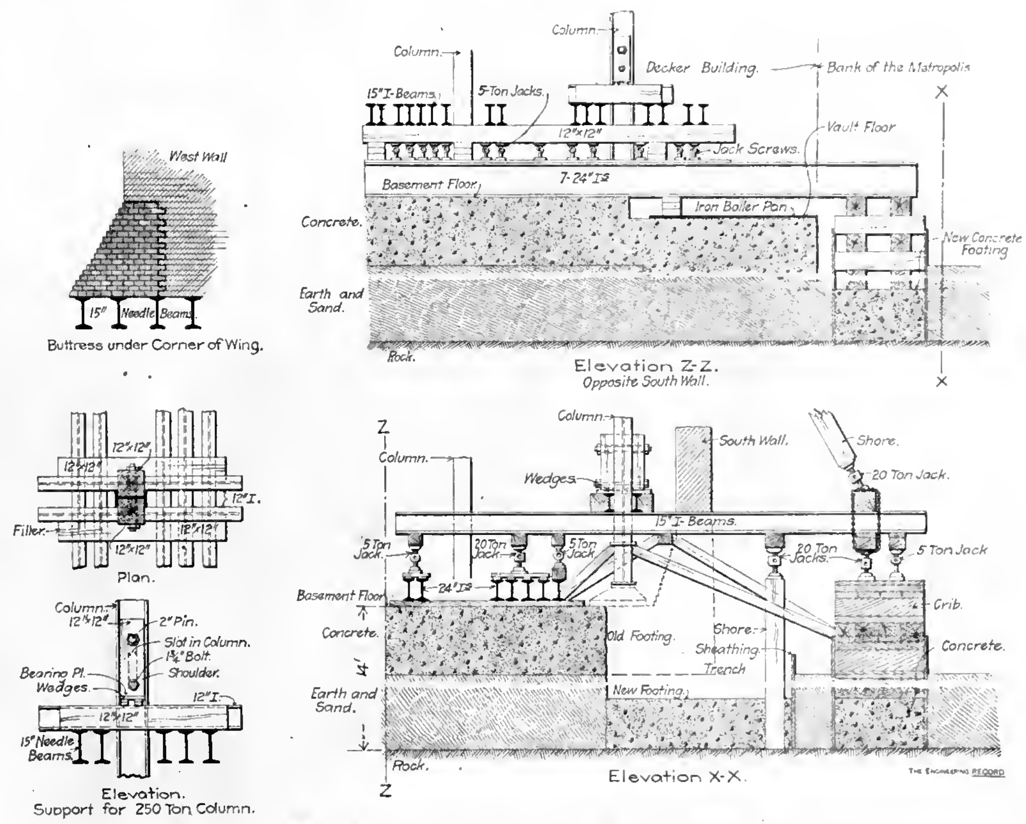
At the west end of the Decker Building there is a full-height 6x12-foot rear wing or extension, the foundations of which were on the surface several feet above the floor of the adjacent new cellar and some of which required to be extended down to rock, like those previously described for the south wall. The wing resembles a narrow tower, 175 feet high, which is structurally independent of the main building except for the continuity of the brickwork in the south wall, which extends from the main building to the outer corner of the tower, and for such bonding as is secured by the intersection of the north wall of the wing with the west wall of the main building. The walls are weakened by numerous windows and have built into their thicknesses four I-shaped cast-iron columns, which carry the floors. One of the columns has an estimated load of 600 tons and the loads on the others vary from 200 to 250 tons.

In one corner of the wing there is a square brick chimney weighing 200 tons, and as the walls are estimated to weigh 38 tons per lineal foot, the total estimated weight of the wing is about 2,500 tons, which was originally carried on a solid bed of concrete 4 feet thick, continuous over the full area of the wing.

The boilers and machinery for the freight elevator were located in the basement of the wing and in an outside vault at about the same level beyond its west wall, under the open court and alley. The elevator shaft extends up to the top of the wing and the rest of the space there is occupied by toilet rooms.

On the south side a new footing is being carried down to rock adjacent to that for the Bank of the Metropolis. It will act as a retaining wall for the sand under the basement floor of the wing, and the other footings on the 4-foot basement floor will not be underpinned.

The drain and sewer pipes were removed from the basement floor and either cut off and capped, or suspended from the ceiling and arranged to temporarily discharge into special connections with the street sewer. The freight elevator service was restricted to the upper stories, and the guides removed in the basement to give more working space there. The elevator ropes were disconnected from their hoists, led around guide sheaves, across the Bank of the Metropolis site and under the sidewalk to the drum of a hoisting engine which, with steam boilers, was set in Sixteenth street. The changes were effected at night without interrupting the elevator service.

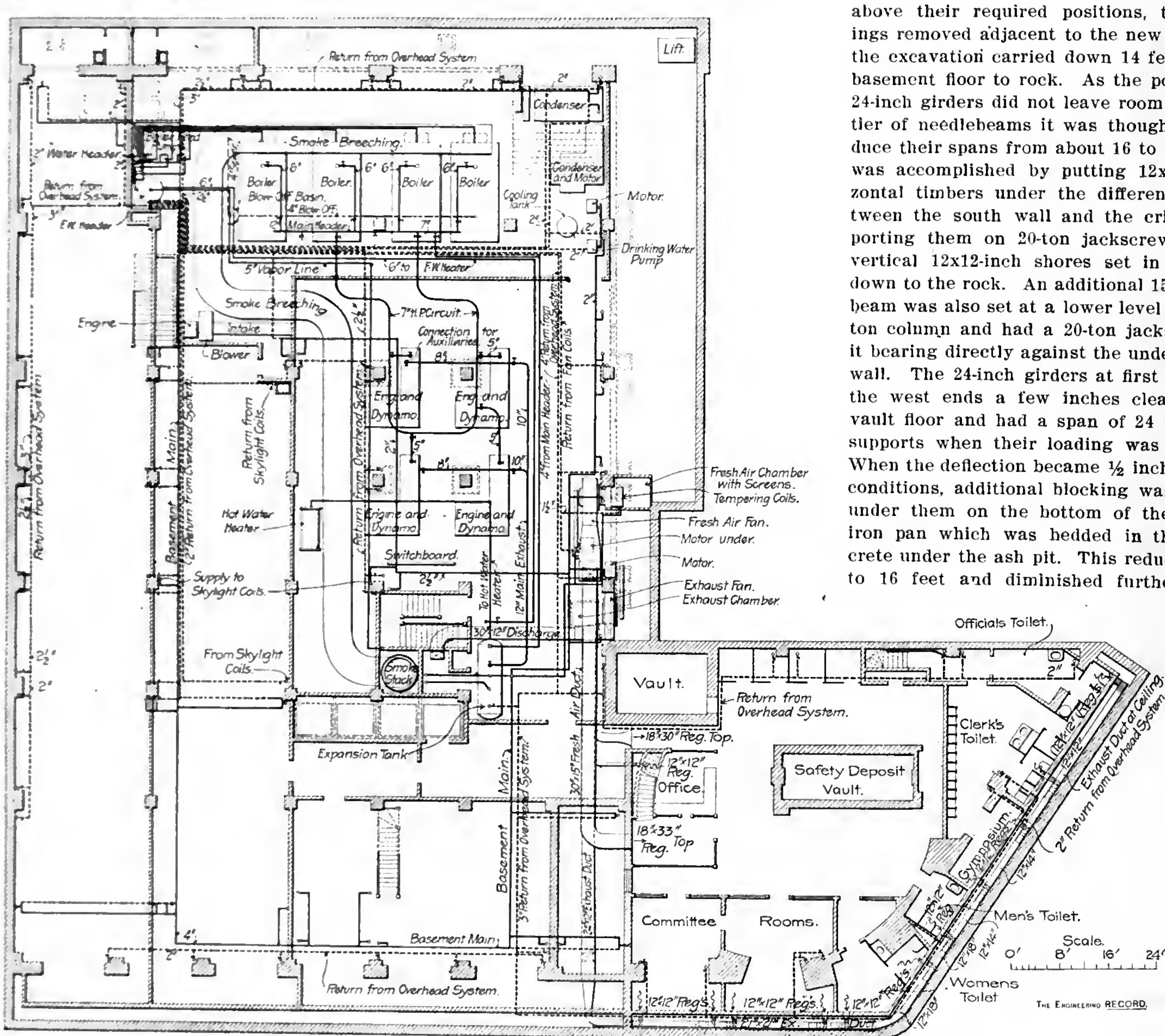


SUPPORT OF WALLS, COLUMNS AND CHIMNEY IN NARROW EXTENSION.

On the south side of the wing sheeted pits were dug in the site of the Bank of the Metropolis, and in them 7x7-foot concrete footings were built on the rock and supported solid timber cribbing which was carried up several feet above the bottom of the general excavation. Four lines of 12x12-inch continuous stringers were laid across the tops of the cribs and bridged from one to the other parallel to the south wall. Each pair of stringers was capped with transverse planks on which jackscrews were seated with their lower ends projecting down between the stringers. The jackscrews in the row nearest the wall were each of 20 tons capacity and those in the outer row were of 5 tons capacity. On each row of jackscrews was seated a 12x12-inch longitudinal distributing girder which carried the south ends of the sixteen 15-inch needlebeams 28 feet long. These supported the brickwork and columns and were arranged and inserted about as explained in the previous description of the main wall underpinning. These beams were, however, in one tier instead of two, and their north ends were supported on longitudinal girders instead of on cribs and piers.

Seven 24-inch 100-pound steel I-beams, 30 feet long, were laid parallel to the south wall on the 4-foot concrete floor. Their west ends projected through the vault and a few feet beyond the north and south line of the bank lot, and were carried on timber cribbing about 8 feet high, built on a concrete pier footing which had been carried down to bed rock for the bank building. Six of the girders supported two lines of 5 and 20-ton jackscrews, which carried the north ends of the needlebeams on 12x12-inch longitudinal timbers the same as at the south end. The seventh girder carried a single line of 5-ton jackscrews near the north side of the south wall.

The weight of the brick wall and chimney was transferred to the needlebeams as described in the previous article. The south wall column with a floor load of 650 tons was built into the brickwork, filling the spaces between its transverse web and the flanges which are in the faces of the wall. The brickwork is of excellent quality, well bonded and has bearing against the under sides of the horizontal diaphragms which unite the flanges and web at frequent intervals, and against the column-splice flanges at every story. It was therefore assumed that the brickwork would safely carry the column, and the latter was not directly connected to the needlebeams, seven of which were set close to it under the wall.



Mechanical Plant of the First National Bank Building, Uniontown, Pa.

Two of the needlebeams were set just outside the west wall and supported it at the corner by a brick buttress built across their top flanges and gained into the old brickwork. Underneath the chimney the needlebeams were reinforced by timber A-braces reaching from the middle of the lower flange, where they had beveled ends abutting on the vertical sides of a short transverse timber. The lower end of one brace was fitted to the bottom flange and web of the nearest 24-inch girder and the lower end of the other brace was fitted to the tops of the sheeting in the pier under the south ends of the needlebeams. The webs of the 24-inch girders were blocked solid to resist the thrust from one diagonal brace and a horizontal strut was braced against the opposite side of the pier to resist the transverse component of the thrust from the other brace.

One of the interior columns, with a 250-ton load, had vertical timber shoulders or bearing pieces fitted against the web between the flanges on both sides and clamped together by a ¾-inch bolt at the bottom and a 2-inch steel pin through the top. The latter had a horizontal bearing in the upper end of a vertical slot cast in the web of the column. Thin steel wedges were driven under the lower ends of these shoulders and transferred the column load to the I-beams and filler timbers which were set across the needlebeams on both sides of and close to the column. The lower end of the column projected below the needle beams and was securely braced by inclined struts wedged against one of the horizontal diaphragms cast on the column. Their lower ends were secured in the same manner as those of the needlebeam struts.

A longitudinal timber was chained to the needlebeams and one of the jackscrew stringers as described in the former article. Beveled seats were gained into it to receive two 20-ton jackscrews at the feet of long inclined shores which braced the outside of the south wall at the second story. At this point an offset in the brickwork projected 6 inches and afforded a horizontal bearing against which a timber 3 feet long was set to form an angle block distributing the pressure of the shore on the brickwork so as to avoid danger of crushing it.

The walls and columns were lifted ⅛ inch above their required positions, the old footings removed adjacent to the new building and the excavation carried down 14 feet below the basement floor to rock. As the position of the 24-inch girders did not leave room for a double tier of needlebeams it was thought best to reduce their spans from about 16 to 12 feet. This was accomplished by putting 12x12-inch horizontal timbers under the different groups between the south wall and the cribs, and supporting them on 20-ton jackscrews on top of vertical 12x12-inch shores set in pits carried down to the rock. An additional 15-inch needlebeam was also set at a lower level near the 650-ton column and had a 20-ton jackscrew set on it bearing directly against the under side of the wall. The 24-inch girders at first projected at the west ends a few inches clear above the vault floor and had a span of 24 feet between supports when their loading was commenced. When the deflection became ½ inch under these conditions, additional blocking was wedged up under them on the bottom of the thick cast-iron pan which was bedded in the floor concrete under the ash pit. This reduced the span to 16 feet and diminished further deflection while still transmitting part of the 500-ton total load from the needlebeams to the rock foundation at the west ends of the girders.

The underpinning is in charge of Mr. A. E. Riendeau, who has designed and supervised it for the George A. Fuller Company; Mr. C. T. Purdy, chief engineer, contractors for the Bank of the Metropolis.

Wringing Blue-prints in the same way that clothes are passed through a wringer in a laundry has proved so satisfactory that a special machine for the purpose has been designed by the American Wringer Company, 99 Chambers Street, New York. It is made in several sizes to take prints from 12 to 30 inches wide, and has helical steel springs to press the rolls firmly together.

The Mechanical Plant in the First National Bank, Uniontown, Pa.

The First National Bank, of Uniontown, Pa., has just completed the largest building of that industrial city, for its own use and for the rental of offices. Exclusive of basement and attic, the building is 11 stories high, occupying an irregular space of approximately 10,100 square feet between Main, Pittsburg and Peters Streets, and is of the steel-cage type of construction. It is fitted with electric light and telephone services, mail chutes, ice water distribution, and a heating and ventilating system supplied from its own steam plant in the basement. Plans of the latter as well as of the attic and one of the intermediate floors is herewith shown.

The steam plant includes four horizontal tubular boilers, made by Heggie Brothers, of Joliet, Ill., in which steam is generated at a working pressure of 125 pounds per square inch. Each boiler has a heating surface of 1,070 square feet and is fitted with Jones underfeed automatic stokers made by the Underfeed Stoker Company of Chicago. The furnaces are operated under forced draft from a blower nearby taking air from the engine room, thereby ventilating the latter.

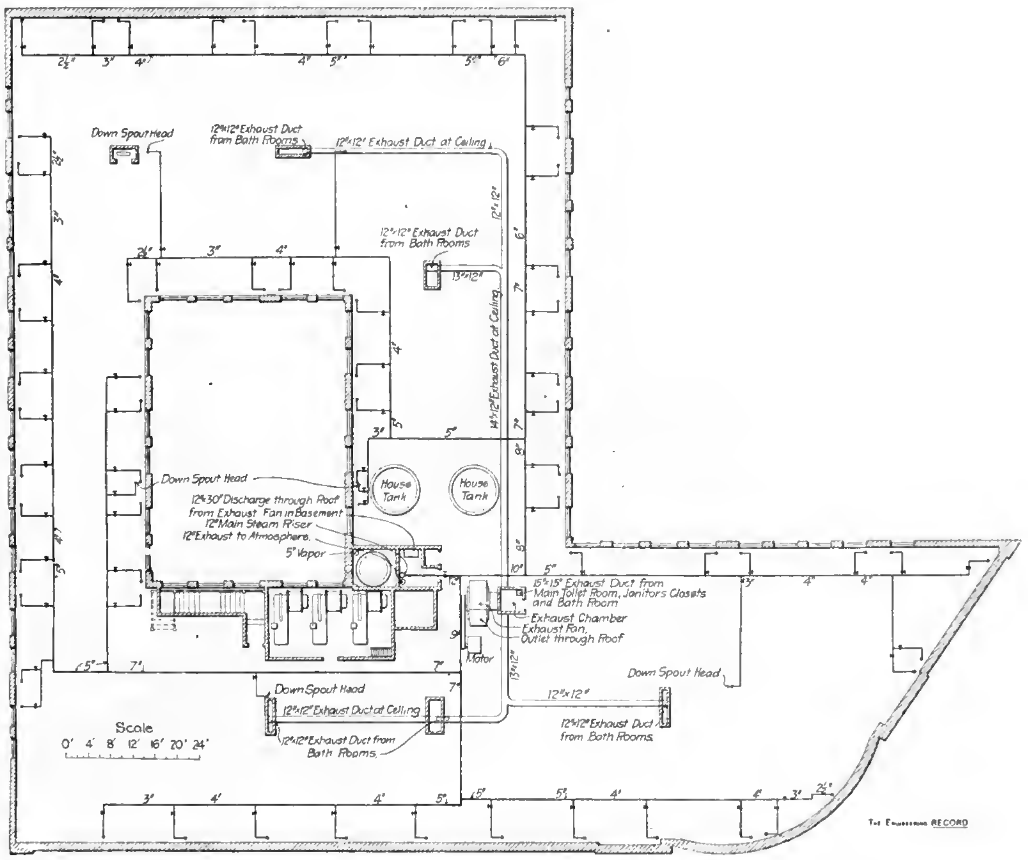
Steam is taken from the top of the boilers through 6-inch outlets and flows into a 12-inch horizontal header over the rear of the boilers. From the header are taken two 7-inch branch mains which are connected at their far ends to form a ring main or loop for the supply of four generating sets, grouped in a rectangle.

The boiler water supply is principally obtained from the returns of the heating system which, coming from the foot of the risers, drains by gravity into a 700-horse-power open feed water heater manufactured by Warren Webster & Company, of Camden, N. J., in the boiler room. This, in addition to utilizing exhaust steam to heat the water, is used to perform the offices of a feed-water purifier and of a return tank for the reception of the return water, and the automatic control of the feed pumps. Passing into the heater it is drawn off by 6x4x6-inch pumps installed in triplicate, made by the Laidlaw-Dunn-Gordon Company, and discharged into a 3-inch header. The header is located against the boiler room wall at the pumps, and affords very convenient means of control, the feed line to each boiler leaving it separately. It was deemed advisable to locate the boilers in the rear for readily receiving their coal supply, notwithstanding the previous location of the stack behind the elevator shafts; this has necessitated a long smoke connection in the basement from boilers to stack as shown. Coal is taken from a vault in front of the boilers.

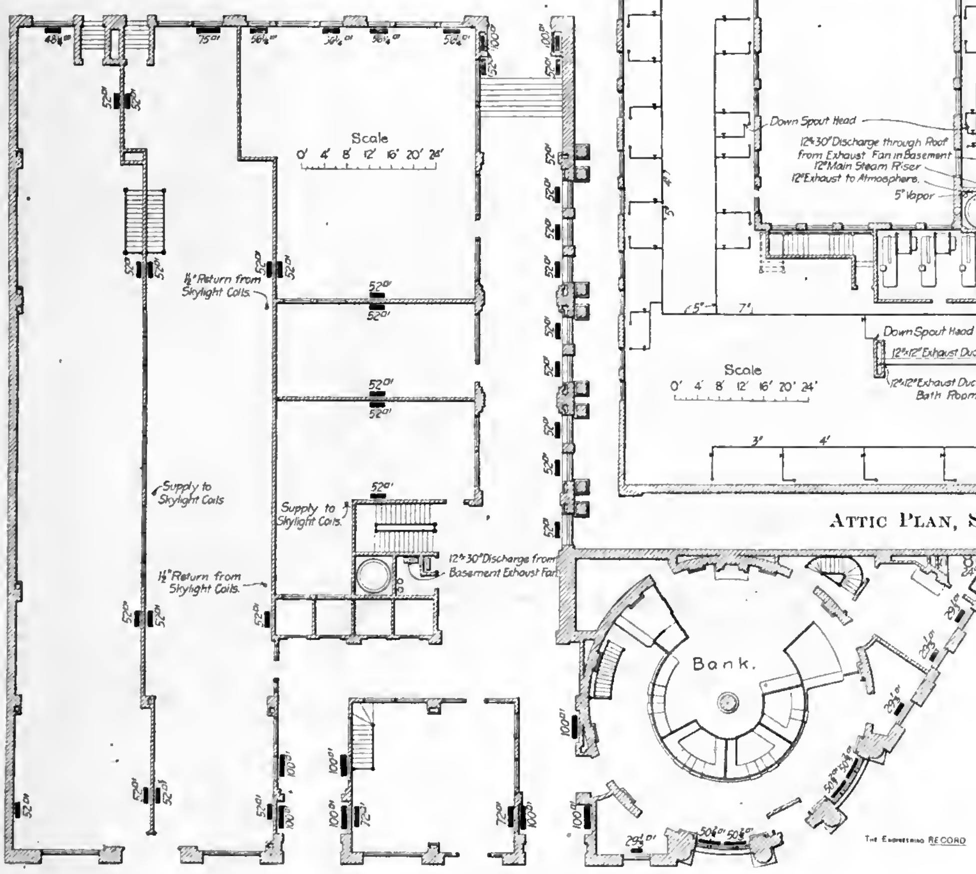
The engines are horizontal tandem compound engines made by the Ball Engine Company. Each is 12x19x14 inches in size and operates at 250 revolutions per minute; the 100-kilowatt Crocker-Wheeler dynamos to which they are coupled generate current at a potential of 125 volts. The engines are fed with steam, as mentioned, from a 7-inch loop overhead and exhaust into 8-inch lines joining a 10-inch main which runs to an expansion tank, 12 feet long by 4 feet in diameter. This tank serves as a low-pressure steam receptacle from which there may be an equalized pressure of steam on all the lines leading from it. Assuming three of the four engines exhausting at the same time, 2,500 cubic feet of steam will be delivered to the expansion tank per minute, irrespective of steam pressure. This means that the tank will be filled 16 or 17 times in that time, and will to that extent act as a muffler in reducing steam pulsations and resultant vibrations, as well as equalizing the pressure in the outgoing lines from the pumps. Besides being supplied by the exhaust mains, a 4-inch live steam branch is led into it, which allows the steam-heating apparatus to work under a wider limit of pressure and temperature. The following connections are made independently with the tank; a heating main for the basement, including the fan coils, the heating main from the rest of the building, the free-exhaust riser, a main for warming some adjacent buildings and a main sub-divided for the feed-water heater, and a hot water heater for the house supply.

The ventilating apparatus includes two basement steel plate centrifugal fans of the American Blower Company's manufacture, one for exhaust ventilation of the safe deposit vaults in the basement and the other for the supply of fresh air to the same. An attic fan draws from an exhaust chamber into which two flues deliver vitiated air from the toilet rooms throughout the structure. The supply fan is 48 inches in diameter, 14 inches wide and is intended to deliver 3,000 cubic feet of air per minute against a pressure of 0.09 ounce per square inch. It takes air from a screened fresh air chamber, as shown, and drives it out over a heating surface of 445 square feet into a 30x15-inch galvanized-iron duct to two registers at the ceiling in the vault room. The drawing shows the manner in which the ends are expanded to reduce the velocity of the air flow. The discharge fan draws from an exhaust chamber 4x4 feet in plan, to which is brought a main 12x12-inch duct from several registers on the sidewalls of the smaller rooms, as shown. The discharge from the exhaust fan is carried over to a vertical flue, whence it makes its exit through the roof.

The heating of the building is accomplished by direct means, with the exception of the small amount of indirect already mentioned. For the greater part, the overhead method of distribution was adopted and a 12-inch steam supply riser carried from a connection on the expansion tank upward to the attic, there feed-



ATTIC PLAN, SHOWING THE OVERHEAD HEATING PIPING.



PLAN OF THE FIRST FLOOR.

ing into a 10-inch distributing main. From the latter are taken off various branches to 65 downward lines of pipe at the outside walls of the building, connecting with the numerous radiators. The radiators have one-pipe connections and the steam condensation drains from the drop lines, as before mentioned, into the basement return mains. The overhead system supplies the radiators of the second to eleventh floors inclusive. The return mains from the bottom of drop lines are run in the basement in trenches, and are pitched to drain into the feed-water heater. The basement heating mains also supply one-pipe radiators and are graded downward in the direction of steam flow to cause water of condensation to pass with the steam, in turn to be discharged into the return mains. The basement system includes first-floor radiators and skylight coils in the second story, comprising altogether about 3,370 square feet of radiation. The overhead system feeds about 20,075 square feet, making a total surface of direct in the building 23,445 square feet.

The lighting system of the structure is quite extensive. Current from the generators is distributed by two-wire feeders to panel boards. Feeders from the latter are tapped in the usual way. There are two general centers for this distribution, with an adjacent riser shaft in each case. Each riser shaft contains one main feeder which supplies current to that part of the building through which it is run. Provision for an equal division of the total load has been made by connecting the several main feeders, in their various positions, to the middle of branch circuits between the second and eleventh floors inclusive. One feeder supplies the lights on the first floor and store rooms in the basement. The switchboard, located in the basement, contains the usual panels for the separate control and supervision of each generator and feeder panels, one switch per feeder. Current is also taken for the operating machinery of four elevators and for the motors of a refrigerating plant.

The refrigerating plant, made by the Carbondale Machine Company, of Carbondale, Pa., is run on the compression system. The compressor operates through belting from a 40-horse-power motor. The plant is installed to furnish cold drinking water for the employees and tenants, and is circulated by a 6x4x6-inch pump, also motor-driven. The ammonia gas is cooled through the agency of pipe condensers in the usual way, but artesian well water, not only being cheaper, but colder than the city supply in warm weather, is used as the cooling medium.

The elevator plant consists of three passenger elevators, one combination elevator and a sidewalk lift. They are of the electric drum type, the machines being located overhead, and were installed by the Otis Company, of New York. The motors are run under 110 volts and the cars are under magnetic control. The passenger elevators have a carrying capacity of 2,250 pounds and are designed to travel at the rate of 300 feet per minute. They operate between the first and eleventh floors inclusive. The freight elevators, traveling between the basement and the attic, have a lifting capacity of 4,000 pounds and a speed of 150 feet per minute, while the sidewalk lift carrying a maximum load of 2,500 pounds runs at 50 feet per minute.

The building was erected from the plans of Messrs. D. H. Burnham & Company, of Chicago, and the mechanical plant described was designed by Mr. C. M. Wilkes, their engineer. The heating and ventilating apparatus was installed by the L. H. Prentice Company, of Chicago, Ill., and the lighting plant by the Iron City Engineering Company, of Pittsburg, Pa.

Water Supply in the Carnegie Residence, New York.

The residence now being completed for Mr. Andrew Carnegie, on upper Fifth Avenue, New York, opposite Central Park, is a four-story and basement house about 70x130 feet in principal dimensions, besides conservatory and picture gallery extensions. It occupies a lot extending from 90th to 91st Streets and having a depth of about 225 feet east from Fifth Avenue, and is surrounded by a moat, lawns, flower gardens and shrubbery, laid out by a landscape architect, for which elaborate water supply and drainage systems have been installed in connection with those for the house service.

Except a 500-gallon attic tank which is installed to provide an auxiliary supply to supplement the regular service in case this should be interrupted, all the tanks, pumps, filters and other plant connected with the water supply and the whole installation for the water system, except the riser pipes for fixtures and their short branches, are located in the cellar, and the distribution pipes, connecting mains and other horizontal branches, are suspended from its ceiling. The filter plant and suction tanks occupy one room; the pumps are arranged in an adjacent room and the cold-water pressure tanks and hot-water heating tanks are arranged in a third room. These rooms are of sufficient size and height to prevent crowding, permit the advantageous arrangement of the plant, afford clearance around the tanks and other apparatus and space for their connections and to run the pipe lines, and are well lighted, neatly finished and have their walls faced with enameled white bricks. This rather unusual architectural provision for the plumbing installation promotes economy of construction and maintenance.

Water is provided for domestic purposes, for fire protection and for sprinkling and hose washing. In the cellar and basement it is normally under street pressure, and for the rest of the house it is under direct pump pressure, both systems, together with the auxiliary tank pressure being cross-connected so as to be interchangeable. Water for all purposes except irrigation and hose washing is normally filtered, storage, about 6,600 gallons, being provided by the suction, pressure and auxiliary attic tanks.

All water pipes are of drawn seamless brass, tinned inside and outside and tested in place by a water pressure of 150 pounds per square inch, applied after the lines are completed. All drain and leader pipes are of screw-jointed wrought iron or steel, specially galvanized for this order. Screw-jointed brass pipes with recessed brass drainage fittings are used throughout for all soilpipes and for waste and trap-vent lines, including short brass connections to fixtures. All exposed pipes are frost-proofed by a 1-inch packing of hair felt or asbestos, covered with canvas sewed on and painted. All gate valves are of steam metal made by the Chapman Valve Manufacturing Company and, except in the basement, are nickel plated. All fixtures have separate white metal gate-valves and air chambers, and all riser lines have air chambers and air valves at the top and controlling and emptying valves and waste pipes at the bottom. All valves have numbered brass tags corresponding to printed key-diagrams. All bathrooms and slop-sink closets have tiled floors laid in full-size safes made of 4-pound sheet lead turned up 3 inches on all sides and provided with a strainer outlet and waste pipe emptying through a brass flap-valve over a porcelain sink in the cellar. The refrigerator safes have convex strainers with trapped wastes supplied with hot water for flushing them out, and emptying through numbered flap valves into a cellar sink. The riser lines are mostly grouped together and carried up in furred spaces in the outside walls; there are no horizontal branches crossing any of the upper floors.

The water supply is distributed under three general systems, viz., street, pump and tank pressure, all of which are cross-connected so as to be interchangeable. The street pressure system is subdivided into unfiltered water for garden sprinkling and for washing out the fresh air inlet pipes, and filtered water for domestic purposes. The filtered water system is divided into hot and cold supplies for basement and cellar and refiltered cold water for drinking purposes. The pump pressure system is divided into filtered hot and cold water for domestic purposes and fire lines in the upper stories and refiltered drinking water for the upper stories.

Separate 2-inch taps are made in the street mains in 90th Street and in Fifth Avenue, and the supplies pass through 3-inch Trident water meters, valves and check valves, and are branched to the sill-cock distributing line, which also supplies the fresh air inlets at the main traps with unfiltered flushing water. Each of the two 2-inch street supply pipes has an attachment for preventing water hammer, and is connected to an improved double-cylinder Loomis filter of a capacity of 30 gallons a minute under 25 pounds pressure. The filter cylinders are about 3 feet in diameter and 6 feet high, set on brick piers; one is filled with quartz sand and the other with charcoal or sand and polarite. They have aerating apparatus but no alum attachments, and their filtering materials can be replaced through large manholes. They are valved and piped for washing and emptying and are cross-connected so that they can be used separately, alternately or together. One is normally used under street pressure to supply only the cellar and basement; the other, although operated under street pressure, is for the pump-pressure supply to the upper stories.

The pump-pressure filter normally discharges through a 2-inch pipe to two vertical closed 3½-foot cylindrical suction tanks, 12 feet high, with a capacity of 888 gallons each. The tanks are cross-connected and provided with manholes and emptying pipe; they are white enamel painted inside, and tested to an internal pressure of 50 pounds per square inch. The 2½-inch outlets are connected to two Quimby pumps, which discharge into two pressure tanks from which supplies are taken to all the hot and cold water fixtures in the upper stories. The arrangement of the meters, filters, suction tanks, pumps and pressure-tanks in duplicate and cross-connected throughout provides a complete reserve installation to maintain the supply if any part of the system should be disabled or out of service for alteration or repairs.

Provision is made for screwing outside 1-inch hose to the sill-cocks to spray the trees and shrubbery with unfiltered water direct from the street mains, and to secure a higher pressure than may be always available from the Croton system, it is proposed to install in the cellar a supplementary pump, not shown in the general plan. A branch from the 2-inch service pipe from the 5th Avenue main will deliver into a 40-gallon tinned copper boiler suspended horizontally from the cellar ceiling and having a 1½-inch outlet to a Quimby rotary house-service pump, driven by a direct-connected 2-horse-power electric motor. The pump will have a capacity of 15 gallons a minute at 40 pounds pressure, and will have a short rubber hose connection to a 1½-inch discharge pipe, on which there will be a Ford pressure regulator connected to an electric switch and adjusted so as to automatically start the pump whenever one of the sill-cocks is opened, and to stop it when the sill-cocks are all closed and the pressure rises to about the average street pressure. The pump will be cross-connected to the filtered water supply and can be used to increase the pressure in the cellar and basement fixtures.

The house-pressure pumps have extreme dimensions of 16x55x20 inches high, and are set in copper drip pans with 1 inch of hair felt cushion between the pan and the leveled surface of the masonry foundation. Each pump has short lengths of five-ply rubber pressure hose with tinned brass couplings on the inlet and outlet to secure noiseless operation, and is driven by an independent 3-horse-power compound-wound motor, manufactured by the General Electric Company. Each pump is guaranteed to deliver 1,800 gallons an hour against a head of 160 feet and is fitted with a Ford pressure regulator connected to an electric switch so as to automatically start and stop the pump when the pressure in the tank falls or rises below the required limit. The pumps are cross-

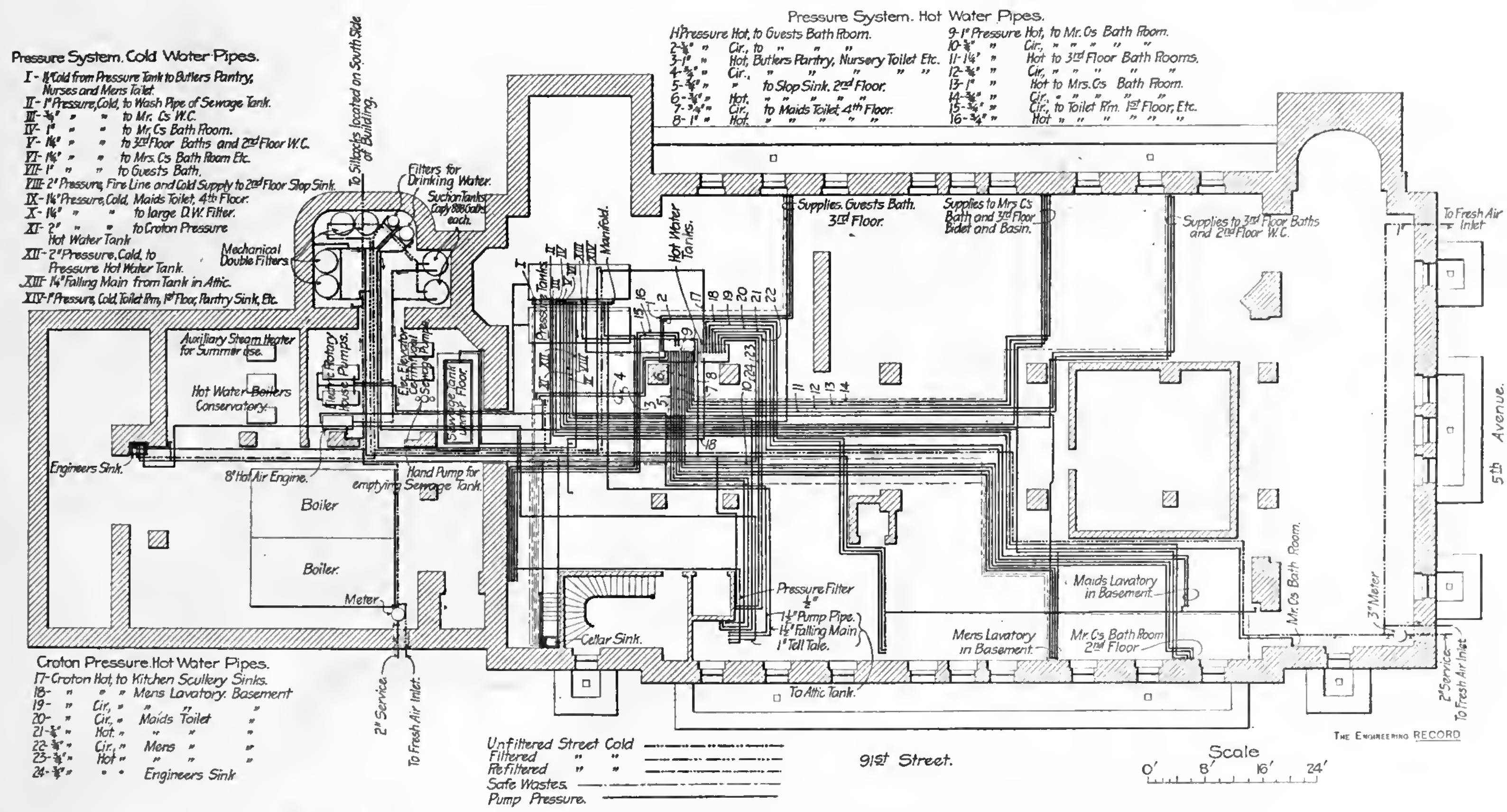
ply to the conservatory fountain and sink, and one 1½-inch, four 1¼-inch, four 1-inch and one ¾-inch lines.

In the cellar, suspended from the steel I-beams in the basement floor, are two horizontal cylindrical hot-water tanks, made of copper, polished outside, tinned inside, and tested for 150 pounds internal pressure. One tank is 30 inches in diameter and 4 feet long, has a capacity of 148 gallons, and is normally used under street pressure to supply cellar and basement fixtures. The other, 36 inches in diameter and 5 feet long, has a capacity of 265 gallons and normally supplies hot water under pump pressure to the fixtures in the upper stories. The tanks are cross-connected and each contains a coil of 1½-inch brass pipe proportioned to heat the water with steam at a pressure of 5 pounds. Both tanks are fitted with thermometers, gauges, safety and blow-off valves, emptying pipes and thermostats to automatically regulate the supply of steam to the heating coils and maintain the water at a constant temperature. They are covered with Keasbey's sectional magnesia and canvas sewed on and painted.

dry. These two tanks supply hot water to all fixtures in the house except the waterclosets.

In the house-supply filter room are two large Berkefeld supply filters for filtering the drinking water. Normally one is connected with the street pressure, and the other with the pump pressure filtered water supply, but they are cross-connected so that either can be put under either pressure or can be supplied with unfiltered water. One filter has twenty-one 15-inch cylinders 43 inches high and has a capacity of 10½ gallons per minute under 40 pounds pressure. It is connected with the street pressure system and supplies the basement fixtures through three pipes, a ¾-inch line to the kitchen and scullery sinks, a ½-inch line to the butler's pantry sinks, and a ½-inch line to the engineer's sink. The other filter has thirty 20-inch cylinders 43 inches high, with a capacity of 15½ gallons a minute under 40 pounds pressure. It was designed to supply upper-story bath rooms and toilet rooms through six ½-inch lines, but the plan has been revised so as to supply only a pantry and slop sinks through one rising line.

In order to provide a water supply for the



ARRANGEMENT OF WATER-SUPPLY PLANT AND DISTRIBUTION LINES IN BASEMENT.

connected at both suction and discharge ends, and have relief valves and emptying pipes which discharge into an underground tank.

The two pressure tanks are 5-foot horizontal cylinders 14½ feet long and hold 2,150 gallons each. They are made of boiler iron, painted with white enamel inside and also painted outside and tested to 150 pounds per square inch internal pressure. They are fitted with blow-off pipes, gauge glasses, and manholes, and are connected at the top by a valved equalizing air pipe. The 3-inch bottom outlets are valved to a horizontal distribution header between them, which is made up of 4-inch tinned brass nipples and tees and has connections to the supplies for the different lines of fixtures in the upper stories, and to the fire service, hot water service and drinking water filter. There are thirteen distribution branches from the header, each being valved and dripped. They include a 2-inch supply to the hot water tank, a 2-inch supply to the fire lines, a 1-inch sup-

The street pressure tank has two 2-inch outlets connected to a 2-inch header from which one ½-inch, three ¾-inch and two 1-inch pipes are taken to supply the different distribution lines. The pump pressure tank has two 3-inch outlets connected to a similar horizontal 3-inch header made up of tees and nipples and connected to two 1¼-inch, four 1-inch and two ¾-inch pipes to the distribution lines supplying the upper story bath and toilet rooms and slop-sinks. A return-circulation pipe is run separately from the highest fixture in each group and connected in the cellar with a manifold at the bottom of the tank. All flow and return risers have controlling and emptying valves at the hot water tanks. In winter the coils in the hot water tanks will be supplied with steam from the large house heating boilers; in summer they will be supplied with steam from a special smaller auxiliary boiler. There are no range boilers or waterbacks in the house and no boilers in the kitchen or laun-

upper story fixtures in case the pump pressure system should be disabled, a gravity supply from an attic tank is provided for auxiliary use. Water from the street main or the suction tanks is raised about 75 feet to the 750-gallon attic tank by an 8-inch Rider hot air engine in the cellar pump room. The engine has 1½-inch inlet and outlet pipes and a capacity of 2,000 gallons an hour under 50 feet head. It is provided with a coal furnace, a copper air chamber and an automatic cut-off arrangement to stop it when the house tank is filled up to the telltale. This pump and all other pumps are seated on brick piers faced with white enamelled bricks and having cut stone caps.

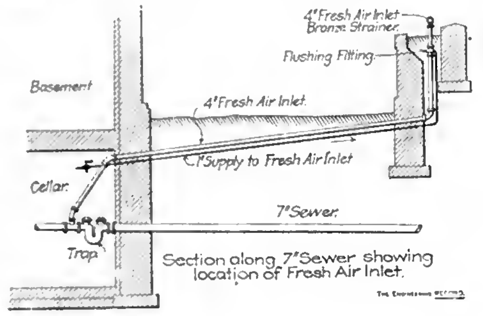
The 2x5x10-foot attic tank is made with 2x4-inch wooden staves laid flat, nailed together and dovetailed at the corners. It is lined with 16-ounce planished tinned copper, is seated on a platform supported on steel I-beams and covered with 4-pound sheet lead, turned up 3 inches on all sides, and has a tinned wooden cover, made in three sections. There is a 1½-inch emptying pipe to the roof gutter and a ¾-inch telltale 1 inch below the level of the 3-inch overflow pipe. There is a 1½-inch brass supply pipe from the bottom of the tank to the distribution header between the two pump pressure tanks. Normally the valve at the foot of this pipe is closed and all the other valves at the header are open, but if it is necessary to supply the house from the attic tank the foot valve is opened and the two valves on the pressure connection between the header and the pressure tanks are closed.

On each floor, including the cellar and attic, there is one hose reel, seven in all, with 125 feet of hose, nozzle coupling and gate valve complete for the fire protection service of the house. The hose is of unlined mildew-proof linen, warranted to stand a pressure of 400 pounds per square inch, and to be of make acceptable to the Board of Fire Underwriters. The 30-inch nozzles have swivel handles, and with the valves and couplings are nickel plated. The swinging hose reels are made of gun metal, nickel plated. It is specified that the hose, after having been wet and dried, shall not leak more than 1/6 gallon per foot in the first minute under a pressure of 75 pounds, or more than 0.01 gallon per foot in the second five minutes under a pressure of 75 pounds per square inch.

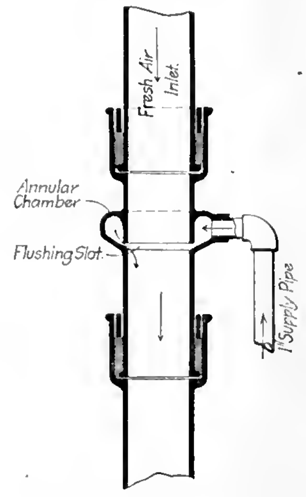
Each sewer trap is vented by a fresh air pipe pitched up about 1:6 from the cellar wall to the area wall and thence carried vertically to terminate with a bronze strainer above the surface of the ground. The upper section of the vertical pipe is about 3 feet long, and just below the surface of the ground is calked into the bell of a special fitting which, as shown in the general view and detail, is provided with a flushing arrangement designed to wash down all rust and accumulations of dust or rubbish into the sewer pipe. An annular chamber is cast around the outside of the pipe, and into it is tapped a 1-inch supply pipe from the street pressure system in the cellar. Just over the main trap this pipe has a stop and waste cock which allows the annular chamber to be filled and flush out the vertical pipe through a horizontal slot in its sides.

There are seven bath rooms for the family and guests and three for the servants, besides five toilet rooms without baths. The total number of fixtures includes eight wash-basins, ten servants' wash-basins, eight water-closets, seven servants' water-closets, seven bath-tubs, three servants' bath-tubs, three sitz baths, one shower, one shower and needle bath, one shampoo wash stand, four slop-sinks, three pantry sinks, three scullery and kitchen sinks, one still room sink, one brush-room sink, one conservatory sink, one engineers' sink, one refrigerator sink, one conservatory fountain, four laundry tubs, two kitchen ranges and three floor cesspools.

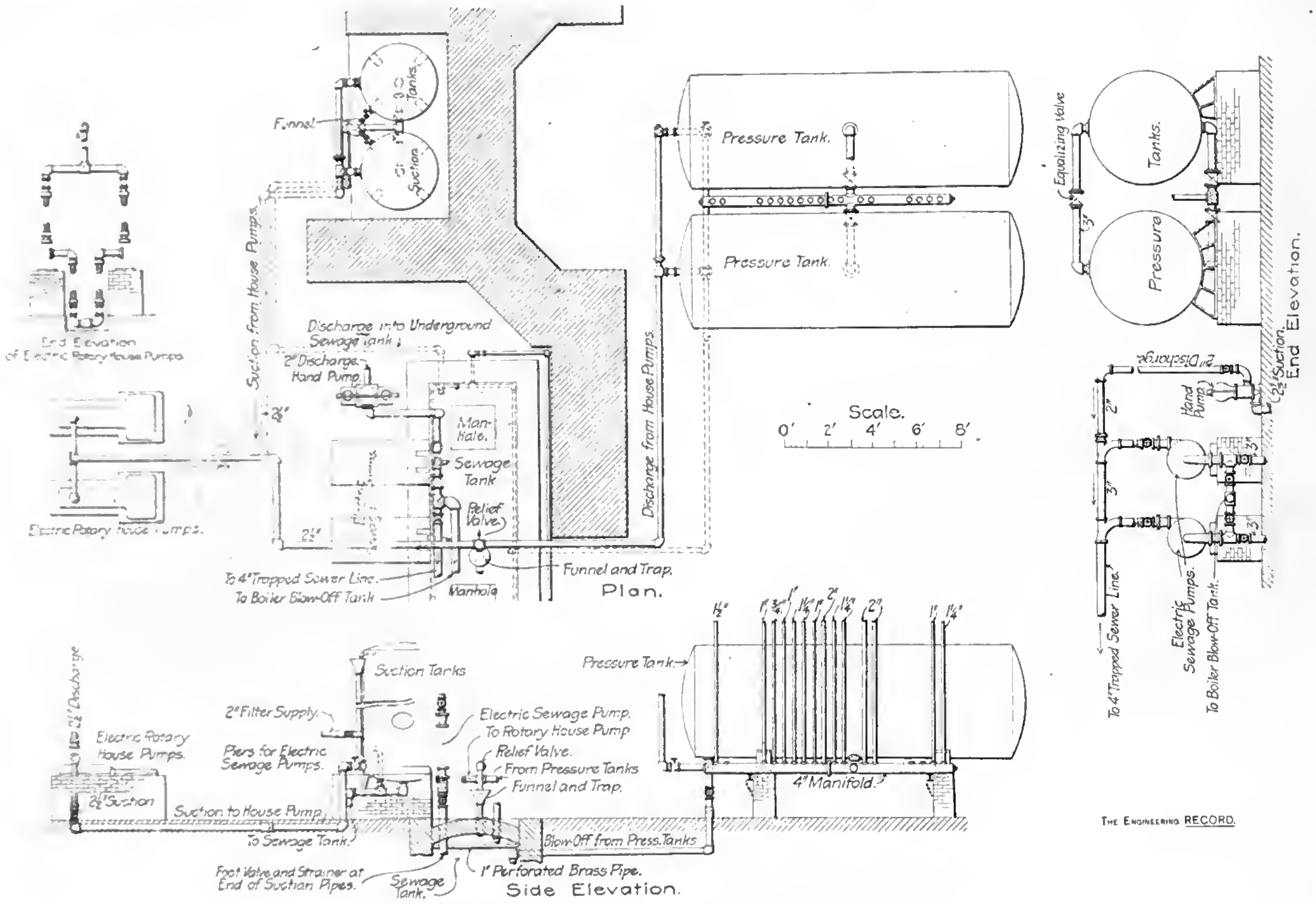
Messrs. Babb, Cook & Willard are the architects, and Mr. Wm. Paul Gerhard is the hydraulic and sanitary engineer of this residence. Mr. James Armstrong is the contractor for the plumbing and water supply system.



Section along 7" Sewer showing location of Fresh Air Inlet.



Flushing Fitting for Fresh Air Inlets.



Location and connection of Pumps and Tanks in Cellar.

DETAILS OF WATER SUPPLY IN THE CARNEGIE RESIDENCE.

A Steam Railway 40 miles long, the Cincinnati, Georgetown & Portsmouth Ry., is shortly to be converted from steam to electric traction. The Tennis Railway Equipment Co., which has the contract, has recently purchased from the Westinghouse Electric & Manufacturing Company two 600-kilowatt alternating-current generators and a number of 300-kilowatt rotary converters for supplying current to the line.

The Septic Tank System at Birmingham,

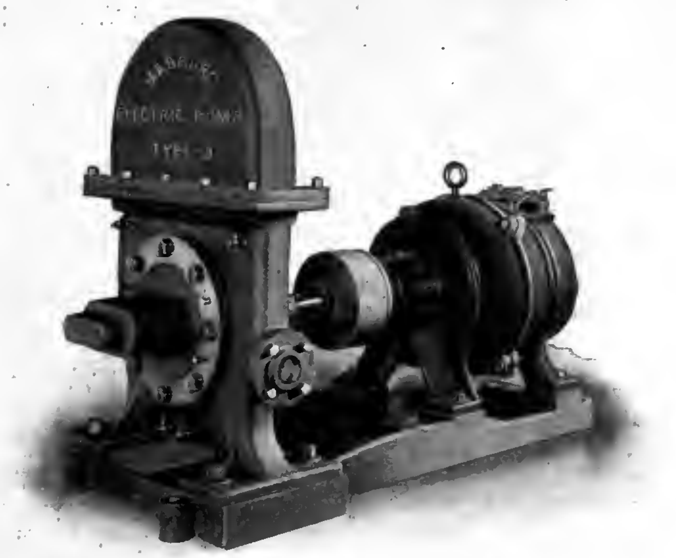
England, is briefly described in "Engineering," on the authority of figures given by Mr. F. R. O'Shaughnessy. The sewage contains acid wastes and the spent liquors of breweries, paper mills and fellmonger works as well as the household sewage of a population of 815,000. This is discharged into three tanks having a total capacity of 440,000 cubic feet. Each tank is divided into three basins, where much of the suspended matter settles. From the tanks the partly clarified sewage passes into sixteen small tanks having a total capacity of 728,960 cubic feet, which act as septic tanks. After remaining eight hours in them, the septic sewage is discharged over the land of the large farm on which the works are situated. The sludge is mostly buried, and the introduction of the septic system has reduced the total quantity to be handled to less than half of the amount which resulted from the chemical treatment formerly in use.

Two Pumping Devices.

The E. W. Bliss Company, Brooklyn, N. Y., is making two pumping devices for buildings and country estates which possess several interesting features. The first is the Marburg electric pump, consisting of a rotary pump with two interlocking wheels like those used in pressure blowers, driven by a direct-connected motor mounted on the same baseplate. This type of pump has a continuous discharge and steady motion which eliminates pounding, and the apparatus designed by Mr. Marburg has special advantages due to the arrangement of the suction and delivery openings in such a manner that the internal pressures of the water have been balanced and the friction thus reduced to a minimum. These pumps are made with capacities ranging from 300 to 3,500 gallons per hour and designed to work against heads between 30 and 175 feet.

The second device is the Bliss-Heath pumping engine, which is of the atmospheric type. It consists of a low-pressure tubular boiler, an atmospheric engine driving a water pump, and a single-acting air pump. The entire apparatus is designed to be perfectly safe in the hands of the most thoughtless laborer. The boiler works under a pressure about equal to that of a domestic tea kettle, and the safety valve is a light lid or cover fitting a large opening in the top of the boiler. The engine operates by expelling air from the power cylinder by admitting steam, which is exhausted in turn into the condenser, in which a constant vacuum is maintained. Steam is then admitted into the power cylinder, breaking the vacuum and giving the piston the required impulse. During the winter the apparatus can be worked by steam from any ordinary low-pressure heating boiler, thus making a separate fire in the engine boiler unnecessary. The apparatus is sold in four sizes, with capacities of 600, 1,200, 2,000 and 3,000 gallons per hour.

THE BLISS-HEATH PUMP.



THE MARBURG ELECTRIC PUMP.

Trade Publications.

A beautifully printed album of engravings has been issued by the Crocker-Wheeler Co., Ampere, N. J., to illustrate some of the applications of the electric motor to driving machinery of many types.

Eighteen months ago a new paint called "Protectus" was placed on the market by The Protectus Co., North American Building, Philadelphia. Its advantages are stated to lie in the vehicle, the base of which is a mineral oil, instead of in the pigment. The company has just issued a pamphlet describing a number of tests of the paint and explaining its uses on metal and steel for various classes of service.

The Caskey punch, described in a pamphlet from F. F. Slocomb & Co., Wilmington, Del., consists of a movable frame having a punch operated by pressure oil. The oil is forced to the punch by the piston of a cylinder in which the motion of the parts is produced by compressed air. The apparatus has been tested in a number of large works and is now placed on the market in sizes with reaches of 3¼ to 12 inches.

The General Electric Co., Schenectady, has added three new numbers to its excellent series of bulletins, No. 4,285 on the four forms of automatic circuit breakers for 500-volt direct-current circuits, No. 4,286 on an adjustable shunt field coil for Thomson recording wattmeters to counteract the friction of the meters, and No. 4,288 on slow and moderate speed belt-driven generators. Flyers have also been issued on the renewal parts for electric brakes, blue-printing with enclosed arc lamps, porcelain knobs and cleats and fuse wire, and a general description of transformers for high potential is given in a special manual.

The Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia, has issued a number of circulars which will appeal particularly to the designers of small electric lighting plants for country estates and situations requiring similar service. Many illustrations are given of such plants, and there are also notes on line batteries for voltage regulation and use of storage batteries in commercial electric automobile service.

The Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., is distributing a handsomely illustrated pamphlet explaining in detail the construction of the Florida and Tropic boilers for steam and hot water respectively.

The construction of the Chicago cube concrete mixer is described in a catalogue issued by the Municipal Engineering & Contracting Co., Manhattan Bldg., Chicago. It is made in sizes from ½ to 2 cubic yards and in portable, semi-portable and stationary types, and one of its features is a measuring hopper in which the materials for a batch are placed in proper proportions while the mixer is preparing the preceding batch.

A catalogue of air compressors driven by special electric motors, mounted so as to form compact units, has been issued by the Christensen Engineering Co., Milwaukee, and 153 Broadway, New York. These compressors range in capacity from 4 to 1,000 cubic feet per minute, and are built in several types for different classes of service. One portion of the pamphlet illustrates a number of portable plants for use with pneumatic tools where an expensive piping system is undesirable.

A large number of designs of lawn fencing made of wire are illustrated in a 48-page catalogue from the Up-to-Date Mfg. Co., Terre Haute, Ind. These can be used with wooden posts if desired, but ornamental steel and cast-iron posts are made specially for the purpose, and gates, both single and double, are provided with the different styles.

The American Conduit Mfg. Co., New Kensington, Pa., has issued a folder describing the iron armored conduit tubing it is making for electric wiring.

The Philadelphia Machine Tool Co., 443 North Darien St., Philadelphia, has issued a folder describing its machines for testing chains, rope, long bars and the like. Large chain is proved in 15-fathom lengths which makes a special apparatus like this necessary.

The United Telpherage Co., 20 Broad St., New York, has issued several circulars illustrating the application of its system of overhead tracks and motors for handling baggage at railway stations, stone buckets in cement works and large packages in a paper-bag mill.

Personal and Obituary Notes.

Mr. Henry F. Hornbostel has been appointed consulting architect for the Department of Bridges, New York City.

Mr. William Kleefeld, Jr., has been appointed supervisor of bridges on the Middle Division of the New York Central & Hudson River Railroad, with headquarters at Utica.

Col. H. G. Prout, editor of the "Railroad Gazette," has received an honorary degree as Master of Arts from Yale University. He is a graduate of the University of Michigan in civil engineering.

The Pennsylvania Steel Company has located its Northwestern office in the Western Union Building, Chicago, in charge of Mr. Clifford J. Ellis, sales agent, and Mr. Robert E. Belknap, assistant sales agent.

Mr. C. A. Wentworth, of Somerville, Mass., and Mr. George A. McKay, of Troy, N. Y., have scored the highest marks in a competitive examination which will entitle them to appointment as civil engineers in the U. S. Navy.

Mr. C. E. Cartlidge has been appointed chief bridge engineer of the Chicago, Burlington & Quincy Railway, with headquarters at Chicago. Mr. George H. Bremmer has been appointed engineer of the Illinois lines, with jurisdiction in the States of Illinois, Wisconsin and Minnesota, and Mr. Frank Beckwith, engineer of the Iowa lines, with headquarters at Burlington.

Capt. M. G. Howe, M. Am. Soc. C. E., died June 19, at his home in Houston, Tex., after many months of poor health. He was born at Methuen, Mass., in 1834, and was a graduate of Dartmouth College. He had been a resident of Houston since 1859, when he entered upon an almost continuous railroad career, chiefly with the Houston & Texas Central Railroad, of which he became chief engineer. He served in the Confederate Army, rising to the rank of captain in the engineering corps.

Ira Alexander Shaler died on June 29 at the Presbyterian Hospital, New York, from the results of an accident received on June 17 in the Park Avenue tunnel of the New York Rapid Transit Railway. He was not quite 40 years old, yet in his brief career he had achieved the distinction that usually comes only later in life. After graduating from Cornell in 1884, he entered the employ of the Croton Aqueduct Commission, rising from a rodman's position to that of assistant engineer. He recognized very early, however, that contracting was his most congenial field, and in 1889-90 built several small water-works plants. In 1890 he became one of the firm of Washburn, Shaler & Washburn, and built the Titicus dam for the New York water-works. In 1894 he was the engineering member of J. W. Hoffman & Co., and built one of the Philadelphia electric roads. Later he served again as assistant engineer of the Croton Aqueduct Commission, but it was not long before he engaged once more in contracting. Some of his interesting plant for building the Gull Island fortifications was described in The Engineering Record of December 2, 1899. He was the engineer for John D. Crimmins while the latter was constructing many of the electric railways in New York. During all these years he had been gaining an unsurpassed reputation for care, skill and energy in the management of work, and it was accordingly expected when he undertook the construction of the tunnel where his fatal accident occurred, that this difficult enterprise would be carried through to a successful conclusion in a similarly notable manner. But, on the contrary, the contractor met with one misfortune after another, all borne with a courage that made even the people suing him for damages admire the steadiness with which he carried his great responsibilities.

The Feed-Water Heater in the Chicago Tribune Building, mentioned on page 608 of The Engineering Record of June 28, is a closed Bundy heater made by the A. A. Griffing Iron Company, and not an open heater, as stated erroneously.

Electric Power Transmission is to be tried in the refractory brick works of the Fayette Manufacturing Company, Chester, Pa. Induction motors will be used to drive the plant for mixing and grinding the materials, conveying them about the works and pressing them. A three-phase Westinghouse equipment has been purchased for the purpose.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Montreal, Que.—Bids are wanted July 8 for furnishing and delivering for the year 1902 special castings, brass castings, etc. L. O. David, City Clk.

Newcastle, N. B.—Bids are wanted July 15 for constructing a covered concrete and masonry reservoir. Address R. T. D. Aitken, Town Clk.; Willis Chipman, Ch. Engr., 103 Bay St., Toronto, Ont.

Brockport, N. Y.—The Village Trustees are reported to have appointed a committee to consider the question of establishing a municipal water works plant.

Canajoharie, N. Y.—The Palatine Bridge Water Co., of Canajoharie, has been incorporated with the Secretary of State. Its capital stock is placed at $10,000, and the directors for the first year are David Gring, of Newport, Pa.; J. D. Lanes, of Mechanicsburg; M. E. Johnson, of Canajoharie, and E. H. Ireland, of Palatine Bridge.

Biloxi, Miss.—This city has sold water works bonds to the amount of $40,000.

Baraboo, Wis.—The Water Wks. Com. is reported to have engaged an engineer to prepare plans and specifications for the new water works plant.

Indianapolis, Ind.—The Bd. of Pub. Wks. has approved in part the water main extensions (in all 8 miles are provided for) to be made by the Indianapolis Water Co. for the recently annexed territory of Irvington and Tuxedo.

Wallingford, Conn.—The Water Comrs. have voted to take land necessary for a storage reservoir for its water supply on Muddy River, including land for flowage, dam, etc.; dam to be built according to plans prepared by Engr. McKenzie.

Grafton, W. Va.—The Valley Falls Power Co., of Grafton, has been incorporated to operate water and electric light plants; capital stock, $50,000. Incorporators: John T. McGraw, George W. Whitescarver, of Grafton; James Conning, of Valley Falls, W. Va., and others.

Eldon, Ia.—Town Clk. Ed. J. Moore writes that it is proposed to change the location of the water works plant to river instead of wells. F. G. Isbell, Engr. in Charge.

Trenton, N. J.—The estimated cost of extending the water mains to Hillcrest is about $12,000.

Peabody, Mass.—Bonds to the amount of $150,000 are stated to have been voted for water works and $95,000 for a new school.

Gueydan, La.—The Gueydan Water Works & Power Co. has been organized, with a capital of $10,000. Bd. of Directors: W. L. Doss, H. L. Gueydan, J. G. Neells, and others.

Providence, R. I.—Bids are wanted July 15 for labor and material necessary for constructing a slow-sand filtration plant for the city, as advertised in The Engineering Record.

Ft. Revere, Mass.—Capt. Alfred M. Palmer, Q. M., U. S. A., Boston, writes that the following bids were opened June 19 for furnishing labor and material and constructing a water tower and standpipe at this Post: C. N. Taylor, Wellesley, Mass., rock, $15,900 and $15,700; brick, $14,400; granite, $16,500. R. Baffrey, 1123 Bway., New York, $11,980 (awarded). Walsh's Holyoke Steam Boiler Wks., Holyoke, Mass., steel standpipe, $2,960.

Troy, N. Y.—City Engr. E. R. Cary writes that the contract for the completion of Quakenkill dam was awarded to E. H. McKenna on June 28, for $4,562. The other bidders were P. Harrison Sons Co., at $5,874, and Behan & Cavanaugh at $6,843.

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until July 18 for furnishing material and erecting, testing and painting steam and feed water piping with fittings, separators, filters, galleries and platforms in H. S. Station No. 1. Hiram Phillips, Pres.

Chicago, Ill.—Contract Clk. Frank Murphy writes that the time for receiving bids for furnishing materials and constructing in the Chicago Ave. pumping station one electric traveling crane, with maximum lifting capacity of 20 tons, has been postponed until July 11. F. W. Blocki, Comr. of Pub. Wks.

Wheaton, Ill.—See "Schools."

Geneseo, Ill.—City Clk. Henry F. Hoeft writes that the contract for furnishing and delivering 9,600 ft. of 4-in. cast-iron pipe, 5,280 ft. of 2-in. wrought-iron, lap-welded steam pipe, 19 Matthews hydrants and 6 4-in. valves has been awarded to Doremus & Becker, of Geneseo, for $4,810.

Bloomington, Ill.—Ordinances have been passed for water mains on 3 streets. Elmer Folsom, City Engr.

Houston, Tex.—T. W. House writes that the Clark Rice & Irrigation Co., of which he is one of the incorporators, proposes to construct an irrigation system. Ross L. Clark, of Port Lavaca, Tex., Treas.

Bird Island, Minn.—Recorder Frank Murray writes that at a recent election it was voted to construct a system of water works at a cost of $8,000.

Henry, Ill.—Mayor A. G. Humphrey writes that it is proposed to construct water works at a probable cost of $40,000.

Whatcom, Wash.—City Clk. Wm. H. Hildebrand writes that on June 21 it was voted to issue bonds to the amount of $30,000 for the purchase of cast-iron water pipe.

Piqua, O.—W. B. Mitchell, Secy. Bd. of Water Wks. Trus., writes that on June 24 there were 34 bids received for furnishing pumps and boilers, as advertsed in The Engineering Record. Contracts for same were awarded as follows: To John H. McGowan & Co., of Cincinnati, for one 14 and 25x16x24-in. duplex pump, for $2,900. To Atlas Engine Co., Indianapolis, Ind., 2 horizontal tubular boilers, 66-in.x16 ft., for $1,390.

Philadelphia, Pa.—The only bid received June 25 by Wm. C. Haddock, Dir., Dept. of Pub. Wks., for erecting an administration building and pumping station at Upper Roxborough filters, and for constructing a system of baffles for the Lower Roxborough reservoir, was from Daniel J. McNichol, Betz Bldg., at $37,800 for the building and $13,390 for the baffles.

Sugar City, Colo.—Town Clk. and Recorder Sherman Farr writes that on June 13 a vote was taken in favor of constructing water works.

Austin, Pa.—Bids are wanted July 10 for furnishing materials and constructing a water works system, as advertised in The Engineering Record.

Mobile, Ala.—The Council has authorized Com. No. 6 to look into the possibility of purchasing the Bienville water works.

Los Angeles, Cal.—The Suburban Water Co. is stated to have been incorporated, with a capital of $30,000. Principal place of business, Los Angeles. Directors: Valentine Peyton, Arthur L. Hawes, John D. Pope, of Los Angeles, and others.

Blairsville, Pa.—The issue of $7,000 water extension bonds is said to be under consideration. M. E. Brown, Burgess.

Nassau, N. Y.—Bonds to the amount of $13,500 were voted at the recent election for a public water supply to be taken from Lyon's Lake.

Albany, Minn.—This village has sold water works bonds to the amount of $7,000.

Westerville, O.—Press reports state that the Water Wks. Trustees have finished drilling 3 wells which will have a capacity of 500,000 gal. daily, and that plans and specifications will soon be completed and contracts let for the construction of the water works system.

Comanche, Tex.—Local press reports state that Engr. Haley estimates the cost of a system of water works at $17,000.

Cullom, Ill.—This village is reported to have voted to establish a system of water works.

Enfield, N. H.—Bonds to the amount of $45,000 have been voted for a system of water works. E. B. Huse, Chmn. of Water Com.

Findlay, O.—Press reports state that the project to pipe water for this city from Mineral Springs, a distance of 10 miles, has been approved by the State Bd. of Health.

Philadelphia, Pa.—Local press reports state that the contract for furnishing gas engines for the high pressure fire pumping station to be erected at Delaware Ave. and Race St. has been awarded to M. R. Muckle & Co., of Philadelphia. They offered to furnish four vertical triplex double-acting piston or plunger pumps, connected with three cylinder driving engines, and two smaller pumps of the same type for $116,242. Their bid for extra pumps of the large type was $20,957 and for the smaller ones $9,378 each.

Milford, Ind.—The Town Bd. has granted a franchise to the Milford Water Co.

Duquoin, Ill.—Press reports state that the Ill. Central R. R. Co. proposes to construct a 60,000,000-gal. reservoir at Duquoin, on the St. Louis division. W. J. Harahan, Ch. Engr., Chicago, Ill.

Washington, D. C.—Congress has appropriated $600,000 for the filtration plant.

Horseheads, N. Y.—The proposition to secure a gravity system of soft water is under consideration.

Grinnell, Ia.—It is stated that a soft water supply is to be installed at an estimated cost of $15,000.

Langford, S. D.—The Langford Artesian Water Co. has been incorporated, with a capital of $5,000. Incorporators: Richard Williams, P. H. Gilbert, Q. A. Krieger, and others.

McRae, Ga.—At a recent election it was voted to issue bonds for water works and electric lights.

Tacoma, Wash.—Mayor Louis D. Campbell, in a communication to the City Council, recommended that steps be taken at once to procure an adequate supply of good water for the city. The Green River is said to be the only sufficient and permanent all-gravity water supply available. Estimated cost of securing a supply from this source is given as $500,000.

Portsmouth, Va.—Local press reports state that the Portsmouth, Berkley & Suffolk Water Co. proposes to put in a pumping system that will supply water direct from Lake Kilby to the main pipes. Geo Hornung, Gen. Mgr.

Sutherland, Ia.—Bonds to the amount of $4,500 have been voted to start work on the construction of a system of water works.

Berlin, Pa.—The Berlin Water Co. has been given the exclusive right to lay mains, etc., in the Boro. of Berlin. O. P. Shupe and W. H. Kalp, of Mt. Pleasant, are Pres. and Secy., respectively, of the Co.

Russell, Ia.—At a recent election a vote was taken in favor of installing water works. Estimated cost, $5,000.

Waco, Tex.—The City Council has voted to issue bonds to the amount of $200,000 for water works and an electric light plant, and the Mayor and Finance Com. has been authorized to do such preliminary work as may be necessary to secure right of way, etc.

Hamilton, O.—Dabney H. Maury, of Peoria, Ill., in a recent report to the Bd. of Control on the city's water works plant, recommends the installation of a new 6,000,000-gal. pumping engine, with necessary boilers, and extension of buildings; also supply reservoir wells, supplementary pump, motor and new pipe line, new wet well, connection of old supply to new pipe line, and supplementary pump house. Total estimated cost, $110,000.

Lancaster, Pa.—The Special Water Com. of Councils has recommended that the proposition of the Lancaster Water Co. to lease the water plant of the city for $900,000 be refused.

Terrell, Tex.—Water works bonds to the amount of $6,000 were voted at the recent election.

Ennis, Tex.—A committee has been appointed to consider plans for improving the water works.

Black River, N. Y.—B. N. Scott and H. C. Dexter are members of the committee of citizens which is making investigations with a view to installing water works.

Oxford, Ind.—The Oxford Water Co. has filed articles of incorporation, with a capital of $25,000. Directors: Sam. V. Perrott, Henry C. Ulen, Jr., and Albert G. Perrott.

Fairhaven, Wash.—Bonds to the amount of $60,000 are stated to have been voted for water works improvements.

Sacramento, Cal.—The City Bd. of Trustees has under consideration 2 propositions for a water supply for the city. One proposition offered by A. M. Hunt for the Eldorado & Deep Gravel Ditch Co. and the Diamond Ridge Ditch Co. proposes to bring water of the Eldorado ditch system to a point near Folsom and thence pipe it to Sacramento. The other proposition was offered by R. G. Hanford, representing New York capitalists, and contemplates carrying the water of North Fork ditch from the $100,000 stone dam near Auburn, in a cemented and covered ditch 25 miles to the settling and storage reservoirs above Orangevale, filtering the water there and piping thence in 30-in. steel mains to Sacramento, 22 miles. Mr. Hanford asks for a 20-year contract from the city, with the privilege of extension on its part for 10 years more, the city to pay a minimum of $80,000 per year for the water; daily supply, 6,500,000 gal.

SEWERAGE AND SEWAGE DISPOSAL.

Dayton, Ky.—The City Engr. estimates the total cost of constructing a sewerage system at about $100,000.

Indianapolis, Ind.—The Bd. of Pub. Wks. has approved plans of the City Engr. for the Northwestern Ave. sewer; length of sewer, 7,300 ft.; at its outlet it will be 5 ft. high and 10 ft. wide, and it will diminish gradually until it reaches an oval, 2x3 ft., and then end in pipe sewer from 24 to 10 in. in diameter; there will be 51 catch basins, 22 manholes and 35 inlets. Probable cost about $60,000.

Roselle, N. J.—At a recent special election Roselle Park voted in favor of sewer construction.

Washington, D. C.—Among the appropriations made by Congress are the following for work on the sewerage system in the Dist. of Columbia: Continuing construction of sewage disposal system, pumping station and for machinery with which to equip it, $250,000; cleaning and repairing sewers, $58,000; main and pipe sewers and receiving basins, $50,000; suburban sewers, $50,000; continuing boundary sewer to 22d and A Sts., N. E., $40,000; completing east side intercepting sewer, $52,000; continuing low area trunk sewer, $60,000; B St. and New Jersey Ave. sewer, $50,000; trunk sewer for western part of Georgetown, $20,000, and authority to complete said sewer at a cost not to exceed $42,000; additional work to cost $25,000.

Delray, Mich.—Bonds to the amount of $65,500 have been authorized for a sewer system.

Akron, O.—The City Council has adopted a resolution to construct a main trunk sewer in Dist. 9.

Canton, S. D.—Bids are wanted July 14 for constructing a sewer system. W. S. Ingham, City Aud.

Rock Rapids, Ia.—This town is reported to have contracted with C. F. Loweth, of St. Paul, Minn., to prepare plans and specifications for a system of sewers.

Antigo, Wis.—The Council has voted to construct a system of sewerage, according to local press reports.

Newark, N. J.—The lowest bid received June 26 for building Section 4, Second and Third Divisions of the West Branch of the Joint Outlet Sewer, was from Earle & Dougherty, of Jersey City, at $51,754.

Buffalo, N. Y.—Bids are wanted July 16 for constructing a 24-in. brick and a 15-in. tile sewer in a portion of Hayes Pl. and a 10-in. tile sewer in Zittle St. Francis G. Ward, Comr. of Pub. Wks.

Cleveland, O.—Bids are wanted July 8 for constructing sewers in portions of several streets. Chas. P. Salen, Dir. Pub. Wks.

South Brooklyn, O.—Bids will be received by W. T. Pupikofer, Village Clk., until July 19 for constructing sewers in portions of numerous streets.

Newark, N. J.—See "Bridges."

Des Moines, Ia.—Bids will be received by the Bd. of Pub. Wks. until July 21 for constructing 470 lin. ft. of 24-in., 1,130 lin. ft. of 18-in., and 7,115 lin. ft. of 12-in. vitrified clay pipe sewers. Bids will be received by the Bd. of Pub. Wks. until July 22 for constructing brick and pipe sewers as follows: 40 lin. ft. of 48-in., 4,320 lin. ft. of 42-in. and 790 lin. ft. of 36-in. 2-ring brick sewers; also 2,360 lin. ft. of 18-in. and 1,820 lin. ft. of 15-in. clay pipe sewers. Bids will also be received until July 22 for constructing the Highland Park lateral sewers, requiring about 27,330 lin. ft. of 12-in. vitrified clay pipe. J. E. Stout, Chmn.

Geneva, O.—City Clk. A. H. Reed writes that on June 26 it was voted to issue $25,000 bonds for sewerage.

San Juan, P. R.—Bids are wanted July 18 for furnishing and delivering upon the wharf at San Juan a quantity of salt-glazed sewer pipe, branches and Y pieces, as advertised in The Engineering Record.

Bloomington, Ill.—Ordinances have been passed for pipe sewers on 3 streets. Elmer Folsom, City Engr.

Fresno, Cal.—A storm water sewer system is to be constructed for the business portion of the city, at a cost of about $35,000. Sewers to be of brick, and laterals of pipe, 18,000 ft. in all, 30-in. to 12-in. in diameter.

Beloit, Wis.—The Bd. of Pub. Wks. will receive bids July 7 for 2,700 ft. of 20-in. and 900 ft. of 8-in. pipe sewers. Robt. Caldwell, City Engr.

Columbus, Miss.—An additional 10 miles of sewers will be built, work to be done by the city. J. L. Ludlow, of Winston, N. C., Engr.

East Grand Forks, Minn.—Bids for furnishing and laying 1,750 ft. of 12-in. and 490 ft. of 8-in. sewer pipe, 18 catchbasins and 6 manholes, will be opened by the City Council on July 15. Henry Harn, Recorder.

Rochester, N. Y.—The Common Council on June 24 passed final ordinances for sewers in Colvin and Barton Sts.

Albany, N. Y.—Bids will be received by the Bd. of Contract & Supply until July 7 for constructing the Central Ave. sewer, consisting of 1,330 lin. ft. of 10 and 12-in. pipe, and 1,130 lin. ft. of 15-in. double strength pipe. Bids are also wanted for constructing pipe sewers in portions of 4 streets. Isidore Waschman, Clk.

Binghamton, N. Y.—Bids are wanted July 22 for constructing sewers in portions of 4 streets. I. C. Hull, City Clk.

Worcester, Mass.—The Com. on Sewers of the Council voted to recommend the adoption of an order for the construction of a sewer and pumping station in Worcester Highlands, at an estimated cost of $7,500.

Griffin, Ga.—Local press reports state that the City Council has decided to construct a sewer system.

Plain City, O.—The City Council is said to be considering plans for a drainage system.

Indiana, Pa.—The Council has passed an ordinance providing for the construction and maintenance of filter bed or disposal plant and mains for public sewerage for the Boro. of Indiana and the extension of necessary sewer mains beyond limits of borough to the disposal plant.

E. St. Louis, Ill.—Bids are wanted July 8 for constructing 18,000 lin. ft. of 6 to 24-in. sewers, 35,000 cu. yds. of sewer excavation and refilling. L. L. Harper, Chmn. Bd. Local Improv.

Lafayette, Ind.—Bids will be received by the Co. Comrs. until July 11 for 15 steel pipe culverts and 5 concrete or vitrified brick arch culverts. G. H. Stevenson, City Engr.

La Grange, Ga.—At the election held June 23 bonds to the amount of $25,000 were voted for the construction of a system of sewerage.

Napakoneta, O.—Riggs & Sherman, of Toledo, are stated to have received the contract for the preparation of plans for a sewerage system.

Galveston, Tex.—See "Paving and Roadmaking."

Pueblo, Colo.—Local press reports state that the following bids were opened June 23 for the construction of a combined storm and sanitary sewer system for this city: J. M. O'Rourke Const. Co., Denver, $335,889; The Colorado Co., Denver, $298,254.

Seattle, Wash.—An ordinance before the City Council calls for an expenditure of $20,000 for the building of septic tanks on the shores of the lakes to consume the sewage of the city.

Worcester, Mass.—The City Council recently made a partial inspection of the city sewer system, one of the objects of the trip being to consider the need of at least 50 new filtration beds at the sewage purification works at Quinsigamond. The city has already acquired the land for these beds and the estimated cost of construction has been placed at $100,000. It is not proposed to build all of these beds at one time.

Cincinnati, O.—The Bd. of Pub. Service has approved specifications for a sewer in Observatory Ave. Estimated cost, $7,028.

Maryville, O.—The business men are stated to have petitioned the City Council for a public sewer system.

Salem, Mass.—The Com. on Sewerage of the City Council has voted to employ Guy W. Ricker, of Salem, to make plans for the South Salem intercepting sewer.

BRIDGES.

Newport, Va.—Press reports state that the Hampton Roads Ry. & Electric Co. has asked the city for permission to construct a bridge at 26th St.

St. Paul, Minn.—Local press reports state that the State Bd. of Control has awarded the contract for constructing a 387-ft. steel truss bridge across Vermilion River, near Hastings Asylum, to the American Bridge Co. at $5,000. The main span is to be 95 ft. long.

Sioux Falls, S. D.—The City Council has adopted a resolution to compel the Great Northern, the Omaha and the Chicago, Milwaukee & St. Paul R. R. Cos. to construct a viaduct at 8th St.

South Bend, Ind.—Fred. Hoffman, Crawfordsville, Ind., has received, according to local press reports, the contract to construct a bridge across the race at Colfax Ave. for $8,495.

Benicia, Cal.—It is stated that the officials of the Southern Pacific R. R. Co. are considering the construction of a bridge across the Straits of Carquinez, from Benicia to Port Costa. W. Hood, Ch. Engr., San Francisco.

Flint, Mich.—Local press reports state that the construction of a bridge at Saginaw St., at a probable cost of $21,458, is contemplated.

Newark, N. J.—According to local press reports plans are about to be adopted for a through girder steel and iron bridge which the Delaware, Lackawanna & Western R. R. Co. intends constructing across Broad St., this city.

Pittsfield, Mass.—Collins & Norton have submitted plans and specifications for an iron bridge to be built at Dalton Ave.

Charleston, S. C.—The Senate has passed bills authorizing the construction of 2 bridges across Ashley River, in the counties of Charleston and Dorchester, S. C.

Pierre, S. D.—A bill has passed both the House and Senate authorizing the Duluth, Pierre & Black Hills R. R. Co. to construct a bridge across Missouri River at Pierre.

Solebury, Pa.—The Co. Comrs. have approved plans for an arch bridge to be built by the Supervisors of Solebury Township.

Middlebourne, W. Va.—D. Hickman, Clk. of the Tyler Co. Court, writes that the Riverside Bridge & Machine Wks., of Wheeling, have secured the contract for the iron superstructure for the Shiloh bridge, at $3,734, and the contract for the stone work has been awarded to B. F. Pipes, of Shiloh, for $5,175.

Three Rivers, Mass.—At a Town Meeting held recently, $6,000 was appropriated for the construction of a bridge, with concrete floor, across Quaboag River at Three Rivers.

Altoona, Pa.—City Engr. Harry Linton writes that plans are being prepared for a highway bridge near the sewage filter beds.

Akron, O.—Bids are wanted July 26 for the construction of a concrete-steel arch bridge at Falor St., width over all 43 ft., 5 arches, span 40 ft. 3 in. Estimated cost, $25,000. Plans and specifications on file at the office of City Engr. J. W. Payne and at office of Osborn Engineering Co., Cleveland, O.

Port Royal, Tenn.—It is stated that the construction of a bridge across Red River is being agitated.

Tuscaloosa, Ala.—B. H. Hardaway is reported to have received the contract to repair the Foster's Ferry bridge at $6,150.

Macleod, N. W. Ter.—Press reports state that the replacing of the bridge washed away by the freshets is being agitated.

Artemus, Ky.—It is stated that the Co. Comrs. will soon receive bids at Knox for the construction of a $15,000 bridge 375 ft. long across Cumberland River at Artemus.

Lethbridge, N. W. Ter.—According to reports the bridge which was destroyed by the floods last month may be replaced in the near future.

Grafton, Pa.—J. J. Neel, the Comr. appointed by the Co. Court to report on the condition of the bridge at Grafton, reports in favor of removing present structure and constructing a steel bridge at an estimated cost, including the removal of present structure, of $11,560.

Ft. Plain, N. Y.—Bids will be received at Albany by Chas. S. Boyd, State Supt. of Pub. Wks., until July 10 for constructing a bridge across Otaquago Creek, in Ft. Plain.

Craig, Mont.—Bids will be received by the Comrs. of Clarke & Lewis Co. until July 19 for constructing a steel or combination bridge across Missouri River at Craig. Plans and strain sheets are to be furnished with bids. Sidney Miller, Co. Clk., Helena.

St. Clairsville, O.—Bids will be received by the Bd. of Co. Comrs. until July 24 for furnishing material and constructing the stone substructure of a bridge on McMahons Creek Pike, in Pultney Township. M. Aldredge, Co. Aud.

Noblesville, Ind.—Bids will be received by the Bd. of Co. Comrs. until July 8 for furnishing and constructing a steel bridge, 50-ft. span, and a steel bridge, 65-ft. span, across Stony Creek near Dublin; also a steel bridge, 52-ft. span, across Mud Creek near Fishers Station. J. A. Mitchell, Engr.

North Loup, Neb.—It is stated that bids will be received by the Co. Comrs. at Ord until July 15 for constructing a 320-ft. bridge across North Loup River, about 2 miles northeast of North Loup. Address Co. Clk.

Erie, Kan.—Bids will be received by the Co. Comrs. until July 12 for constructing 3 steel bridges, to be located as follows: 1 across Village Creek, the main span to be 65 ft. long, the northern approach 40 ft. and the southern approach 65 ft. long; 1 across Neosho River, the main span to be 125 ft. long, the northern approach 28 ft. and the southern approach 36 ft. long; and 1 across Neosho River, the main span to be 150 ft. long, the east approach 75 ft. long and the west approach 30 ft. long. B. W. Garvin, Co. Clk.

Newark, N. J.—Bids will be received by the Bridge Com. of the Co. Bd. of Chosen Freeholders until July 7 for constructing the following bridges: Stone abutments and steel beam bridges on Turrell Ave. and Meadow Brook Lane, South Orange; culvert on Avondale Road, Nutley; extension of steel superstructure and brick bridge on Glenwood Ave., Bloomfield; stone abutments and steel beam bridge on Cross St., Montclair; also for 2,000 ft. of 24-in. stoneware pipe. Jas. Owen, Co. Engr.

Allentown, Pa.—It is stated that the building of a bridge from the 10th to the 6th Ward is being agitated.

Cincinnati, O.—The Miami & Erie Transportation Co. has asked the Co. Comrs. for permission to strengthen and lengthen the following bridges: Ross Ave., Cook Ave., 2d St., Carthage, Paddock Road and Edgemont Ave. structures.

Washington, D. C.—A bill has passed both the House and Senate authorizing the W. Elizabeth & Dravosburg Bridge Co. to construct a bridge across Monongahela River, in Pennsylvania.

Philadelphia, Pa.—Local press reports state that the engineers of the Philadelphia Rapid Transit Co. are considering plans for a bridge which will replace present structure at Market St.

Richmond, Va.—See "Electric Railways."

Houston, Tex.—City Engr. Dormant has prepared plans and specifications for constructing a viaduct across Montgomery Ave. crossing as a solution of the question of allowing the Southern Pacific R. R. to build 4 more tracks on the avenue.

Hammond, Ind.—The House and Senate have passed a bill authorizing the N. Y., Chicago & St. Louis and the Chicago & St. Louis R. Rs. to construct a bridge across Calumet River at Hammond.

Morgantown, W. Va.—The South Morgantown Bridge & Improvement Co. has been incorporated, with a capital of $50,000, for the purpose of improving the southern part of Morgantown by building bridges and paving and constructing roads.

Medford, Ore.—C. D. Redinger is reported to have secured the contract to construct a 2-span steel bridge, each span 110 ft. long, across Bear Creek at 7th St., for $5,995.

Akron, O.—The Northern Ohio Traction Co. has, according to reports, awarded the contract to construct a concrete and steel viaduct across Cuyahoga River at the gorge, 2 miles above this city, to the American King Bridge Co., of Cleveland, for $50,000.

Paterson, N. J.—Bids will be received at Paterson until July 8 by the West Milford & Wayne Bridge Committees of the Bd. of Co. Chosen Freeholders, David Wickham and Garret Berdan, Chmn., respectively, for constructing the following bridges: Steel beam and concrete arch bridge with macadam roadway on the Paterson and Hamburg Turnpike above Smith Mills, West Milford Township, and a steel beam and brick arch bridge with macadam roadway in Wayne Township. Wm. L. Whitmore, Co. Engr., Rm. 29, Savings Institute Bldg., Paterson.

Kansas City, Kan.—A bill has passed the Senate authorizing the construction of a bridge across Missouri River, about 5 miles north of the Kaw River in Wyandotte Co., Kan., and Clay Co., Mo., and to make the same a post route.

Paducah, Ky.—See "Electric Railways."

Brooklyn, Minn.—Bids are wanted July 7 for rebuilding bridge No. 160, Brooklyn. Geo. W. Cooley, Co. Surv., Minneapolis.

Braceville, O.—Bids are wanted July 11 for constructing an iron bridge across Mahoning River at Braceville. Chas. R. Shelby, Co. Aud., Warren.

Tremont, Pa.—Bids are wanted July 8 for constructing 2 iron bridges. J. H. Faust, Secy., Tremont.

Walhalla, S. C.—Bids are wanted July 10 for constructing a steel bridge. F. A. H. Schroder, Co. Clk.

Glen Cove, L. I., N. Y.—Local press reports state that the construction of a $20,000 iron bridge across the lower lake, connecting North and South Glen Cove, is being agitated.

Pekin, Ill.—The Highway Comrs. of Pekin Township have petitioned the County for assistance in the construction of an iron bridge across Lick Creek, estimated to cost $3,000.

PAVING AND ROADMAKING.

Upper Sandusky, O.—The County Comrs. on June 28 sold $32,700 road improvement bonds.

Mobile, Ala.—The City Council on June 27 adopted the 2d Dist. paving scheme, which provides for the paving with asphalt, on concrete foundation, of numerous streets, the paving with brick on concrete foundation of 1 street and the paving with brick on sand foundation of several streets; curbing for this improvement to be of both stone and of concrete.

Michigan City, Ind.—H. M. Miles, City Engr., writes that bids will be received until July 21 for improving 8th St. by paving with asphalt, 5,500 sq. yds.

Pasadena, Cal.—It is stated that bids will be received by the City Clk. until July 14 for furnishing an improved road roller, to be delivered Dec. 1.

Massillon, O.—The City Council has adopted a resolution providing for the paving with brick blocks of Plum, Tremont, Oak and other streets; total estimated cost, $13,023, and Mill St., total estimated cost, $24,146.

Perth, Ont.—The Lanark County Council has decided to issue $85,000 bonds, for the purpose of constructing a system of good roads throughout the county.

Milwaukee, Wis.—Local press reports state that the Reliance Contracting Co. secured the work of paving a portion of 13th St., an area of 4,911 yds., with brick at $2.16 a yd., and Alfred Johnson secured a contract for paving 24,710 sq. yds. on 3d St. with brick at $2.23 a yd.

New Brighton, S. I., N. Y.—Bids will be received by Geo. Cromwell, Boro. Pres., 1st Nat. Bank Bldg., St. George, New Brighton, until July 11 (readvertisement) for furnishing materials and regulating, grading and paving with macadam on portions of several streets, in all about 24,250 sq. yds.

Brainerd, Minn.—Bids are wanted July 7 for paving with macadam of crushed rock, and a curbstone of granite or Kettle River sandstone, on Front St. Bids are also wanted for cement curb and gutter on Laurel St. R. K. Whiteley, City Engr.

Minneapolis, Minn.—The City Council has authorized the expenditure of approximately $60,000 for paving. The paving ordered being sandstone blocks on 6-in. concrete foundations for 3 streets, sandstone blocks on sand foundations for 2 streets; brick on 6-in. concrete for 2 streets, and macadam for 1 street.

Buffalo, N. Y.—Bids are wanted July 15 for paving a portion of Woodside Ave. Francis G. Ward, Comr. of Pub. Wks.

Jersey City, N. J.—Bids will be received by the Bd. of Street & Water Comrs. until July 8 for improving a portion of Garfield and Wilkinson Aves., requiring about 21,200 sq. yds. of Belgian pavement; also for improving a portion of Pavonia Ave., requiring about 1,822 sq. yds. of Belgian pavement. Geo. T. Bouton, Clk.

Napoleon, O.—Bids will be received by Usher Fisher, Village Clk., until July 22 for furnishing material and paving Perry St. and Oakwood Ave. (about 18,000 sq. yds.) with a vitrified brick or asphalt block on a stone foundation, or with asphalt block on present stone or sand foundation on Perry St. and on a crushed stone foundation on Oakwood Ave. C. N. Schwab, Engr.

Duluth, Minn.—W. B. Patton, City Engr., writes that bids will be received about July 14 for paving with sheet asphalt and also with Warren's bituminous macadam, about 20,000 sq. yds., on E. Superior St., from 8th Ave. E. to 16th Ave., E.

Galveston, Tex.—City Engr. C. G. Wells has submitted the following estimates for improving Tremont St.: pipe drain, which includes 1,900 ft. 36-in. and 1,425 ft. 30-in. drain, 50 catch basins and 1,920 ft. 12-in. connections, $13,122; brick paving, 16,183 sq. yds., 1,000,000 brick, removing old blocks, etc., $36,222.

Morgantown, W. Va.—See "Bridges."

Paterson, N. J.—Bids will be received by the Co. Bd. of Chosen Freeholders until July 7 for grading and macadamizing the Clove Road in Little Falls Township. Geo. W. Botbyl, Clk.

Bids will be received by the Road Com. of the Co. Bd. of Chosen Freeholders at Paterson, until July 7 for macadamizing the following roads: portions of Jane, North 3d and E. 26th Sts., Paterson Saw Mill Road, Wayne Township, and Broad St. and part of Montclair Ave., Pompton Lakes Borough. Jacob Geroe, Chmn.; Wm. L. Whitmore, Co. Engr., Rm. 29, Savings Institution Bldg., Paterson.

Darby, Pa.—Bids are wanted July 7 for grading and macadamizing portions of 3 avenues and a portion of Springfield Road. Address Wm. Simpson, Chmn. Highway Com., Box 82, Darby.

Mt. Pleasant, O.—Bids will be received by the Turnpike Comrs., care Jas. E. Finley, Mt. Pleasant, until July 23 for grading and macadamizing Mt. Pleasant Section and Long Run Free Turnpike.

Steubenville, O.—Bids will be received by the Co. Comrs. until July 22 for paving and curbing a road, about 5,200 ft. long and 28 to 30 ft. wide. C. M. Brown, Chmn.

Delaware, O.—Bids will be received by J. B. Taggart, Co. Surv., Delaware, until July 21 for constructing the Cryder and Hughes Road Improvement.

Chicago, Ill.—Bids are wanted July 8 for improving a portion of Blue Island Ave. by curbing and paving with brick. John A. May, Secy.

Cincinnati, O.—The contract for improving Augusta St. with granite has been awarded to F. H. Kirchner, Cincinnati, for $7,367.

Dayton, O.—Bids are wanted July 23 for paving with bituminous macadam, brick or sheet asphalt, furnishing and setting curbs on Maple St. Estimated quantities: 5,600 sq. yds. of paving, 3,650 lin. ft. straight curb, 80 lin. ft. circular curb, etc. Bids will also be received for paving with bituminous macadam or macadam, furnishing and setting curbs on Central Ave. Estimated quantities: 7,370 sq. yds. paving and 4,425 lin. ft. straight curb, 60 lin. ft. circular curb, etc. Robt. M. Ferguson, City Compt.

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until July 18 for furnishing material and improving portions of numerous streets, by grading, preparing the roadbed for the superstructure, setting granite curbing and laying a vitrified brick roadway, both on a concrete foundation. Said bids to include a 6-year guarantee. Hiram Phillips, Pres.

Long Island City, N. Y.—Bids will be received by Jos. Cassidy, Boro. Pres., until July 10 for furnishing and delivering to the Bureau of Highways 10,000 cu. yds. of broken stone and screenings of trap rock and limestone.

Brooklyn, N. Y.—Bids will be received by J. Edw. Swanstrom, Boro. Pres., until July 11 (extension of date) for regulating, grading and paving with asphalt (11,661 sq. yds) on portions of 4 streets. Bids will also be received for regulating, grading and paving 5,090 sq. yds. with granite on a sand foundation on Meserole and Waterbury Sts., 3,370 sq. yds. with macadam on Mermaid Ave., and for regulating and repaving 2,760 sq. yds. with Medina sandstone on a concrete foundation on High and South 3d Sts.

Des Moines, Ia.—Bids will be received by the Bd. of Pub. Wks. until July 21 for paving about 20,300 sq. yds. on Walnut St. with 1 course No. 1 vitrified brick on a concrete foundation, with Portland cement top filler. J. E. Stout, Chmn.

Lafayette, Ind.—Press reports state that Main St. is to be paved with asphalt.

Kensington, Md.—The Town Council has decided to issue $5,000 bonds for the purpose of constructing additional sidewalks and improving the streets.

South Bend, Ind.—Bids will be received July 8 by the Co-operative Investment Co., of South Bend, Edgar A. Stoll, Secy., for improvements on Bowman St. as follows: 19,082 sq. ft. cement walk, 3,896 lin. ft. cement curb, and 4,007 cu. yds. of excavation.

Chicago, Ill.—The South Side Streets & Alley Com. has decided to recommend the passage of an ordinance providing for the pavement of streets in the vicinity of 34th St. between Robey St. and South Western Boulevard. The improvement will cost $161,000.

Albany, N. Y.—Bids will be received by the Bd. of Contract & Supply until July 7 for grading and paving on portions of 3 streets with vitrified paving blocks; on a portion of Beaver St. with granite blocks and on a portion of Robin St. with vitrified fire clay paving blocks. Isidore Waschman, Clk.

Elgin, Ill.—A petition has been granted by the Bd. of Local Improv. for the paving of West Chicago St. with brick at an estimated cost of $18,000 to the city and $5,500 to street car company.

Fond du Lac, Wis.—F. A. Bartlett, City Clk., writes that it is proposed to repave Main St., probably with brick. Contracts will not be let until next spring. E. B. Parsons, City Engr. Probable cost, $40,000.

East Grand Forks, Minn.—Recorder Henry Harm writes that the City Council has extended the time for letting contracts for about 41,753 sq. yds. of paving and about 21,100 ft. of curbing until July 15, and will consider bids on cedar blocks, sandstone, solid granite macadam, or any other material. Plans and specifications for cedar block and solid granite macadam paving and for pine, Kettle River sandstone, solid granite curbing or combined curb and gutter, are on file in the office of the Mayor; parties bidding on other materials to furnish their own plans and specifications.

Bloomington, Ill.—An ordinance has been passed for brick pavement on Jefferson St. Elmer Folsom, City Engr.

Auburn, N. Y.—The Common Council on June 26 resolved to pave South and Dill Sts., in all about 17,200 sq. yds., with asphalt.

Beloit, Wis.—The Common Council has given notice that contracts are about to be let for grading, paving with vitrified brick, macadamizing and setting stone curbing on several streets. D. H. Foster, City Clk.

South Glens Falls, N. Y.—The Village Bd. is stated to have awarded to Perry S. Brackett at $3.37½ per sq. yd. the contract for paving a portion (about 1,000 yds.) of the river hill with granite block.

Saginaw, Mich.—The Bd. of Estimate is stated to have approved an issue of $5,000 east side street improvement bonds and $20,000 west side street improvement bonds.

Rochester, N. Y.—The Common Council on June 24 passed final ordinances for macadam pavement on Brunswick, Somerset and Tacoma Sts.; also for cement walks on Temple and Van Stallen Sts.

Avondale, Ala.—See "Railroads."

Allentown, Pa.—The Comrs. of Whitehall Township have decided to build a road on Helfrich Spring route from Allentown to W. Coplay. Estimated cost, $25,000.

Schenectady, N. Y.—An ordinance for grading, paving and curbing Devine St. has been adopted by the Common Council.

Cincinnati, O.—The County Comrs. have adopted a resolution asking Co. Engr. Krug to submit estimates for the improvement of Carthage Pike between Mitchell and Spring Grove Aves.

Trenton, N. J.—Local papers quote State Comr. of Pub. Roads Henry J. Budd as having stated that it is expected to build nearly 200 miles of State roads in New Jersey this year.

Camden, N. J.—The Bd. of Freeholders has rejected all bids opened June 25 for stoning Sandy Lane for a distance of 2.2 miles (the lowest bid being $16,419), and new bids will be opened July 9. Edw. S. Dobbs, Chmn. of Stone Road Com.

Lowell, Mass.—The Street Com. has voted to recommend the appropriation of $69,105 for the paving with asphalt and macadam of certain streets.

Watertown, N. Y.—The Bd. of Pub. Wks. on June 23 adopted a resolution for the paving of State St. from Smith block to Pleasant St. with bituminous macadam, at a total estimated cost of $42,113.

Niagara Falls, N. Y.—Local press reports state that plans are under consideration for extensive asphalt paving in the business portion of the city.

Tacoma, Wash.—Local press reports state that the Northwest Bridge Co., known as Mill & Tweeden, secured the contract for paving a portion of I St. with bituminous macadam for $37,409.

Indianapolis, Ind.—The contract for resurfacing with asphalt the roadway of a portion of Washington St. is stated to have been awarded to the Western Construction Co. at $6.46 per lin. ft.

Toronto, Ont.—Local press reports state that the following asphalt paving contracts have been awarded to the Forest City Paving Co., of London, Ont.: Fern Ave., $8,100; Phoebe St., $6,200; Spadina Ave., Queen to College, $43,400; Spadina Ave., Baldwin to College, east side, $8,000; west side, $5,900.

Washington, N. J.—The voters of Washington Township have voted to make application for 7 more miles of macadam roads, and authorized the Township Com. to borrow money to pay 10 per centum of the cost thereof.

Norwich, N. Y.—Plans and specifications have been prepared for paving old Lock St. with brick to a width of 22 ft. Estimated cost, $5,555 to $7,000.

Buffalo, N. Y.—The lowest bids opened June 26 for paving Bradley St. are reported to have been from the German Rock Asphalt Paving Co. at $8,730 for asphalt and from L. H. Gipp at $8,700 to $8,999 for brick, according to the kind desired.

E. St. Louis, Ill.—Bids are wanted July 8 for 25,200 sq. yds. of vitrified brick paving, cement grouted, on concrete foundation; 9,900 lin. ft. stone curbing, etc. L. L. Harper, Chmn. Bd. Local Improv.

Akron, O.—Bids are wanted July 12 for paving Byers Ave. with brick or block asphalt, about 3,000 sq. yds. J. W. Payne, City Engr.

Wilkesbarre, Pa.—This city has readvertised for bids, to be opened July 7, for resurfacing certain streets with asphalt. Fred. H. Gales, City Clk.

Chicago, Ill.—Bids are wanted July 9 for improving certain streets by curbing and brick paving. F. W. Blocki, Comr. of Pub. Wks.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until July 28 for improving a portion of Lincoln Ave. by grading, curbing and paving the roadway with asphalt. Geo. F. Holmes, Clk.

Ashland, Wis.—M. T. Dozer, City Engr., writes that the time for receiving bids for macadam paving has been extended to July 15.

St. Louis, Mo.—Bids will be received by Isaac S. Taylor, Dir. of Wks., until July 7 for lagoon grading, revetment and drains; also for 7,000 lin. ft. of macadam roads. Richard H. Phillips, Ch. Engr.

Detroit, Mich.—Bids for paving in several streets were opened June 24, the lowest in each case being as follows: Vinewood Ave., cedar, J. Mercer, $8,792, $1.43 per yd.; Forest Ave., brick, W. Lappin, $12,673, $1.91 per sq. yd.; Hastings St., brick, W. Lappin, $8,368, $1.98 per sq. yd.; 24th St., cedar, J. Porath, $12,854, $1.45 per sq. yd.; Humboldt Ave., cedar, J. Porath, $7,887, $1.56 per sq. yd.; Congress St., cedar, W. E. Linnane, $9,086, $1.53 per sq. yd.; Labrosse St., cedar, W. E. Linnane, $8,062, $1.49 per sq. yd.; St. Aubin Ave., cedar, Henry Merdian, $8,726, $1.42 per sq. yd.

Oshkosh, Wis.—The Council has awarded the contracts for paving Algoma St. to Harding, Nelson & Johnson, of Racine, for brick between Bond and Light Sts. at $2.39 per sq. yd., and to the Barber Asphalt Paving Co. for asphalt between Light and Jackson Sts. at $1.98 per sq. yd.

The Council has voted to issue street improvement bonds to the amount of $10,000.

Superior, Wis.—Local press reports state that the following bids were opened recently for repaving Tower Ave. with cedar blocks: *a*, setting curb, per ft.; *b*, oak lumber, per thousand; *c*, gravel, cu. yd.; *d*, white pine, thousand; *e*, hemlock, thousand; *f*, old plank, relaying, thousand; *g*, cedar, sq. yd.: Burke Bros., of Superior, *a* 8 cts., *b* $30, *c* 95 cts., *d* $26, *e* $21, *f* $6.50, *g* 80 cts.; P. McDonnell, of Duluth, *a* 15 cts.; *b* $35, *c* $1, *d* $23, *e* $18, *f* $7, *g* 79 cts. The contract is stated to have been awarded to Burke Bros., their total bid being estimated at about $55,000.

Elizabeth, N. J.—City Surv. W. H. Luster, Jr., writes that the following bids were opened June 16 for paving a portion of Fulton St.: A, J. R. Shanley, 26 Exchange Pl., Jersey City, $39,967; B, Jas. J. Poth, Elizabeth, $40,820; C, W. J. McCloud, Elizabeth, $43,331; D, Van Duzen & Oliver, New Brunswick, $46,930; E, Chas. Wagner, Jersey City, $42,383. For detail bids see accompanying table:

Bidders.	Specification blk., 21,625 sq. yds.	Curb reset, 10,000 ft.	New curb, 750 ft.	Curved corners.	Bridgestone.
A	$1.79	$.05	$.36	$1.00	$.95
B	1.83	.05	.40	.50	.90
C	1.94	.07	.40	.60	.75
D	2.10	.05	.35	.60	.70
E	1.90	.06	.40	.40	.80

St. Louis, Mo.—The following bids were opened June 10 for reconstructing Laclede Ave. from Grand Ave. to Kingshighway Boulev.:

Items and Quantities.	R. F. Conway & Co.	Parker-Washington Co. of W. Va.
Taking up old gutter and crosswalk pave., hauling, etc., per square of 100 ft., 671 ft.	$3.00	$3.00
Filling with new macadam, per square of 100 cu. ft., 145 cu. ft.	4.00	4.00
New Port. cement concrete, 6-in. deep, laid, per square of 100 ft., 671 ft.	9.20	9.00
New limestone curb, furnished and set, per lin. ft., 4,542 lin. ft.	.60	.70
Old curb reset, per ft., 3,634 lin. ft.	.10	.10
Rem. portions of roadway pave. above grade of found., per square of 100 ft., 2,291 ft.	3.00	2.50
Placing fine concrete 1-in. thick on portions of roadway having found. of old macadam, per square of 100 ft., 2,291 ft.	1.50	....
Vit. brick paving on base of sand, inclusive of expansion joint, per square of 100 ft., 2,962 ft.	18.66	16.50
Totals	$77,435	$70,212

Bids for the reconstruction of several other streets were opened at the same time and were as follows on the principal items: *a*, per lin. ft. for granite curbing 6 in. thick and 16 in. deep on concrete foundation; *b*, per square of 100 ft. for Portland cement concrete 6 in. deep, laid complete; *c*, per square of 100 ft. for vitrified brick paving laid on a base of sand; *d*, total:

Morgan St.—Parker-Washington Co., *a* $1.07, *b* $8.50, *c* $16.50, *d* $37,579; R. F. Conway & Co., *a* $1, *b* $9.20, *c* $16.02, *d* $37,365.

Lawton Ave.—R. F. Conway & Co., 50 cts. per ft. for 4-in. limestone curbing, *c* $18, *d* $39,132; Parker-Washington Co., 4-in. limestone curbing 65 cts., *c* $16.50, *d* $39,513; Gilsonite Const. Co., 55 cts. for 4-in. limestone curb, *c* $16.50, *d* $37,811.

Leonard Ave.—Morey Eng. & Const. Co., *a* $1.10, *b* $7, *c* $13.98, *d* $19,931; R. F. Conway & Co., *a* $1, *b* $9.20, *c* $16.02, *d* $22,611.

Cardinal Ave.—Fruin-Bambrick Const. Co., *a* $1.05, *b* $9, *c* $18.50, *d* $18,521; Morey Eng. & Const. Co., *a* $1.10, *b* $7, *c* $13.93, *d* $15,016; Parker-Washington Co., *a* $1.07, *b* $9, *c* $16.50, *d* $17,418; R. F. Conway & Co., *a* $1, *b* $9.20, *c* $16.02, *d* $17,092.

Compton Ave.—Morey Eng. & Const. Co., *a* $1.10, *b* $7, *c* $13.73, *d* $16,447; Fruin-Bambrick Const. Co., *a* $1.05, *b* $9, *c* $18.50, *d* $20,385; R. F. Conway & Co., *a* $1, *b* $9.20, *c* $16.02, *d* $18,816; Parker-Washington Co., *a* $1.07, *b* $9, *c* $16.50, *d* $19,180.

Boyle Ave.—R. F. Conway & Co., $1 per ft. for granitoid curb and gutter 3 ft. wide, *b* $9.20, *c* $18, *d* $15,017; Parker-Washington Co., $1.10 for granitoid curb and gutter, *b* $9, *c* $16.50, *d* $14,579.

Bridgeport, Conn.—City Clk. E. T. Buckingham writes that the following bids were opened June 23 for furnishing and laying about 8,500 sq. yds. of brick pavement: *a*, Mack block; *b*, Mack brick; *c*, Porter block; *d*, Porter brick; *e*, Syracuse brick: Silliman & Godfrey, Bridgeport, *a* $2.80, *b* $2.78, *c* $2.76, *d* $2.73, *e* $2.70; B. D. Pierce, Jr., Co., Bridgeport, *b* $2.85, *d* $2.80, *e* $2.80; C. W. Blakeslee & Sons, New Haven, Conn., *b* $2.79, *d* $2.72½, *e* $2.71½; Frank L. Pidgeon, Saugerties, N. Y., *a* $2.68, *b* $2.66 wire cut, *c* $2.25, *d* $2.46 wire cut (awarded), *e* $2.61 wire cut or straight edge.

New York, N. Y.—The following bids were opened June 30 by Jacob A. Cantor, Pres. Boro. of Manhattan, for asphalt block pavement on a concrete foundation: A, Hastings Pavement Co., 25 Broad St., B, Lake Erie Asphalt Block Co.; C, Continental Paving Co.:

Items and Quantities.	A.	B.	C.
Broadway, from 187th St. to Dyckman St. line.			
Asph. blk., 26,808 sq. yds.	$1.58	$2.30	$1.59
Concrete, 5,124 cu. yds.	6.00	5.50	6.40
New curb, 6,250 lin. ft.	.90	1.00	.95
Old curb, 1,250 lin. ft.	.40	.35	.45
Audubon Ave., from Kingsbridge Rd. to 173d St.			
Asph. blk., 8,768 sq. yds.	$1.79	$2.30	$1.59
Concrete, 1,636 cu. yds.	6.00	5.50	6.80
New curb, 1,500 lin. ft.	.90	1.00	.95
Old curb, 2,138 lin. ft.	.40	.35	.45

Albany, N. Y.—The following bids were opened June 28 at the office of Edw. A. Bond, State Engr. and Surveyor, for public highway improvements:

Road.	Bidder.	Local stone.
W. Henrietta, Monroe Co., 6.23 miles.	Whitmore, Rauber & Vicinus	$61,500
	Harry L. Smith	53,700
	Anderson, Thomas & Brown	52,200
	J. Dunfee & Co.	53,900
Scottsville, Monroe Co., 2.25 miles.	Wm. Fuller	21,800
	Brayer & Albraugh	19,369
	Harry L. Smith	21,375
	Anderson, Thomas & Brown	20,400
	John Dunfee & Co.	17,990
Catskill, Tompkins Co., 1.86 miles.	John Dunfee & Co.	13,600
Clifton, Monroe Co., 3.62 miles.	Brayer & Albraugh	30,988
	Chambers & Grady	34,786
	Casey & Murray	34,800
	Harry L. Smith	30,765
	John Dunfee & Co.	28,757
	Anderson, Thomas & Brown	33,400
Scottsville, Sec. 2, Monroe Co., 7.53 miles.	Brayer & Albraugh	68,485
	Swan & Murray	63,795
	Harry L. Smith	60,000
	John Dunfee & Co.	29,757
	Anderson, Thomas & Brown	55,555
	H. M. Cowles	29,500
Webster, Sec. 5, Monroe Co., 3.39 miles.	Casey & Murray	31,500
	Lauer & Hagaman	30,000
	Harry L. Smith	25,000
	John Dunfee & Co.	27,876
	Anderson, Thomas & Brown	32,000
	Thomas Holihan	29,410
Webster, Sec. 4, Monroe Co., 2.87 miles.	Casey & Murray	26,900
	H. N. Cowles	26,000
	Lauer & Hagaman	27,215
	Harry L. Smith	20,000
	John Dunfee & Co.	25,427
	Anderson, Thomas & Brown	29,100
	Thomas Holihan	26,390
Lestershire, Broome Co., 2.5 miles.	Crary Sons Co.	30,203
	John Dunfee & Co.	26,000

Rochester, N. Y., is given as the address of all bidders except the following: Harry L. Smith, Long Island City; Anderson, Thomas & Brown, Glens Falls; J. Dunfee & Co., Syracuse; Swan & Murray, Elmira; Crary Sons Co., New York.

Brooklyn, N. Y.—Bids were opened July 2 by the Boro. Pres. for asphalt paving on 18 streets. The largest bids were as follows: On Herkimer St. from Nostrand Ave. to Albany Ave.: A, Uvalde Asphalt Paving Co.; B, Century Construction Co.; C, Matthew T. Meagher; D, Cranford Co.; E, Brooklyn Alcatraz Co.; F, Interstate Paving Co.; G, Green River Asphalt Co.:

Bidders.	Asph., 11,070 sq. yds.	Conc., 1,860 cu. yds.	Old stone.	Curb: New, 5,150 lin. ft.	Curb: Old, 650 lin. ft.	Manhole covers, 33.
A	$1.35	$5.62	$.20	$.72	$.20	$3.00
B	1.92	5.40	.30	1.00	.35	21.00
C	1.50	5.50	.50	.75	.50	10.00
D	1.07	4.25	.25	.65	.25	5.00
E	1.25	4.50	.35	.75	.35	5.00
F	1.32	4.00	.30	.55	.45	4.00
G	1.30	4.75	.20	.65	.10	6.00

On Fourth Ave. from 40th St. to 60th St.:

Bidders.	Asph., 26,400 sq. yds.	Conc., 4,230 cu. yds.	Old stone.	Curb: New, 8,600 lin. ft.	Curb: Old, 1,000 lin. ft.	Manhole covers, 5.	Excav., 5,338 cu. yds.	Top soil, 9,609 cu. yds.	Conc. curb, 9,275 lin. ft.
A	$1.40	$4.40	$.20	$.68	$.20	$3	$.40	$1.25	$.50
B	1.82	5.20	.30	1.00	.35	21	.50	1.00	.90
C	1.65	5.50	.50	.80	.50	10	.75	.85	1.00
D	1.15	4.30	.25	.65	.30	5	.30	.85	.60
E	1.10	4.20	.35	.65	.30	3	.35	.75	.50
F	1.32	3.90	.30	.55	.45	4	.25	.60	.50
G	1.25	4.50	.20	.65	.10	6	.25	.70	.25

POWER PLANTS, GAS AND ELECTRICITY.

Gallipolis, O.—Bids will be received by Geo. F. Bovie, City Clk., until July 15 for a 25-year franchise to construct and install an electric light plant, and furnish and sell electricity for power, heat and lighting purposes, and for furnishing the city for a period of 10 years with the following lights: 100 alternating current 6.6 amperes enclosed arc lamps; 10 3-glower 1.2 ampere 220-volts Nernst lamps; 50 16 c. p. incandescent lamps.

Wheaton, Ill.—See "Schools."

Santa Fe, N. M.—The Capitol Light & Power Co. has been incorporated, and according to report will develop the water power of Pecos River. A. R. Gibson, Pres. Consolidated Copper Co., is reported interested.

Manchester, O.—The citizens are stated to have voted to issue $7,000 bonds for an electric light plant.

Grafton, W. Va.—The Grafton Gas & Electric Light Co. is stated to have decided to expend about $10,000 in improvements.

Ft. Dodge, Ia.—The controlling interest in the Ft. Dodge Light & Power Co., including the Ft. Dodge St. Ry., is reported to have been sold to Healy Bros. & Kelleher, of Ft. Dodge. The property includes gas and electric light plants, and 3 miles of street railway. It is reported that the new management contemplates important improvements.

Lebanon, Tenn.—Engr. Granbery Jackson, of Tullahoma, Tenn., writes that the contract for electric light improvements has been awarded to J. E. Mott & Co., of Huntington, Ind., for $4,911. The contract includes 80 H.-P. boiler (Atlas), 75 H.-P. engine, Stillwell heater and feed pump, 50 Kw. alternator, 30 arc lamps with transformer, etc., installed and in operation.

Milwaukee, Wis.—See "Business Buildings."

San Jose, Cal.—The Globe Light & Power Co. has been incorporated, with a capital of $200,000, for the purpose of securing water rights and for building a power plant for the generation of electricity in the high Sierras. J. R. Curnaw and H. W. McComas, of San Jose, are among the directors.

Whittier, Cal.—J. C. Hiatt, of Whittier, is stated to have secured a franchise for the construction of a gas plant.

Altoona, Pa.—It is reported that the Mountain City Gas Co., recently incorporated, will construct a gas plant to cost $300,000.

Bloomsburg, Pa.—A franchise is stated to have been granted to the Irondale Electric Light, Heat & Power Co.

Hoopeston, Ill.—J. W. Tilford, representing the Chicago Building & Construction Co., 230 Lake St., Chicago, is reported interested in the construction of a gas plant.

Washington, D. C.—The Chesapeake & Potomac Telephone Co. is reported to have completed plans for about 7 miles of new conduits.

McRae, Ga.—See "Water."

Baker City, Ore.—The Consolidated Power Co. has been incorporated; capital, $100,000. Incorporators: Frank S. Baillie, H. S. Bowen and John L. Rand.

Waco, Tex.—See "Water."

Crockett, Tex.—The plant of the Crockett Light & Ice Co. is reported to have been destroyed by fire June 23.

St. Cloud, Minn.—The St. Cloud Light & Power Co. has been incorporated; capital, $32,000. Incorporators: Albert C. Cobb, J. O. P. Wheelwright and C. E. Johnson, of Minneapolis.

Westerly, R. I.—The citizens are reported to have voted in favor of municipal electric lighting.

Huntsville, Ala.—R. C. Brickell and associates are stated to have purchased the plant of the Huntsville Gas Light Co., and will make extensive improvements.

Allentown, Pa.—The power house of the Lehigh Valley Traction & Allentown Electric Light Co. is stated to have been destroyed by fire July 1. Two 550-H.-P. cross compound engines, 13 dynamos, an alternating machine and 7 boilers are also reported to be included in the loss.

Brooklyn, N. Y.—See "Public Buildings."

Newcastle, N. B.—Bids are wanted by R. T. D. Aitkin, Town Clk., until July 22 for an electric lighting system exclusive of boilers. Willis Chipman, Ch. Engr., 103 Bay St., Toronto, Ont.

Grafton, W. Va.—See "Water."

New Orleans, La.—The Dock Bd. is stated to have granted the New Orleans Lighting Co. permission to lay a gas pipe from some point on the banks of the river in the 1st District to a point on the Algiers side.

Charles City, Ia.—The Charles City Lighting & Htg. Co. has been incorporated; capital, $75,000. Geo. E. May, Pres.; H. V. Fusell, Secy.

Rockford, Ill.—J. A. Walker and Fred. K. Houston, of Rockford, are reported to have petitioned the Council for a franchise for a heating plant.

Rochester, N. Y.—The Bd. of Contract is stated to have awarded to the Rochester Gas & Electric Co. the contract to light the city for 5 years. The new contract price is at the rate of 21½ cts. a night each for lamps of 2,000 c. p., or $78.50 a lamp per yr., and 18¼ cts. a night each for 1,200 c. p. lamps, or $66.61 a lamp per yr. According to the figures of the City Engineer the contract price under the new contract is about $213,616 a yr.

ELECTRIC RAILWAYS.

Easton, N. Y.—The Bennington & Hoosic Falls Electric R. R. Co. is stated to have petitioned C. H. Dixon, Highway Comr. of Easton, for permission to construct and operate a surface railroad through Easton from Cambridge to Greenwich. Such a road would connect Hoosick Falls, Cambridge and Greenwich, and would be about 20 miles in length.

Geneva, O.—The Council is stated to have granted a franchise to the Cleveland, Painesville & Ashtabula Ry. Co.

New York, N. Y.—The certificate of the Bd. of Rapid Transit R. R. Comrs. granting permission to the Pennsylvania, New York & Long Island R. R. Co. to construct a tunnel railroad under the City of New York and under the East and North Rivers, and to maintain a terminal station on 32d St., Manhattan Boro., was filed with the Secretary of State June 26. It defines the route to be followed by the railroad and provides that electricity shall be the motive power. A. J. Cassatt, Pres. Robt. W. Groff, Secy.

Kansas City, Kan.—The Comrs. of Wyandotte Co. are stated to have granted a franchise to Willard E. Winner and other promoters of the Kansas City & Topeka Electric Ry. Co.

Grand Rapids, Mich.—H. F. Thomas, of Allegan, is reported interested in the construction of an electric railway between Grand Rapids and Kalamazoo.

Iola, Kan.—A charter is stated to have been granted to the Chanute & Iola Interurban Ry. Co. for a line 30 miles in length. M. T. Jones, Pres., Chanute.

Bloomsburg, Pa.—A franchise is stated to have been granted to the Bloomsburg & Millville Electric Ry. Co.

Portland, Ore.—A press report states that the Oregon & Portland City Ry. Co. will, in the near future, expend $5,000,000 upon a new system of trolley roads, the trunk line of which will extend from Portland to Spring Water, a distance of about 35 miles. W. H. Hurlburt, Pres., Portland.

Richmond, Va.—The plans and specifications of the Citizens' Rapid Transit Co. were filed with City Engr. Cutshaw. The plans are reported to include a viaduct to cost about $100,000.

Whately, Mass.—The Selectmen are stated to have granted the Greenfield, Deerfield & Northampton St. Ry. Co. a right of way through East Whately.

Columbus, O.—The Bd. of Pub. Wks. is stated to have granted a franchise to the Columbus, Newark & Eastern Traction Co.

Jacksonville, Fla.—Stone & Webster, of Boston, Mass., is stated to have purchased the street railway properties, and according to reports will make extensive improvements.

Huntington, W. Va.—The Camden Interstate Ry. Co. of this city is reported to have sold all its electric lines in this city, Central City, Ceredo and Kenova, W. Va., Catlettsburg and Ashland, Ky., and Ironton, and its electric light plants in Ironton, Ashland and Huntington, to John Graham and Edmund McCandish, of Newville, and John J. Henry, of Philadelphia.

Paducah, Ky.—A press report states that the Paducah St. Ry. & Light Co. will extend its line into Mechanicsburg across Island Creek; also construct a steel bridge across Island Creek.

Elizabeth, Pa.—The West Elizabeth & Dravosburg Bridge Co., recently incorporated, is reported to be considering the construction of an electric railway from the end of the Pittsburg Railways Company's Glassport division across the new bridge and up the Monongahela Valley to Monongahela City, a distance of 14 miles. Wm. T. Pierce, McKeesport; E. J. Askey, Pittsburg, and J. A. Pierce, Elizabeth, are among the incorporators.

Lebanon, Ill.—The City Council is stated to have under consideration an ordinance, granting a franchise to the St. Louis, O'Fallon & Lebanon Electric Ry. Co.

New York, N. Y.—A permit has been issued for the erection of a 2-story brick power house, to be erected by the Union Ry. Co., at 175th St. and Southern Boule.; cost, $20,000. Architect, A. V. Porter, 621 Bway.

Ft. Smith, Ark.—About 3 miles of electric street railway is now being located. In market for supplies. R. G. Hunt, Pres.

RAILROADS.

Dallas, Tex.—The International & Great Northern R. R. Co. has contracted with the citizens of Dallas to construct a branch line from Ft. Worth Division north of Italy to Dallas, a distance of 40 miles. It is also reported that the branch line which runs from Round Rock north to Georgetown is to be extended to Vernon, Tex., a distance of about 200 miles, where connection will be made with the Ft. Worth & Denver City and the Blackwell, Enid & Southwestern Railroads. J. D. Trammel, Ch. Engr., Palestine.

Phillips, Me.—The Madrid R. R. Co. is reported formed to construct a railroad in Phillips and in Township No. 6, Franklin Co. Fletcher Pope, Sidney G. Haley and others, all of Phillips, are the incorporators.

Cape Girardeau, Mo.—The Cape Girardeau & Chester R. R. Co. is reported incorporated, with a capital of $600,000. J. A. Hawkins, Wm. H. Bohnsach and Henry Hauenschild are among the incorporators.

Portales, N. M.—It is stated that the Atchison, Topeka & Santa Fe R. R. Co. will construct a line from Portales to Albuquerque. H. U. Mudge, Gen. Mgr., Topeka, Kan.

Carthage, Mo.—A charter has been granted to the Carthage & Western R. R. Co., of Carthage; capital, $270,000. The road is to be a Missouri Pacific extension and is to extend from Carthage to Asbury, a distance of 18 miles. Incorporators: Geo. J. Gould, New York, N. Y.; Russel Harding, of St. Louis, and others.

Blue Creek, W. Va.—It is reported that a line 22 miles long will be built by the Blue Creek & Belva Ry. Co. Preston Crowell, of Fairmont, is reported interested.

Buffalo, N. Y.—Local press reports state that the Lackawanna R. R. Co. will expend about $75,000 on improvements in Buffalo. C. J. Phillips, Div. Supt.

Manchester, Vt.—The Manchester, Dorset & Granville R. R. Co. is reported incorporated, with a capital of $350,000, to construct a steam railroad about 23 miles in length.

Baltimore, Md.—A press report states that the Suffolk & Carolina R. R. is to be changed from a narrow gauge line 35 miles long to a broad gauged system 75 miles long. An extension will be built to Edenton, N. C., and another to Elizabeth City, N. C. Wm. H. Bosley, Pres., Baltimore, Md. Henry Crocker, Supt., Suffolk, Va.

Chicago, Ill.—The Directors of the South Side Elevated R. R. Co. are reported to be considering the question of expending about $300,000 in the improvement of its line between 12th and 43d Sts.

Irondale, Ala.—The Mayor and Bd. of Aldermen are stated to have granted the Seaboard Air Line Ry. the right to lay tracks through the city, provided the company grade, macadamize and curb the avenues through which it will pass. J. M. Larr, Gen. Mgr., Portsmouth, Va.

New York, N. Y.—Bids are wanted July 21 by the Bd. of Rapid Transit R. R. Comrs. for the construction and operation for a period of 35 years, of the Bklyn. connection of the rapid transit railway, substantially as described in The Engineering Record of Feb. 9, 1901. This work includes loops at City Hall and the Battery, New York, and at Borough Hall, Bklyn., and tunneling under the East River. Alex. E. Orr, Pres.

Johnson City, Tenn.—The Ohio River & Charleston R. R., extending from Johnson City, Tenn., to Huntdale, N. C., is reported to have been sold to the Southern & Western R. R., of which Geo. L. Carter, of Bristol, is Pres. The purchasing company is reported to have authorized the issue of $600,000 bonds, with which to complete the construction already begun.

New Orleans, La.—H. H. Pearson, Jr., Pres. New Orleans Railways Co., is stated to have acquired the rights of the Orleans & Pontchartrain R. R. Co. and will at once construct the line.

Pittsburg, Pa.—Local press reports state that the Baltimore & Ohio R. R. Co. will expend about $1,100,000 on improvements in the Pittsburg district, including a $500,000 depot. J. M. Graham, Ch. Engr., Baltimore, Md.

Denver, Colo.—Bids will be received by the Denver & Northwestern R. R. Co. until July 10 for grading 18 miles of roadbed (divided into sections). T. J. Milner, Ch. Engr., Rm. 18, Evans Blk., Denver; S. M. Perry, Pres.

Lufkin, Tex.—An amended charter of the Texas & Louisiana R. R. Co. is reported to have been filed with the Secy. of State. The charter provides for building an extension of the road, which now runs from Lufkin, to Windham, on from Windham through the counties of Angelina, Nacogdoches, San Augustine, Jasper and Newton to the town of Newton, a distance of about 75 miles. E. A. Frost, Gen. Mgr., Lufkin.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Winnipeg, Man.—Bids are wanted July 9 for plumbing the Post Office at Winnipeg. Fred Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont.

New York, N. Y.—Bids are wanted July 10 for furnishing material and constructing lockers, ventilation and other work in the Metropolitan Museum of Art in Central Park. Wm. R. Wilcox, Park Comr.

Aitkin, Minn.—Bids will be received by the Bd. of Co. Comrs. until July 14 for heating and plumbing the Co. Court House. J. S. Campbell, Co. Aud.

Valley City, N. Dak.—Plans will be received by the Library Bd. until July 15 for a library, to cost about $15,000.

Walker, Minn.—Bids will be received by the Bd. of Co. Comrs. until July 15 for $30,000 bonds, the proceeds to be used to erect a court house. C. E. Griffith, Co. Aud.

Columbus, O.—Bids will be received by E. G. Carpenter, M. D., Secy. Bd. of Trus. of the Columbus State Hospital, until July 26 for furnishing material and erecting 2 buildings for the Hospital. It is reported that the buildings will cost about $40,000 each.

Hastings, Minn.—Leck & Prince, of Minneapolis, are stated to have secured the contract for erecting the wing additions to the Insane Asylums at Hastings and Anoka, to cost about $21,000 each.

Kalispell, Mont.—Contracts for the construction of Flathead Co. Court House and Jail are stated to have been awarded as follows: Buildings, to Hastie & Dougan, Spokane, Wash., $44,500; jail and cell work to the Irwin Hudson Co., of Portland, Ore., $6,770; and heating and plumbing to McIntosh Hardware Co., of Kalispell, $5,370.

St. Louis, Mo.—The Church of the Ascension is stated to have purchased a site on Cates and Goodfellow Aves. and will erect a new edifice on same, at a cost of about $50,000.

Elizabeth, N. J.—The lowest bid received June 25 for erecting the Union Co. Court House is stated to have been submitted by John H. Parker Co., New York, N. Y., for $534,750. This does not include the structural iron work, which is estimated to cost about $30,000 additional.

Baltimore, Md.—The contract for improvements to the First Baptist Church, Lafayette Ave. near Fremont, of which Rev. Curtis Lee Laws is pastor, is stated to have been awarded to Thos. L. Jones, 317 Clay St., for $60,000.

Kansas City, Mo.—It is stated that a church to cost about $60,000 is being planned by the Congregation of the Westminster Church. Rev. W. P. George, Pastor.

Cedar Falls, Ia.—The plans of W. A. Robinson, of Cedar Falls, are stated to have been accepted for the proposed Carnegie Library.

Sheboygan, Wis.—Contracts will probably soon be let for a new public library. For information apply to Francis Williams, of the Library Bd.

Baltimore, Md.—The contract for constructing an engine house on York Road has been awarded to John T. Buckley, 127 Richmond St., for $17,250.

Pueblo, Colo.—Patton & Miller, 115 Monroe St., Chicago, Ill., are reported to be the architects for the McClellan Public Library to be erected here, the funds having been provided by Andrew Carnegie. The building will be 2 stories high, and will cost $60,000.

San Jose, Cal.—The Bd. of Superv. are stated to have ordered plans prepared for a county building to be located in the rear of the Hall of Records, to cost $50,000.

Brooklyn, N. Y.—Plans have been filed for a 3-story brick parish building to be erected on Driggs Ave. and N. 6th St. for St. Vincent de Paul's Church, to cost $25,000. Architect, F. J. Berlenbach, 260 Graham Ave.

Paterson, N. J.—Local press reports state that bids recently received for restoring the City Hall have been rejected, the lowest being $85,149, and that new bids will be received July 16. Rudolph H. Matthies, Chmn. Pub. Bldgs. Com.

Eureka, Cal.—Bids will be received by the Carnegie Free Library Com. until July 21 for furnishing material and constructing the foundations and basement for Carnegie Free Library, including drainage and sewerage, and for furnishing material and erecting the superstructure, including all brick, stone, metal, mason, iron, terra cotta work, plumbing, etc. Geo. A. Kellogg, Secy.

Richmond, Va.—The Penitentiary Comn. has adopted the plans of P. Thornton Mayre, of Newport News, for a new cell building, to cost about $180,000. It will have 334 cells. Working plans will be ready about Aug. 1.

Washington, D. C.—It is stated that a new edifice is to be erected on 16th and Madison Sts., for the Foundry M. E. Church, to cost about $150,000. Rev. Luther B. Wilson, Chmn. Bldg. Com.

St. Louis, Mo.—The contract for erecting the Art Palace, the permanent structure at the World's Fair, is reported to have been awarded to the Goldie Construction Co. for $945,127.50. The building is designed to become a Louisiana Purchase Museum after the close of the fair.

Brooklyn, N. Y.—The Bd. of Aldermen on July 1 is stated to have authorized the issue of $150,000 corporate stock of the City of New York, to defray the expenses of installing a steam heating and lighting plant in the Kings County Hospital and Almshouse.

Camden, N. J.—The plans of Walter Smedley, Stephen Girard Bldg., Philadelphia, Pa., are stated to have been accepted for the Nurses Home, to be erected at the Cooper Hospital, to cost about $20,000.

Altoona, Pa.—Bids will be received by the Trus. of Altoona Hospital until July 11 for erecting a fireproof "Women's Ward" building. C. A. Wood, Clk.; Chas. M. Robinson, Archt., Park Bldg., Pittsburg.

Newark, N. J.—The contract for erecting the new City Hall is reported to have been awarded to E. M. Waldron, of Newark, for $1,088,177. The building is to be completed in 30 months. It will be constructed of Webb granite from the quarries of the Webb Granite Construction Co., Fitzwilliam, N. H.

Pittsburg, Pa.—The Trus. of the Jewish Hospital Assoc. are stated to have adopted the plans of Simon B. Eisendrath, 203 Michigan Ave., Chicago, Ill., for a hospital to be erected on Reed and Miller Sts., to cost $50,000. Dr. A. Bloomberg, Chmn. Bldg. Com.

Hillsboro, Ill.—Bids are wanted July 12 for erecting a brick church at Hillsboro. Geo. R. Cooper, Chmn. Com.; S. A. Bullard, Archt., Springfield.

Sheldon, Ia.—Bids are wanted July 23 for erecting a building to be used as a City Hall and fire house. G. T. Wellman, Clk.

BUSINESS BUILDINGS.

Sheboygan, Wis.—Bids will be received by the Sheboygan Theater Co. until July 8 for erecting a theater. Herman F. Roenitz, Secy.

Sharon, Pa.—McIntyre & Sons are stated to have secured the contract for erecting a freight station on W. State St. for the Youngstown & Sharon St. Ry. Co.; cost, $16,000.

Lansing, Mich.—Spier & Rohns, Chamber of Commerce Bldg., are stated to have prepared plans for a depot for the Grand Trunk R. R. to cost about $30,000.

Peoria, Ill.—The Peoria & Pekin Union R. R. Co. is stated to have decided to erect a $100,000 roundhouse. F. L. Tompkins, Gen. Supt.

Louisville, Ky.—It is stated that the Monon Route will erect a brick freight depot on Duncan and 15th Sts. to cost about $100,000. W. H. McDoel, Pres. and Gen. Mgr., Chicago, Ill.

Fresno, Cal.—The roundhouse of the Southern Pacific R. R. at Fresno is stated to have been destroyed by fire June 23. Wm. Hood, Ch. Engr., San Francisco.

Bay City, Mich.—The contract for erecting a new depot for the Pere Marquette R. R. has been awarded to Matthew Lamont and J. H. Tennant, of Bay City. The building will be 161x36 ft., and will be 2 stories high with a 65-ft. tower.

Detroit, Mich.—A 3-story brick store 32x110 ft., stone trimmings, is to be built on W. Miami Ave. for J. F. Hartz. Cost, $20,000.

Kansas City, Mo.—Geo. Carman, 309 Hall Bldg., is the architect for a $15,000 brick store to be built at 546 and 548 Walnut St. for Mrs. M. R. Platt.

Holyoke, Mass.—The French Bldg. Assoc. is stated to have accepted the plans of Arthur Perreault for a building to be erected on Appleton and Race Sts. to cost between $50,000 and $70,000.

Milwaukee, Wis.—Local press reports state that the Wisconsin Telephone Co. is at present preparing plans for the erection of 2 branch exchange buildings in Milwaukee, besides making other improvements to the system in the city proper, and also putting in 1,000 miles of additional circuits throughout the State during the present year, at an outlay of about $500,000.

Montreal, Que.—It is stated that Mann & Strachan will erect a hotel on Guy St., to cost about $150,000.

San Francisco, Cal.—Cunningham & Politeo are stated to have prepared plans for a hotel, to be erected on Geary and Hyde Sts. for Harvey H. Dana, to cost about $70,000.

Algonac, Mich.—M. L. Smith & Son, Home Bank Bldg., Detroit, are stated to have prepared plans for a hotel for the Algonac Hotel Co., to cost about $30,000.

New Orleans, La.—O. H. Burnham, of Chicago, Ill., is stated to have prepared plans for a 12-story building for the Hibernia Trust & Banking Co., to be erected on Carondelet and Gravier Sts. J. W. Castles, Pres.

Pittsburg, Pa.—See "Railroads."

Derby, Conn.—It is stated that the New York, New Haven & Hartford R. R. Co. is to erect here a 1½-story brick depot, 30x103 ft. E. E. Pratt, Supt. of Bldgs., New Haven.

Syracuse, N. Y.—Edwin L. Loomis, 604 Turtle St., is reported to have had plans prepared by Mervel D. Makepeace, Everson Bldg., for a 6-story fireproof industrial building to be erected at Almond, E. Water and E. Washington Sts., to cost, including site, $200,000.

New Orleans, La.—The New Orleans Auditorium Co., Ltd., is reported formed to erect an auditorium on Canal St. It will have a seating capacity of about 15,000 people, and cost about $300,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

217-219 Rivington St, br stores & tenemt; c, $40,000; o, David Kidansky; a, Horenburger & Straub.
2d Ave & 12th St, br and stone store & flat; c, $90,000; o, Moslowitz & Bermau; a, Harde & Short.
68 & 70 Pitt St, br stores & tenemt; c, $25,000; o, Louis Oshinsky; a, Horenburger & Straub.
206 Thompson St, br stores & tenemt; c, $35,000; o, I Lippman; a, Bernstein & Bernstein.
171 to 175 Thompson St, 2 br stores & tenemt; c, $70,000 all; o, Weinstein & Woolenstein; a, Bernstein & Bernstein.
22d St & 4th Ave, br and stone loft and store bldg; c, $95,000; o, Greenwich Realty Co; a, De Lemos & Cordes.
45th St & 6th Ave, br and stone hotel; c, $300,000; o, Forty-fifth St Co; a, Tracy & Swartwout; b, Eugene Lenthon.
43d St & 6th Ave, br and stone hotel; c, $700,000; o, Robert H Spaulding; a, Mulliken & Moeller.
1st Ave & 44th St, br storage bldg; c, $60,000; o, Swift & Co; a, Copeland & Dole.
5th Ave & 56th St, br and stone hotel; c, $2,250,000; o, the Fifty-fifth St Co; a, Hess & Weekes.
153 and 155 E 118th St, br stores & tenemt; c, $45,000; o, Max Gold; a, Horenburger & Straub.
5th Ave & 127th St, br and stone club; c, $80,000; o, Columbia Club; a, Oscar Lowinson.
Jerome & Bernside Aves, br stores & tenemt; c, $40,000; o, Asher L Smith; a, John Hauser.
Collister, Hubert, Laight & Hudson Sts, 3 sty side and rear extension to br stable; c, $45,000; o, American Express Co; a, Chas W. Romeyn.

DWELLINGS.

Darien, Conn.—Howells & Stokes, 100 William St., are stated to have completed plans for a new country home for Anson Phelps Stokes, of New York, N. Y., to be erected on Collender's Point, Darien, Conn. The estimated cost of the mansion and various buildings to be erected on the place will be $250,000. This also includes the purchase price on the property.

Milton, Mass.—Mr. Milliken has begun the foundation for a house on Brush Hill Road, to cost about $200,000; contract for construction not yet let. W. H. Besarick, of Boston, Archt.

Detroit, Mich.—A 4-story flat is to be built on Joy St. for Dr. Newton. Cost, $30,000.

Kansas City, Mo.—F. E. Parker, 622 Whitney Bldg., has prepared plans for a $15,000 brick dwelling to be erected at Lydia and 10th Sts. Owner, E. S. Youmans.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Rivington & Norfolk Sts, br tenemt; c, $45,000; o, Goodman Bros; a, Alfred E Badt.
38 E 40th St, br and stone dwelg; c, $25,000; o, Wm C Sheldon; a, Ernest Flagg.
342 & 344 E 15th St, br and stone tenemt; c, $42,000; o, Weinstein & Simon; a, Geo F Pelham.
96th St & 5th Ave, br and stone dwelg; c, $30,000; o, Irwin A Powell; a, York & Sawyer.
Brown Pl and 135th St, 3 br tenemts; c, $66,000 all; o, Walter A Dick; a, C F Kruse.
Railroad Ave & 158th St, 2 br and stone flats; c, $44,000 all; o, Fritz Selje; a, H T Howell.
106 E 57th St, rear extension to br dwelg; c, $20,000; o, Jas W Taylor; a, Marshall R Grimes.

SCHOOLS.

Cleveland, O.—Bids will be received by the Bd. of Educ. until July 23 for furnishing material and erecting an addition to Sibley School, work to include mason, cut stone, iron and steel, galvanized iron and tin work, fireproofing, ventilating and heating, plumbing, gasfitting, sewering, etc. Starr Cadwallader, School Dir.

Camden, N. J.—The City Council is stated to have passed an ordinance authorizing the issue of $50,000 bonds for the purpose of erecting one school and repairing other school buildings.

New York, N. Y.—The Bd. of Educ. is stated to have approved the following contracts: To the Commercial Construction Co., 1 Madison Ave., installing electric light wiring in the new High School of Commerce, Boro. of Manhattan, $27,315; Hartman & Horgan, 287 4th Ave., N. Y. City, alterations to School No. 106, Boro. of Brooklyn, $34,843; and Blake & Williams, 362 W. Bway., N. Y. City, for installing ventilating and heating apparatus in School No. 140, Boro. of Brooklyn, $18,782.

Scranton, Pa.—The Bd. of Control is stated to have decided to erect a $65,000 high school.

West Homestead, Pa.—Hall & Morgan, of Homestead, are stated to have secured the contract for erecting a school in West Homestead for $40,000.

Bellevue, Pa.—B. A. Groah & Co., Ltd., 409 Market St., Pittsburg, are stated to have secured the contract for erecting the 3d Ward school for $39,064.

Braddock, Pa.—E. J. Carlisle & Co., 700 Lewis Blk., are stated to have prepared plans for an $85,000 school.

Elwood City, Pa.—R. G. Brown is stated to have secured the contract for erecting a school for $24,774.

Amherst, Mass.—Amherst College is reported to have received a gift of $65,000 to erect an observatory for the astronomical department.

Pocahontas, Ia.—W. J. Ziterell, of Webster City, is stated to have secured the contract for erecting a school for $16,475.

Baltimore, Md.—The contract for constructing an addition to School No. 54 has been awarded to John T. Buckley, 127 Richmond St., at $17,590.

St. Charles, Ill.—Jenney & Mundle, N. Y. Life Bldg., Chicago, are stated to have prepared plans for the Rural Home and School for Boys, to be erected about 2½ miles n. w. of St. Charles. The buildings will consist of 14 double 2-story cottages for the boys, 4 cottages for the teachers, a 3-story administration and school building, a 1-story manual training school, assembly hall, dining-room, gymnasium, power house, and stables. The buildings will all be of brick and stone, with slate roofs, and will cost probably $250,000.

Wheaton, Ill.—The Bd. of Trus. of Wheaton College is stated to have voted to erect a central heat, light and water plant and a new industrial building, to cost about $40,000.

Carterville, Mo.—The citizens are stated to have voted to issue $21,000 school bonds.

Bloomington, Ind.—John D. Rockefeller is stated to have presented to the Indiana Univ. $30,000 for the erection of a building for social and religious purposes.

New London, Conn.—The lowest bid received for erecting the Central School is stated to have been submitted by Carpenter & Williams, of Norwich, for $58,500.

Ann Arbor, Mich.—The Phi Delta Theta Fraternity is stated to have purchased a site on S. University and Washtenaw Aves. and will erect on same a $25,000 building.

St. Paul, Minn.—Bids will be received by the Bd. of School Inspectors until July 16 for furnishing material and erecting the superstructure of the C. K. Davis School and additions to the Grant, Harrison and Baker Schools.

Indianapolis, Ind.—Bids will be received by the Bd. of School Comrs. until July 8 for steam heating, plumbing and sewerage for School No. 33. J. E. Cleland, Bus. Dir.

Peabody, Mass.—See "Water."

Ann Arbor, Mich.—Bids will be received by the Bd. of Regents of the Univ. of Michigan until July 15 for erecting a Psychopathic Ward at University Hospital in Ann Arbor. Jas. H. Wade, Secy. Bd.

Trenton, N. J.—Bids will be received by the Bd. of Educ. of Hamilton Township at the office of John Sykes, 111 E. State St., Trenton, until July 7 for erecting a school in Groveville. W. C. Rockhill Hart, Dist. Clk.

Albion, N. Y.—It is stated that plans are being prepared for a high school.

Richmond, Cal.—The citizens are stated to have voted to issue $15,000 bonds for a school.

Yonkers, N. Y.—Lynch & Larkin are stated to have secured the contract for erecting an addition to the high school for $45,950.

Bolivar, Pa.—E. M. Lockhard, of Indiana, Pa., is stated to have secured the contract for erecting a school on Lincoln Ave. for $20,000.

Portland, Me.—Bids will be received by Frederic E. Boothby, Chmn. Com. on Pub. Bldgs., until July 7 (readvertisement) for alterations and additions to primary school at Stevens Ave. and Concord St. and for erecting an addition to primary school at Allen's Corner. F. H. & E. F. Fassett, Archts., 93 Exchange Pl.

W. Springfield, Mass.—Bids will be received by C. E. Brockway, Secy. Bldg. Com., until July 11 for erecting, plumbing, heating and ventilating a 4-room brick school on Riverdale Ave.

Philadelphia, Pa.—Cope & Stewardson, 320 Walnut St., are stated to have completed plans for a 3-story engineering building, to be erected on the grounds of the Univ. of Pennsylvania. It will be largely of steel and of slow burning construction.

Sandusky, O.—Bids will be received by Chas. Kubach, Clk. Bd. of Educ., until July 25 for erecting a 4-room addition to the 9th Ward School.

Okmulgee, Ind. Ter.—Bids are wanted for $20,000 school bonds. Address Valdo Smith, Recorder.

Chicago, Ill.—Bids are wanted by the Bd. of Educ. until July 11 for work in the Wabansia School as follows: Masonry, cut stone, sheet metal, steel ceilings, composition roofing, structural iron, fireproofing, steam heating, heat regulation, ventilation, plumbing, gas fitting, sewerage, electric work, etc. W. B. Mundie, Archt., N. Y. Life Bldg., Chicago.

Dowagiac, Mich.—Bids will be received by the Bd. of Educ. until July 10 for erecting a 12-room school. F. H. Codding, Secy. Bd. Educ.

Tippecanoe City, O.—Bids will be received until Aug. 2 by C. H. Allen, Clk. of Bethel Township, for erecting a brick school in Dist. No. 3, to be known as Fairview School.

Castle City, Utah.—Bids will be received by the School Bd. until July 11 for erecting a school. Address W. D. MacLean, Secy.

Bangor, Me.—Wm. N. Sawyer is stated to have secured the contract for erecting a school at 1st and Union Sts. for $18,500.

STREET CLEANING AND GARBAGE DISPOSAL.

Racine, Wis.—The city officials have under consideration a proposition for the construction of a garbage crematory.

Johnstown, Pa.—Bids are wanted July 15 for furnishing a street sweeping machine. Geo. E. Hamilton, City Clk.

San Juan, Porto Rico.—The Dixon Garbage Crematory Co., Toledo, O., has been awarded the contract for constructing a garbage crematory at the United States Army Post at this point.

Newark, N. J.—Bids are wanted July 17 for the collection and disposal of garbage, paper, ashes and rubbish for a term of 5 years, as advertised in The Engineering Record.

Lawrence, Mass.—The Bd. of Health has received a proposition from the U. S. Garbage Reduction Co. for the collection and disposal of the city's garbage for $30,000 a year.

Sheboygan, Wis.—The question of garbage disposal is said to be under consideration.

GOVERNMENT WORK.

San Francisco, Cal.—Bids are wanted Aug. 9 for constructing a 1-story brick and steel building 300x100 ft., at the Navy Yard, Mare Island, Cal. Plans and specifications will be furnished by the Commandant of the navy yard upon deposit of $15 to secure their return. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Robinson, Neb.—Bids are wanted July 23 for furnishing and installing a steam heating plant in the commanding officer's quarters and in the 5 double sets of officers' quarters at Ft. Robinson. Address J. W. Pullman, Ch. Q. M., Omaha, Neb.

Ft. Hancock, N. J.—Bids are wanted July 19 for constructing, heating, plumbing and gas piping addition to hospital and constructing, plumbing and gas piping dead house at this post. Address D. F. Craig, Q. M.

Joliet, Ill.—Bids are wanted July 29 at the Treasury Dept., Washington, D. C., for furnishing the low pressure steam heating apparatus, etc., for the U. S Post Office at Joliet, as advertised in The Engineering Record.

Norfolk, Va.—The following bids were opened June 21 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for a 1-story fireproof building 60x240 ft. at the Navy Yard, Norfolk: J. H. Brinson, Hampton, Va., $25,741; Frank Pidgeon, Saugerties, N. Y., $28,792; J. W. Talliflerro & Co., Brooklyn, N. Y., $26,387; Penn Bridge Co., Beaver Falls, Pa., $25,867; Grant Wilkins, Atlanta, Ga., $28,500.

Ft. Totten, N. Y.—The R. G. Packard Co., 130 Pearl St., New York City, on June 13 bid 17 cts. per cu. yd. for dredging. The address of this company was incorrectly given last week as Providence, R. I.

Freeport, Ill.—Bids are wanted Aug. 13 at the Treasury Dept., Washington, D. C., for furnishing the steam heating apparatus complete for the U. S. Post Office at Freeport, as advertised in The Engineering Record.

Ft. Totten, N. Y.—Bids are wanted at the office of the Quartermaster until Aug. 1 for constructing addition to Guard House at this post, as advertised in The Engineering Record.

Wilkesbarre, Pa.—The contract for constructing the U. S. Post Office at Wilkesbarre has been awarded to Cramp & Co., Philadelphia, for $88,777.

Washington, D. C.—The Senate on June 25 passed a bill providing for a building for the Department of Agriculture to be constructed in accordance with plans already adopted. The limit of cost for this building is $2,500,000, which is to include heating and ventilating apparatus, elevators and approaches.

MISCELLANEOUS.

Brooklyn, N. Y.—Bids are wanted July 11 for furnishing material and repairing the wooden pier with appurtenances at the foot of Noble St., East River, Brooklyn. McDougall Hawkes, Comr. of Docks, N. Y. City.

Pittsburg, Pa.—The Council has passed ordinances authorizing the letting of contracts for improvements in the parks aggregating $169,000.

Portland, Ore.—E. T. C. Stevens, Clk. Port of Portland Bd., writes that the following bids were opened June 26 for constructing a floating wooden drydock of 5 sections, according to plans and specifications prepared by Jas. E. Blackwell, Consulting Engr., Dexter Horton Bldg., Seattle, Wash.: Jos. Pacquet, Portland, $195,000; R. Wakefield, Portland, $198,000; J. B. Bridges, Portland, $199,750; J. E. Bennet, Portland, $204,000.

Minneapolis, Minn.—Local press reports state that the Supreme Court has decided that Mayor Ames must sign the $150,000 permanent improvement bonds authorized by the last Legislature.

Buffalo, N. Y.—The Councilmen have adopted the resolution of the Aldermen in favor of dredging work in Buffalo River at a cost of $12,000, in the ship canal at a cost of $7,500, and in the Peck slip at a cost of $400; total cost, $19,900.

Boston, Mass.—The following bids were opened June 26 by the Harbor & Land Comrs. for dredging an anchorage basin in Boston Harbor 1,000 ft. wide and about 1 mile long, the work to be divided into 4 sections, each containing about 650,000 cu. yds: *a*, Section 1, items 1, 2 and 3 respectively; *b*, Section 2; *c*, Section 3; *d*, Section 4. Prices given are per cu. yd.: Eastern Dredging Co., 247 Atlantic Ave., and New England Dredging Co., 185 Summer St., *a*, 16.3 cts., 19.3 cts. and 18.5 cts. (awarded); *b*, 19.3 cts.; *d*, 16.3 cts.; G. H. Breymann & Bros., Toledo, O., *a*, 15 cts., 15 cts. and 30 cts.; *b*, 15 cts. (awarded); *c*, 15½ cts. (awarded); *d*, 16 cts. (awarded); Bay State Dredging Co., 19 High St., Boston, *a*, 19¾ cts., 19½ cts., and 20 cts.; Morris Cummings Dredging Co., 17 State St., N. Y., *a*, 16 cts., item 1; *b*, 17 cts.; *c*, 16.7 cts.; *d*, 16½ cts.; Chas. M. Cole, Fall River, Mass., *b*, 20½ cts.; *c*, 24 cts.; J. S. Packard Dredging Co., 425 Angell St., Providence, R. I., *b*, 24 cts.; Daly & Hannan Dredging Co., Ogdensburg, N. Y., *b*, 25.9 cts.; *c*, 25.9 cts.

Southold, L. I., N. Y.—Bids will be received by Chas. S. Boyd, State Supt. of Pub. Wks., at Albany, until July 10 for constructing a sea-wall between the Sound and Orient Harbor, between the villages of East Marion and Orient, in the town of Southold.

Kansas City, Mo.—The Admiral Boulevard and Budd Park bonds, amounting to $140,000, were sold recently.

Boston, Mass.—The Governor has signed the bill providing for the construction of a tunnel and additional subways in Boston.

Port Adelaide, South Australia.—Bids will be received at the office of the Engineer-in-Chief, Adelaide, South Australia, until Sept. 30 for constructing a harbor at Light's Passage, Port Adelaide. Drawings and specifications may be obtained on the payment of £5 per set, which amount will be returned to unsuccessful bidders who have sent in a bona fide bid, on return of the documents in good condition within one week from date of notice of non-acceptance of bid. Bids are to be accompanied by an Adelaide Bank deposit receipt of £100, or a cheque on an Adelaide bank for a like amount, marked "Good for 1 week," in favor of the Engineer-in-Chief., H. Allerdale Grainger, Agent General for Australia, 1, Crosby Sq., London. For estimated quantities see page 431, The Engineering Record of May 3.

NEW INDUSTRIAL PLANTS.

The Block-Pollak Iron Co., Cincinnati, O., is figuring on building a steel addition to its forge building at Carthage, O., and installing a 10-ton steam hammer and two smaller hammers for forging purposes.

The Denver, Colo., Sugar, Land & Irrigation Co. will build a beet-sugar factory to have a daily capacity of 350 tons and to allow for doubling this capacity. Wm. C. Johnston, Pres.

F. Sitterding, 609-625 St. James St., Richmond, Va., expects to build a planing mill, sash, door and blind factory next fall. The steam power plant of 100 H.-P. will probably consist of new boilers and engine in addition to the present 40-H.-P. plant.

The Louisville, Ky., Lead & Color Co. has received bids for a 4-story and basement, 60x160-ft. paint factory, which will be equipped with a power plant, sprinkling system and paint machinery. Kenneth McDonald & J. F. Sheblessy, Louisville, Ky., architects.

The Meyer Furnace Co., Peoria, Ill., will erect a new factory to replace that recently burned, and install a 17½ and a 7-H.-P. motor.

The Ridgway, Pa., Machine Tool Co. will erect the following brick and steel building: 75x225-ft. erecting shop; machine shop, 187½-ft. square; foundry, 150 ft. square; 75x150-ft. pattern building; 37½x75-ft. forge shop, and power house, 37½ ft. square.

The Stark Brewing Co., Canton, O., will erect a 20,000-bbl. brewery on a 140x200-ft. plot.

John Gwynn, Yorktown, Ia., is erecting a 10,000-bu. elevator and is in the market for a 10-H.-P. gasoline engine.

The Allen & Currey Mfg. Co., Ltd., Shreveport, La., contemplate erecting a 2-story, 70x140-ft. planing mill and sash and door factory, together with a boiler house, shaving vault and dry kiln. A 150-H.-P. engine and probably a battery of two boilers will be installed.

J. J. Hollaway, Clem, Ga., is interested in forming a company with a capital of $20,000 to erect an oil mill and ginnery.

The New Process Steel Co., Homestead, Pa., contemplates erecting a blast furnace having a daily capacity of 500 tons; three steel-casting foundries, one for machine-molded and small castings, the second for rolls, rolling mill castings and forge blooms, and the third for locomotive, electrical and ship castings; a forge shop, and a machine shop.

The Horseshoe Mining Co., Deadwood, S. D., is receiving bids for the erection of a 350 stamp wet crushing cyanide mill to be located at Pluma, S. D., to have a daily capacity of 1,250 tons. The steam power plant will include engines of about 1,000 H.-P., boilers, air compressors, pumps, etc.

The Peters & Bradley Mill Co., Knoxville, Tenn., will rebuild a 3-story, 36x56-ft. building and install a 100-bbl. flour mill and a power plant of about 60 H.-P.

BUSINESS NOTES.

Buff & Buff, Jamaica Plain, Mass., have removed their Boston office to larger quarters at 27 School St. G. G. Leddes is the Boston sales agent.

The West Virginia Bridge & Construction Co., Wheeling, W. Va., is erecting a plant with a capacity of 1,000 tons per month for the construction of steel factory and office buildings, bridges, viaducts, tanks, etc., which it expects to have in operation by Oct. 1, 1902. The officers are Edward Hazlett, Pres.; Geo. A. Laughlin, Vice-Pres.; G. E. Wincher, Secy. and Treas.; J. H. Barrett, Gen. Mgr.

The Crocker-Wheeler Co., Ampere, N. J., manufacturers of direct-current machinery, report the following among recent orders: Standard Steel Works, Burnham, Pa., 2 200-Kw. generators; James Cooper Mfg. Co., Montreal, Can., 55-Kw. generator; Buda Foundry & Mfg. Co., Harvey, Ill., 240-Kw. generator; Whitehall Portland Cement Co., Cementon, Pa., 85-H.-P. motor; Woodward & Lothrop, Washington, D. C., a 200-Kw., 2 150-Kw. and a 75-Kw. generator; Sparrell Print, Boston, Mass., 14 motors, 3 to 10 H.-P.; Tidewater Steel Co., Chester, Pa., 250-Kw generator; Minot, N. D., Light & Telephone Co., 90-Kw. generator; Armour & Co., East St. Louis, Ill., four 50-H.-P. motors and a 75.-H-P. motor; Green Engine & Machine Co., Harrison, N. J., four 35-H.-P. motors; Descubridora Mining & Smelting Co., Mexico, 4 20-H.-P. motors; Moline Malleable Iron Co., St. Charles, Ill., 90-Kw. generator and 11 motors aggregating 125 H.-P.; Pennsylvania Sugar Refinery, Philadelphia, Pa., 14 motors, 3 to 15 H.-P.; Fretz Umbrella Works, Philadelphia, Pa., 80 motors in small sizes; Lake Shore & Michigan Southern shops, Collinwood, O., 11 motors aggregating 200 H.-P.

The American Steel & Wire Co., Chicago, reports receiving the following awards at the South Carolina Inter-State and West Indian Exposition, each medal being the highest award in its class: Gold medals for merchants iron and steel, cold-drawn steel shafting, horse and mule shoes, wire nails, rail bonds, wire rope, machinery and appliances for drawing wire, springs and spring wire, copper wire, iron and steel wire, aluminum wire. Silver medals for bicycle and automobile spokes, rolled wagon skeins, underground and overhead wires and cables, metallurgy of zinc. Bronze medals for music wire, coal and coke, bale ties, chemicals and colors. Diploma of merit for installation in Commerce Building.

The San Bernardino, Cal., Gas & Electric Co. has recently purchased additional power plant from the Ball Engine Co., Erie, Pa., and Stearns & Foster, Cincinnati, O., are installing an electric plant to consist of a Bullock generator direct-connected to a Ball engine.

The Continental Iron Works, Brooklyn, have recently increased their electric equipment by putting in 11 Westinghouse induction motors, a two-phase alternator and switchboard. The alternating current apparatus will be used almost exclusively in the works after this installation is in operation.

A series of articles on American Art Industries is running in the New York Tribune, and the third paper of the set, published on June 15, is an interesting account of the development and extent of horticultural architecture, as exemplified in the business of the Lord & Burnham Co., Irvington, N. Y.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
July 8.	Montreal, Que.	July 5
July 9.	Platteville, Wis.	June 28
July 10.	Austin, Pa.	July 5
	Adv., Eng. Record, July 5.	
July 10.	Gibbon, Minn.	June 28
July 10.	Baldwin, L. I., N. Y.	June 21
July 10.	Eaton, Colo.	June 14
July 11.	Crane, Chicago, Ill.	July 5
July 11.	San Juan, P. R.	June 21
	Adv., Eng. Record, June 21.	
July 12.	Aspinwall, Pa.	June 28
July 15.	Providence, R. I.	July 5
	Adv., Eng. Record, July 5.	
July 15.	Newcastle, N. B.	July 5
July 15.	Calcutta, India	June 28
July 15.	Independence, Wis.	June 28
July 16.	Paulding, O.	June 28
July 18.	St. Louis, Mo.	July 5
July 23.	Muskogee, Ind. Ter.	June 28
	Adv., Eng. Record, June 28.	
Aug. 13.	Engines, Chicago, Ill.	June 14
	Adv., Eng. Record, June 21, 28.	
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
——	Shrewsbury, Mass.	June 28

SEWERAGE AND SEWAGE DISPOSAL.

July 7.	Beloit, Wis.	July 5
July 7.	Newark, N. J.	July 5
July 7.	Albany, N. Y.	July 5
July 8.	Cleveland, O.	July 5
July 8.	E. St. Louis, Ill.	July 5
July 9.	Cohoes, N. Y.	June 28
July 10.	Cleveland, O.	June 21
July 11.	Lafayette, Ind.	July 5
July 14.	Canton, S. D.	July 5
July 15.	E. Grand Forks, Minn.	July 5
July 15.	Cleveland, O.	June 21
July 15.	Chamberlain, S. D.	June 28
July 15.	Bronxville, N. Y.	June 28
	Adv., Eng. Record, June 28, July 5.	
July 16.	Buffalo, N. Y.	July 5
July 16.	Fairfield, Ia.	June 28
July 17.	Cleveland, O.	June 28
July 18.	San Juan, P. R.	July 5
	Adv., Eng. Record, July 5.	
July 19.	South Brooklyn, O.	July 5
July 21.	Des Moines, Ia.	July 5
July 22.	Binghamton, N. Y.	July 5
July 22.	Des Moines, Ia.	July 5
July 23.	Muskogee, Ind. Ter.	June 28
	Adv., Eng. Record, June 28.	
July 31.	Williamsport, Pa.	June 28
	Adv., Eng. Record, June 28, July 5.	
July —	Guelph, Ont.	May 24
July —	Ames, Iowa	Mar. 29
Aug. 12.	Machinery, New Orleans, La.	June 7
	Adv., Eng. Record, June 7 to July 5.	
Aug. 12.	Construction, New Orleans, La.	June 7
	Adv., Eng. Record, June 7 to July 5.	
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
——	Topeka, Kan.	June 28

BRIDGES.

July 7.	Newark, N. J.	July 5
July 7.	Brooklyn, Minn.	July 5
July 8.	Noblesville, Ind.	July 5
July 8.	Paterson, N. J.	July 5
July 8.	Tremont, Pa.	July 5
July 10.	Ft. Plain, N. Y.	July 5
July 10.	Walhalla, S. C.	July 5
July 10.	Westmoreland, Kan.	June 28
July 11.	Braceville, O.	July 5
July 11.	Cleaning and painting, Buffalo, N. Y.	June 28
	Adv., Eng. Record, June 28, July 5.	
July 12.	Erie, Kan.	July 5
July 12.	Cincinnati, O.	June 21
July 12.	Dayton, O.	June 21
	Adv., Eng. Record, June 28, July 5.	
July 14.	Winona, Minn.	June 21
July 14.	Vidalia, La.	June 14
July 14.	St. Marys, O.	June 28
July 15.	North Loup, Neb.	July 5
July 18.	Indianapolis, Ind.	June 28
July 19.	Craig, Mont.	July 5
July 21.	Ft. Benton, Mont.	June 28
July 24.	St. Clairsville, O.	July 5
July 26.	Akron, O.	July 5
July 28.	Chicago, Ill.	June 28
	Adv., Eng. Record, June 28, July 5.	
July —	Natchez, Miss.	Apr. 26
Aug —	Columbus, O.	June 28
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21

PAVING AND ROADMAKING.

July 7.	Brainerd, Minn.	July 5
July 7.	Albany, N. Y.	July 5
July 7.	Wilkesbarre, Pa.	July 5
July 7.	Paterson, N. J.	July 5
July 7.	Darby, Pa.	July 5
July 7.	St. Louis, Mo.	July 5
July 8.	South Bend, Ind.	July 5
July 8.	Chicago, Ill.	July 5
July 8.	Jersey City, N. J.	July 5
July 8.	E. St. Louis, Ill.	July 5
July 9.	Chicago, Ill.	July 5
July 9.	Camden, N. J.	July 5
July 10.	Long Island City, N. Y.	July 5
July 10.	Pittsburg, Pa.	June 28
July 11.	Brooklyn, N. Y.	July 5
July 11.	New Brighton, S. I., N. Y.	July 5
July 12.	Akron, O.	July 5
July 14.	Road roller, Pasadena, Cal.	July 5
July 14.	Duluth, Minn.	July 5
July 14.	Greencastle, Ind.	June 28
July 14.	Warren, Pa.	June 21
July 14.	Toledo, O.	June 21
July 15.	E. Grand Forks, Minn.	July 5
July 15.	Buffalo, N. Y.	July 5
July 15.	Ashland, Wis.	July 5
July 15.	Bessemer, Ala.	June 14
July 18.	St. Louis, Mo.	July 5
July 18.	Springfield, O.	June 28
July 21.	Des Moines, Ia.	July 5
July 21.	Michigan City, Ind.	July 5
July 22.	Steubenville, O.	July 5
July 22.	Napoleon, O.	July 5
July 23.	Mt. Pleasant, O.	July 5
July 23.	Dayton, O.	July 5
July 28.	Cincinnati, O.	July 5

POWER, GAS AND ELECTRICITY.

July 14.	Columbus, O.	June 28
July 15.	Shenandoah, Ia.	June 7
July 16.	Gallipolis, O.	July 5
July 16.	Norristown, Pa.	June 14
July 21.	Cedar Falls, Ia.	June 28
July 22.	Newcastle, N. B.	July 5

GOVERNMENT WORK.

July 9.	Annapolis, Md.	June 28
July 10.	New Iberia, La.	May 24
	Adv., Eng. Record, May 24, 31.	
July 12.	Bremerton, Wash.	June 7
July 12.	Washington, D. C.	June 7
July 14.	Dam, Wheeling, W. Va.	June 21
	Adv., Eng. Record, June 21 to July 5.	
July 15.	Chamberlain, S. D.	June 28
July 15.	Cribs, Wheeling, W. Va.	June 21
	Adv., Eng. Record, June 21 to July 5.	
July 17.	Tampa, Fla.	May 31
	Adv., Eng. Record, May 31, June 7, 21.	
July 18.	Ft. Hunt, Va.	June 28
July 18.	Ft. Washington, Md.	June 28
July 19.	Ft. Hancock, N. J.	July 5
July 23.	Ft. Robinson, Neb.	July 5
July 28.	Chicago, Ill.	June 28
	Adv., Eng. Record, June 28, July 5.	
July 28.	Butte, Mont.	June 14
	Adv., Eng. Record, June 14, 21.	
July 29.	Joliet, Ill.	July 5
	Adv., Eng. Record, July 5.	
July 30.	Aberdeen, S. D.	June 21
	Adv., Eng. Record, June 21, 28.	
Aug. 1.	Ft. Totten, N. Y.	July 5
	Adv., Eng. Record, July 5.	
Aug. 5.	Brunswick, Ga.	June 21
	Adv., Eng. Record, June 21, 28.	
Aug. 9.	San Francisco, Cal.	July 5
Aug. 12.	Denver, Colo.	June 28
	Adv., Eng. Record, June 28, July 5.	
Aug. 13.	Freeport, Ill.	July 5
	Adv., Eng. Record, July 5.	

BUILDINGS.

July 7.	School, Trenton, N. J.	July 5
July 7.	School, Portland, Me.	July 5
July 8.	Theater, Sheboygan, Wis.	July 5
July 8.	Htg. school, Indianapolis, Ind.	July 5
July 9.	Plumbing P. O., Winnipeg, Man.	July 5
July 9.	Library, St. John, N. B.	June 28
July 10.	Pub. bldg., New York, N. Y.	July 5
July 10.	School, Dowagiac, Mich.	July 5
July 11.	School, W. Springfield, Mass.	July 5
July 11.	School, Castle City, Utah	July 5
July 11.	School, Chicago, Ill.	July 5
July 11.	Pub. bldg., Altoona, Pa.	July 5
July 11.	Fire station, Cleveland, O.	June 28
July 11.	School, Rapid City, S. D.	June 21
July 11.	Pub. bldgs., Athens, O.	June 21
July 12.	Church, Hillsboro, Ill.	July 5
July 12.	Htg. school, Springfield, N. J.	June 28
July 12.	Library, Santa Ana, Cal.	June 28
July 14.	Htg. C. H., Aitkin, Minn.	July 5
July 14.	Htg. school, Columbus, O.	June 28
July 14.	Htg. Court House, Chaska, Minn.	June 21
July 15.	School, Ann Arbor, Minn.	July 5
July 15.	Library, Valley City, N. Dak.	July 5
July 15.	High school, Lawrenceburg, O.	June 28
July 15.	School, Annapolis, Md.	June 28
July 15.	Court House, Woodlands, Cal.	June 28
July 15.	City Hall, Independence, Wis.	June 28
July 16.	Pub. bldg., Paterson, N. J.	July 5
July 16.	Schools, St. Paul, Minn.	July 5
July 16.	Htg. Court House, Norristown, Pa.	June 21
July 17.	Pub. bldg., Mansfield, O.	June 28
July 17.	School, Valley Crossing, O.	June 28
July 17.	Htg. school, Agricult'l College, Miss.	June 28
July 17.	Htg. bldg., Athens, O.	June 21
July 21.	Engine houses, Springfield, O.	June 28
July 21.	School, Iowa City, Ia.	June 28
July 21.	Court House, Crown Point, Ind.	June 28
July 21.	Library, Eureka, Cal.	July 5
July 23.	School, Cleveland, O.	July 5
July 23.	City Hall, Sheldon, Ia.	July 5
July 25.	School, Sandusky, O.	July 5
July 25.	Pub. bldg. plans, Milwaukee, Wis.	June 28
July 26.	Pub. bldg., Columbus, O.	July 5
Aug. 2.	School, Tippecanoe City, O.	July 5
Aug. 5.	School plans, Passaic, N. J.	May 3
Aug. 16.	Dwellg. plans, Cheyenne, Wyo.	July 5
Oct. 7.	Capitol work, St. Paul, Minn.	Mar. 22

MISCELLANEOUS.

July 8	Wharf, New Orleans, La.	June 21
July 10.	Sea wall, Southold, N. Y.	July 5
July 10.	R. R., Denver, Colo.	July 5
July 11.	Pier, Brooklyn, N. Y.	July 5
July 11.	Sprinkling trucks, Brooklyn, N. Y.	June 28
July 15.	Sweeping machine, Johnstown, Pa.	July 5
July 16.	Levee work, Alexandria, La.	June 28
July 17.	Garb. disposal, Newark, N. J.	June 28
	Adv., Eng. Record, July 5.	
July 21.	R. R., New York, N. Y.	July 5
Aug. 11.	Sea wall, Galveston, Tex.	June 28
Sept. 30.	Harbor, Port Adelaide, S. A.	July 5
——	Dam, Millers Falls, Mass.	June 14

THE ENGINEERING RECORD.

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Standard Cement Specifications.

At the recent meeting of the American Section of the International Association for Testing Materials a number of important subjects relating to the uniform determination of qualifications for materials used in engineering construction were well discussed, and among the topics the testing of cements stands at least equal with the others in prominence. The matter of uniform specifications governing the physical or other qualities to be required by civil engineers from the manufacturers of cements is one of unusual gravity for several reasons. Among them is the fact that the manufacture of Portland cements of the best quality has been extended with remarkable rapidity during the past half dozen years, so that at the present time the annual production of cement mills surpasses any limit which the most active imagination would have suggested at the beginning of this period. This obviously means that the use of Portland cement has enormously increased and that civil engineers are making rapidly widening applications of concrete and other classes of masonry in which the resistance and endurance of the completed structure depends wholly upon the cement employed.

In the earlier days of the manufacture of Portland cements, some of their characteristics were not well understood and many of the specification requirements assumed their various and varying features for the reason that their engineer authors were ill acquainted with the things to which those specifications applied. It was absolutely imperative that they should protect their works by those requirements which in their judgment would result in securing a good quality of cement even though their knowledge of that material was neither complete nor exact. It is not surprising under such circumstances that there was produced an abundant crop of all sorts of cement specifications, some, or possibly most, of which were on the whole fairly good, but with a constantly increasing variety of requirements, with uniformity nowhere in sight, calculated to distress the cement manufacturer in a certain and most effective manner. Such a condition of things is perplexing to all concerned; it is advantageous neither to the engineer nor to the manufacturer, nor to any one else, and it is time that the whole matter of cement testing and cement specifications should be put upon a rational and uniform basis. This has been done in connection with the products of the iron and steel mills, at least substantially so, and there is no valid reason why equally sensible and useful procedures should not be employed to determine the excellence of the products of the cement mills, or their adaptability to definite classes of engineering construction.

The processes required to produce prescribed results in cement manufacture with given and suitable raw materials are now well understood and under control. The weak or other unsatisfactory features of cement which are most likely to develop and work injury to any given class of engineering construction can now be anticipated with such reasonable certainty as to enable every competent civil engineer to specify in an effective and fair manner for any prescribed work. With these conditions existing it would seem to be a comparatively simple matter to arrange a set of standard cement specifications sufficiently comprehensive to meet all the demands of at least ordinary construction and sufficiently flexible in those features where it is necessary to satisfy either what may be called the local features of cement manufacture or the special conditions found in connection with different classes of structures. These standard specifications should obviously include such physical features as fineness of grinding, possibly specific weight, but certainly tests for tensile and compression resistances, change of volume in setting, endurance, especially in sea water, and other characteristics imperative for a resisting and enduring cement.

The great difficulty to be encountered in bringing about these desirable results lies first in determining what agent or body shall undertake to secure them, and second, in harmonizing the different interests concerned, both on the part of the user and the producer, so as to attain results which will be respected by all concerned. The handling of such a question involves tact and a thorough understanding of all the elements of the problem. The meeting of the American Section of the International Association for Testing Materials held at Atlantic City appeared to develop a feeling that it would be wise to await the action of the Committee of the American Society of Civil Engineers now having under consideration the same subject of cement testing and affiliated matters. This is undoubtedly the correct attitude. There may possibly be some doubt as to the propriety of the Society taking up for investigation and decision professional questions properly lying within the practice of its members, but there can be no doubt whatever as to the advantage which would accrue from certain general recommendations bearing upon the uniform testing of cements or general standard requirements for that material. Mature recommendations emanating from a committee of that body after deliberate investigations and consideration would undoubtedly be respected by both civil engineers and manufacturers. The report of such a committee would at least form a basis on which both civil engineers and manufacturers might meet and agree as to working standard specifications which could with great advantage displace the almost infinity of specification requirements now existing. It is perfectly practicable to secure these ends; there is required only a moderately concreted action on the part of those interested, with ample opportunity for the consideration and discussion of requirements which have, in the manner indicated, assumed manifold character and multiplicity of values.

In such standard specifications there should be prescribed tests for cements and cement mortars to determine as nearly as practicable just those qualities required in the actual duty of various grades of masonry. Short time tests, as at the end of twenty-four hours, should be given only such limited significance as properly belongs to them. Nor should erratically exacting tests for checking be prescribed in which cement pats are subjected to conditions that neither bear any resemblance whatever to experience in actual construction nor disclose qualities which, so far as known, have any discoverable relation to duties to be performed in the finished structure. This subject of standard specifications for cements is earnestly commended to the consideration of both engineers and manufacturers.

The New Power Plant of the Des Moines City Railway Co.

Thirty-five years ago, a pair of bay mules hauled a shiny yellow car with canopy roof along a twelve-block track in Des Moines and thus inaugurated street railway traffic in a city which to-day possesses a system of unusual interest. The early line was owned by a Dr. Turner, who was a little later joined by Mr. J. S. Polk. Other roads came into existence, some of them electric, others steam and gasoline. The need of uniting them to improve the service and reduce expenses finally became so evident that the Des Moines City Railway Company was organized about 1888 to take over all the properties. Mr. J. S. Polk, then as now the president and leading stockholder of the company, recognized the advantages of electric traction, and the road was one of the first west of the Mississippi to put in a complete electric equipment.

This power equipment was extended from time to time until the equipment included its present outfit of ten 20x6-foot and six 18x5-foot horizontal return tubular boilers, a 200-horse-power vertical boiler, a 22x48-inch and a 30x60-inch Lane & Bodley Corliss engine and a 20x42-inch Sioux City Corliss engine. These engines drive a 200-kilowatt Siemens & Halske generator, a 150-kilowatt General Electric generator and a line shaft to which eleven 45-kilowatt Thomson-Houston dynamos are belted. Two Westinghouse compound engines from the Omaha Exposition are set up in an annex to the engine room and are both belted to a General Electric three bearing generator of about 200 kilowatts capacity, a form of drive which is not very often encountered, even in old-time plants

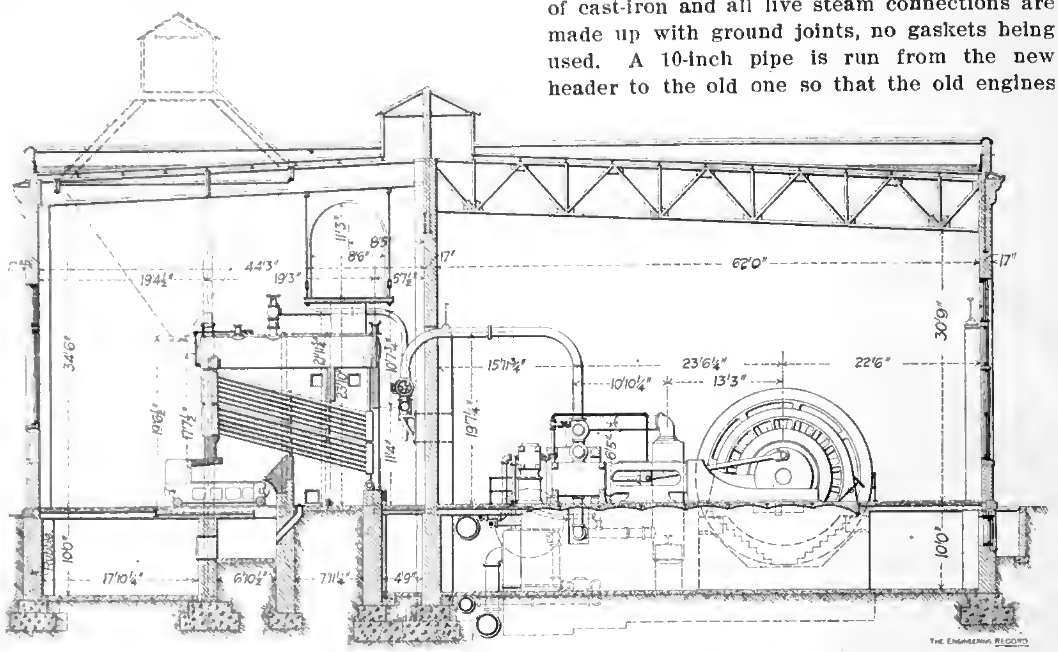
The company recently decided to build some extensive lines out into the country, for which, with the former load, the capacity of the old station was inadequate. The plant was otherwise unsatisfactory, for the boilers were well worn and, although the building was within 200 feet of the river, no condensers had ever been used, conditions which made the fuel charges noticeably high. The company accordingly retained Messrs. Sargent & Lundy of Chicago to design a new plant of thoroughly modern type. After investigation of the conditions in the old station, it was decided to build a new engine and boiler room adjoining the old plant in such a manner that, after the new machinery was put into operation, some of the old apparatus could be removed and the new station extended over the ground occupied by the old plant. The general scheme of this extension is shown in one of the illustrations, the proposed future addition to the new station being shown in broken lines. It was decided to utilize temporarily the old stack which projects out from the old building at a convenient point. The location of the new engine and boiler rooms was determined with due consideration of convenience in receiving coal on a side track from the Chicago & Northwestern Railway and also of the source of condensing water supply from the river.

The boiler room is designed for overhead coal bunkers and a complete system of coal-handling machinery. It was not considered desirable to install these bunkers at the present time, but the roof girders of the boiler room are so built that the bunkers can be readily attached to them at any time. For this purpose also the front ends of the boilers are carried on heavy structural columns which are designed so that they can be extended up to the roof girders, when the bunkers are put in, so as to carry the additional load of the latter. The coal track is outside of the new boiler room and parallel to it, and when the coal bunkers are added the building will be equipped with a conveying system such that the cars will be unloaded into a hopper, and the coal conveyed by machinery to the bunkers, the ashes being carried out from the ash pits in a reverse manner. For the present, however, arrangements are made for unloading the coal cars on to the boiler room floor, from which the stoker hoppers are filled by hand. Under each of the boiler room windows is a cast-iron frame the full width of the window, and this frame is covered by a sheet steel door stiffened with angle irons and provided with counterweights so that it can be swung back against the coal car. These doors have side projections so that when open they form chutes over which the coal is unloaded on to the floor.

The boiler equipment as at present installed in the new station consists of four horizontal water-tube boilers manufactured by the Aultman & Taylor Machine Company, Mansfield, Ohio. They contain 4,400 square feet of heating surface each and are equipped with Aultman & Taylor chain-grate stokers of about 75 square feet of grate surface. As will be seen from the cross-section, the boiler-room is provided with basement ash-pits and with a sheet steel overhead flue. In view of the future development of the station, this flue was made of the same sectional area throughout, the idea being that when the first extension is made to the new station it may possibly be desirable to make it at the end opposite to the old station instead of in the manner indicated in the plan.

At the end of the boiler room against the wall of the old building is located a Stilwell cast-iron heater of 350 cubic feet capacity. This will heat feed water for six boilers such as are now installed, at their maximum capacity. The heater is located on a gallery, with the feed pumps immediately under it, and the piping connections are so made and the gallery so built that when the new station is continued, as shown in the plan, the heater, gallery, pumps and connections can all be moved bodily and set up against the wall of the future stack, so as to make room for another battery of boilers where they now stand.

The steam header in the new boiler room is of cast-iron and all live steam connections are made up with ground joints, no gaskets being used. A 10-inch pipe is run from the new header to the old one so that the old engines can be run from the new boiler plant.

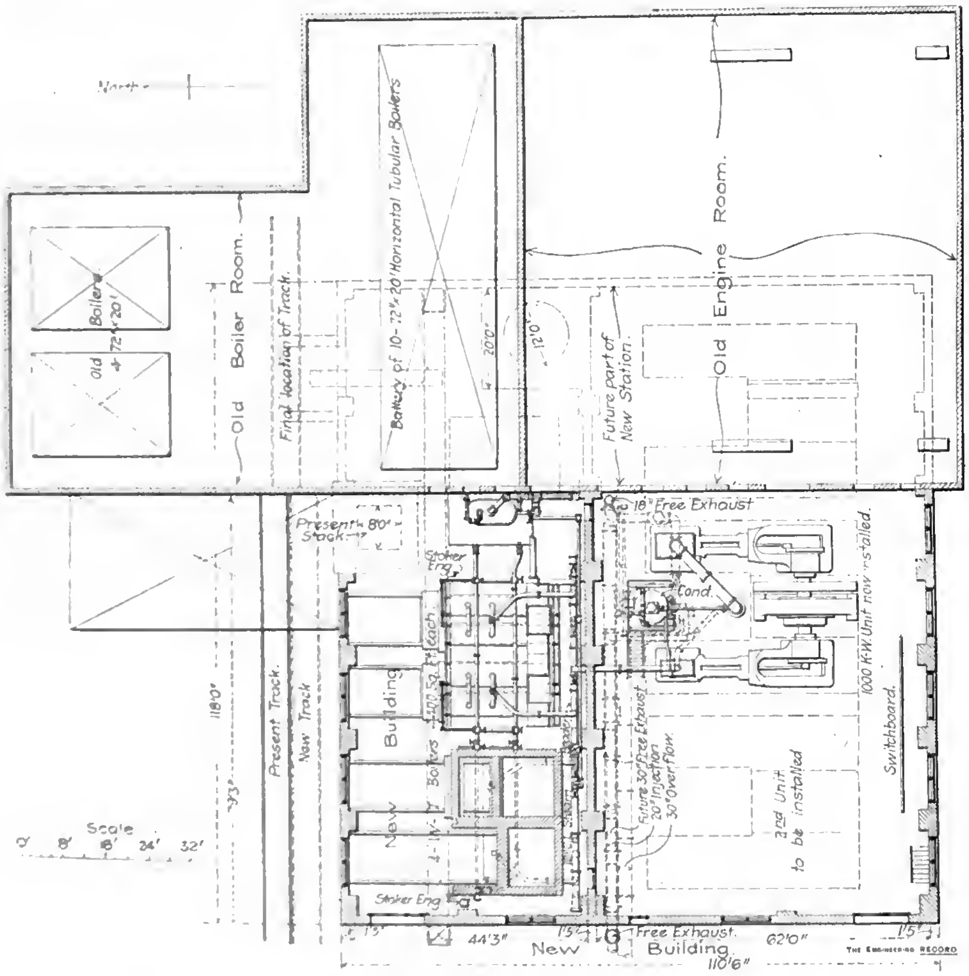


CROSS-SECTION OF NEW POWER PLANT, DES MOINES CITY RY. CO.

The present equipment of the new engine room consists of a 26 and 52x60-inch Allis-Chalmers engine direct-connected to a General Electric 16-pole 1,000-kilowatt 575-volt railway generator making 80 revolutions per minute. This unit is equal to a maximum continuous load of 1,500 kilowatts. It is intended to install another unit of the same size at an early date.

The company runs from 60 to 65 cars, chiefly of the double-truck type, in regular service, and the load at the switchboard varies from 800 to 1,400 kilowatts, with an occasional peak somewhat in excess of the latter amount. The 1,000-kilowatt unit installed will, therefore, carry the load under all ordinary conditions of the traffic.

The company is now building an interurban road to run from Des Moines to Colfax, a distance of about 25 miles through the towns of Mitchellville and Altoona. Electrical apparatus for this extension has recently been ordered from the General Electric Company. A 300-kilowatt inverted rotary converter will be installed in the new engine room, with 330 volts on the alternating-current (three-phase) side. This will be stepped up to 16,000 volts and transmitted to a sub-station at Mitchellville, 19 miles from the power station, where the process will be reversed. The transformers used are the General Electric air blast type, four of 110 kilowatts being put in at each end of the line.



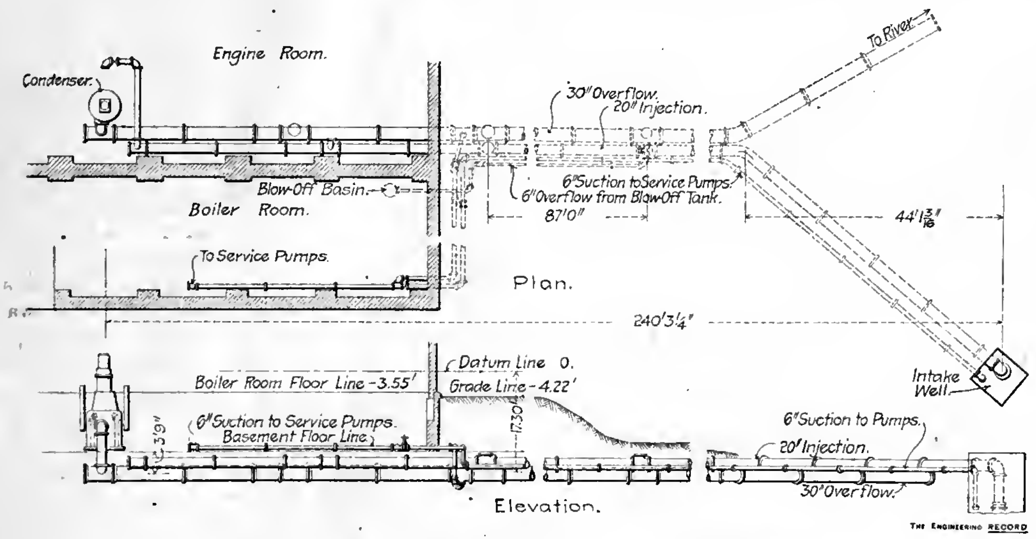
PLAN SHOWING RELATIVE LOCATION OF OLD AND NEW STATIONS.

To revert to the special features of the engine room of the new station, the engine being of course condensing, an independent Allis vertical, flywheel, injection condenser has been installed between the cylinders of the engine. An intake crib is located in the river near the bank and a 20-inch cast-iron injection pipe runs from it to the condenser, and a 30-inch overflow pipe carries the discharge back to the river. These pipes are large enough for four of the 1,000-kilowatt units. Openings are left for future connections so far as possible. The engine room is built for an overhead electric crane although this has not as yet been installed.

An automatic oiling system is installed with reservoir tanks in the basement and overhead distributing tanks into which the oil is pumped from the former. The new type of Lunkenheimer pressure oil cups are used on the engine throughout, and Turner oil filters are installed in the basement to which all the oil drains from the bearings are piped.

The new boiler plant has been in operation for some weeks and the new engine has just been started. The improvement in the fuel economy even since the new boilers were started has been very marked.

The general manager of the Des Moines City Railway Company is Mr. G. B. Hippee, to whose energy the recent improvements are largely due. Mr. J. E. Welch is the master mechanic and has direct charge of the power station. By his continued watchfulness he has been able to run the old plant through many trying load peaks without a mishap. The new station is fulfilling his anticipations of several years past. The new power plant, however, is only one of many interesting features the company can show to visitors. It has a repair shop and small foundry unusually complete for a road of its size, and builds a number of new cars each year as well as makes over the old rolling stock.



GENERAL ARRANGEMENT OF PIPES TO THE RIVER.

Cement Testing in Municipal Laboratories.

A paper, slightly condensed, presented by Mr. R. L. Humphrey before the American Section of the International Association for Testing Materials.

The study of the equipment and methods in use in the various municipal laboratories, particularly so far as they apply to the tests of cement, is exceedingly interesting, and one which presents a wide field for discussion.

The first record of any systematic experiments with Portland cement were made in France by the engineers of the Ponts et Chaussées, by whom this material was employed on a large scale as early as 1850. Their standard of excellence provided that a Portland cement should have a specific weight of 1,200 kilogrammes per cubic meter (103 pounds per imperial bushel), and that briquettes of 1½ inch section, equal to an area of 2¼ inches, should develop the following tensile strengths:

Age.	Neat.	1 cem.; 2 sand.
2 days	140 pounds	...
5 "	280 "	140 pounds
30 "	530 "	280 "

In the latter part of 1858 John Grant began a series of tests in connection with the London main drainage works, and in 1859 we find the following clause in the specifications for this work:

"The whole of the cement to be used in these works is to be Portland cement of the very best quality, ground extremely fine, weighing not less than 110 pounds per striked imperial bushel, and capable of maintaining a breaking weight of 400 pounds on an area, 1½x1½ inches, equal to 2¼ inches, 7 days after being made, in an iron mold, and immersed in water 6 of these days."

Grant maintained no central laboratory but established small laboratories on various parts of the work and equipped them with a few briquette molds, a machine for making tests of tensile strength, and apparatus for ascertaining the weight per bushel. It is interesting to note that Grant subsequently changed the form of the briquette and reduced the section to one inch. He later added a test for fineness. Faija devised a test for constancy of volume, Vicat an apparatus for measuring the rate of setting, while Michaelis and others added improvements in both methods and apparatus. The methods of testing and the specifications proposed by Grant furnished the precedent which is followed by engineers generally in this country and in Europe.

In the half century which has almost elapsed since these tests were proposed, little or no change has been made in the general character of the tests, although the methods and apparatus have been considerably improved, while the quality of the cement produced, particularly Portland cement, has been wonderfully improved.

It seems remarkable that this improvement in the quality should take place without a corresponding improvement in the methods of tests. For as Portland cement came into more general use, we find the engineer, in his anxiety to establish the qualities if this new product, applying a greater variety of tests of increasing severity. The principal qualities sought, viz., fineness, rate of setting, strength and soundness are, however, the same to-day as in the days of John Grant. As a rule the early laboratories were field laboratories, that is, they were located on the work in which the cement was to be used, and the equipment was necessarily limited. Gradually laboratories of a permanent character were established for the purpose of more accurate tests and for investigation.

There are but few thoroughly equipped municipal laboratories in either this country or abroad. The laboratories connected with the technical schools are for the most part fairly well equipped. This is particularly the case abroad. One of the most important of this kind is the laboratory of the Ecole des Ponts et Chaussées. This laboratory was established in 1851 as a chemical laboratory for the examination of limestones, lime, cement, mortars, puzzolanas, and other substances employed in construction. It is interesting to note that, in the circular letter issued about this date, "the engineers of the Ponts et Chaussées and persons who desire tests and analyses made can send their samples to the laboratory which will make the examination gratuitously." This laboratory was established as a permanent laboratory in 1884 for the systematic inspection of lime, cement, mortars, etc., used in construction of public works in France under the direction and charge of the engineers of the Ponts et Chaussées.

The laboratories connected with the technical schools at Munich and Charlottenburg in Germany, the laboratories at Zurich, Switzerland, and at St. Petersburg, Russia, are exceedingly well equipped and are making many valuable and important investigations. That at Charlottenburg is a particularly elaborate affair, being provided with separate rooms for the individual investigators.

In 1877 the Association of German Cement Manufacturers was formed. This association has by its efforts accomplished more towards the unification of methods of testing and the improvement of the quality of cement than any other society, and their standard rules adopted throughout Germany have been closely followed by the engineering profession generally.

In this country among the very earliest municipal laboratories was that established under the Engineer Commissioner of the District of Columbia by the first Board of Commissioners in 1878 and under the charge of Mr. E. J. DeSmedt. Its original purpose was for the use of Mr. DeSmedt in laying the first asphalt pavement in Washington. Mr. DeSmedt was succeeded by Mr. Clifford Richardson in 1887.

The Department of Docks of the City of New York established a laboratory for testing the cement in 1870. Three years later Capt. W. W. Maclay assumed charge of it. Many of the earlier contributions to cement literature were the result of the investigations made in this laboratory. Captain Maclay also devised the Maclay hot bath tests which were so generally adopted in this country. The Boston Main Drainage Board in 1878 established a cement laboratory under the direction of Mr. Elliott C. Clark.

Under the Metropolitan Sewerage Commissioners of Massachusetts an elaborate and well equipped laboratory was established at their principal office in Boston in 1890 at considerable expense; this laboratory was unfortunately destroyed by fire in 1893 and since this time the Commissioners have expended no large sums on a permanent laboratory. They have, however, equipped several field laboratories at convenient points along the work.

The laboratory of the St. Louis Water Works Extension was established about 1888 and for a number of years was in charge of Mr. S. Bent Russell. In 1895 the laboratory was removed to a point further down town and the Sewer and Street Departments joined with the Water Department in operating it for testing cement, paving brick and other materials.

The City of Baltimore's laboratory for testing cement was established about 1891 under the direction of Mr. C. B. Marriott. The equipment of this laboratory was meager and the methods crude, and have been succeeded by the laboratory established in 1900 under the direction of the Highway Division of the State Geological Survey. The latter is equipped principally with apparatus for testing the materials used in road construction, the equipment for cement tests being of a rather limited character.

The laboratory of the City of Chicago was established in 1894, with Mr. S. M. Rowe in charge. The equipment of the laboratory is fairly complete and consists of a Fairbanks testing machine, a 20,000-pound Riehle tension and compression machine, storage tanks with a capacity for 7,000 briquettes, together with the necessary molds, set wires, scales, etc.

New York has from time to time maintained laboratories for testing cement under the direction of the various departments. The equipment of these laboratories was limited and more or less crude, was adapted for field work only, and therefore met with indifferent success.

In 1899 a laboratory was fitted up by the Commissioners of Accounts for the purpose of testing all the material used by the City of New York. The laboratory is under the direction of Mr. Otto H. Klein, chief engineer, with Prof. S. F. Peckham, chemist in charge. The equipment, while on a small scale owing to the limited space set aside for the purpose, is good and sufficient for making all the usual tests, except the compressive and transverse.

Prior to 1892 the inspection and testing of cement in the City of Philadelphia was done in field laboratories and usually on important work only. In that year there was started, in an obscure corner of the city hall, in a very modest way a permanent laboratory for the testing of cements. The equipment consisted of a Fairbanks testing machine, a set of Gilmore wires, an eight-gang briquette mold and a few pans for preserving the briquettes. The work was necessarily of a limited character, was performed in a systematic manner and the results were carefully compiled. Gradually additional apparatus was added, better facilities provided and the scope of the work enlarged. The result of this rather unpromising beginning is a permanent laboratory, with facilities and equipment for making all the tests in general use, whose equal does not exist in the country or which is excelled by but few laboratories abroad. As the engineer in charge I had the pleasure of supervising its development from its inception. This laboratory has done a very great deal towards raising the uniformity and standard of quality of the American cements. The improvements in the quality of the cements furnished the city and the reduction in the cost, incident to the competition which the methods in vogue in the laboratory made possible, have more than compensated the city for its cost of installation and maintenance. The cost of maintenance does not exceed 10 per cent. of the probable annual saving to the city.

This covers in a brief general way the history of the principal municipal laboratories in this country. Laboratories are also maintained by the cities of Cleveland, Indianapolis, Buffalo, New Orleans and others, but they are for the most part on a smaller scale and possess no unusual features. The number of municipalities which maintained laboratories of this character is constantly increasing, although it is to be regretted that neither in facilities, equipment or method do they attain the necessary and desired standard of efficiency.

Municipal laboratories can be divided into two general classes: (1) Field laboratories or those located on the work in which the cement is to be used. Such laboratories are equipped for making only a few simple tests and the work is not carried on in a systematic manner. (2) Permanent laboratories, usually well equipped with apparatus for the thorough investigation of the properties of the materials of construction. Work in the laboratories of this class is carried on in a thoroughly systematic way and the results are carefully compiled and made available for general use.

Aside from private laboratories, more or less well equipped, which do commercial testing, there is a class connected with the technical schools. The latter are for the most part well equipped and many of them make a practice of doing commercial testing and in a few cases have charge of the inspection of the materials used by neighboring cities and towns, while some few others extend the use of their laboratories to the city engineers and county commissioners of the entire State in which they are located. Lehigh University is an example of this class. The work of testing in these laboratories is usually entrusted to the instructors and in many cases the students themselves. As there is a lack of the requisite experience and skill, the results obtained, under these conditions, are of doubtful value.

While the system under which all cements are tested far from fills the requirements, owing largely to the great influence of the personal equation of the persons who make the tests on the results obtained, yet it is nevertheless true that the tests and inspection to which cement are subjected has done more towards improving the quality of cement than any other agency. The manufacturer in order that his product may fulfill the requirements has exerted greater care in the preparation of his output and with a corresponding increase in its quality, both as regards its strength and uniformity. The advent of the rotary kiln has proved another potent factor in the improvement of the quality of Portland cement, indeed the present high standard of quality is due largely to this process. Without the application of systematic inspection by the engineer or consumer, the manufacturer, having no requirements to meet, would fall into careless habits and the standard of quality of the product would gradually fall. When John Grant first proposed a tensile strength of 400 pounds on 1½-inch section at end of 7 days the English manufacturers exerted considerable pressure to have the requirement reduced to 300 pounds fearing they would experience great difficulty in meeting it. That this fear was groundless is shown by the fact that within very short time afterward the requirement was raised to 550 pounds. From the compiled results of tests we learn what tests cement may be reasonably expected to develop. We further learn that those cements which yield the best results in actual use readily meet certain specified requirements. It is therefore natural for the engineer to fix a standard of excellence (based on the results which he has obtained) by which to gauge the acceptability of each shipment. So long as the engineer fixes the requirements of his specifications in this manner, there is small likelihood of a serious disagreement between the engineer and the manufacturer, as to whether the cement does or does not meet the requirements.

It is the class of consumers, however, who draft their specifications with the aid of a pair of shears, that occasion the greatest trouble, not only to themselves but also to the manufacturers. Such persons, as a rule, with their limited knowledge of the properties of cement, select for their specifications the most rigid clauses from a number of other specifications, and the result is a new and impracticable standard calling for impossible and often contradictory conditions. The manufacturer, unless he has a previous knowledge of the personal equation of the person in charge of the laboratory, is loathe therefore to submit his product and chance the possible rejection of a good material required to meet these impossible conditions. It is not surprising that under such conditions the manufacturer refuses to supply cement. As a result the consumer is placed in the embarrassing position of being obliged either to disregard his specifications or change the requirements.

A uniform or standard specification is unquestionably very desirable, but the realization of such a standard is only possible through the adoption of such methods of testing as will secure uniform and comparable results by different persons. A Board of Engineers have prepared a set of specifications for the guidance of the Corps of Engineers of the U. S. A., but it should be noted that they have prefaced these specifications with a detailed description of the methods to be used. It would seem, therefore, that the first step towards securing uniform specifications is the adoption of methods for making uniform and comparable tests. When this has been successfully accomplished standard specifications will not only be possible but will also be the natural sequence.

The testing of cement is an art requiring a combination of skill and experience, and a natural inclination towards scientific research on the part of the person making the test. The wretchedly poor salaries generally paid those in charge and the correspondingly inadequate assistants which such salaries secure, is one of the deplorable features of the municipal laboratories of to-day, the exception being perhaps a few of the larger laboratories where the assistant in charge is content to accept the poor pay for the sake of the reputation and experience to be acquired.

As a rule the assistants in charge have little interest in their work and frequently resign their positions after a few years' service just when they have become experienced and skilful and therefore valuable. The work accomplished under such conditions is inefficient and unsatisfactory. As a result the great bulk of the tests turned out by municipal laboratories, through lack of uniformity in methods and skill on the part of those making the tests, are of little value. It is little wonder, therefore, that there should be such wide difference in the requirements of the specifications of these laboratories. You will find that the specifications issued by laboratories properly equipped and in charge of skilled persons agree much more closely. Municipalities can well afford to maintain thoroughly equipped testing laboratories, conducted systematically and in charge of technically trained engineers, whose compensation will be sufficient to retain their services for a number of years after they have acquired the requisite skill and experience which make them competent and valuable. The wisdom of such an expenditure of time and money will become apparent when the improved quality of the materials furnished at a reduction in cost and the increased durability of the work are taken into consideration.

The number of regular tests to be made in such a laboratory should be few and the methods used the most simple. Ordinarily the tests for determination of strength, neat and with standard sand for seven and twenty-eight days, the degree of fineness, the rate of setting and some simple efficient test for constancy of volume should be sufficient. If the laboratory possess the services of a skilled chemist, chemical analyses should also be made. For further information concerning methods and apparatus to be used in making such tests those interested are referred to the "Journal" of the Franklin Institute for December, 1901, and January and February, 1902.

Another condition, resulting largely from the maintenance of municipal laboratories, particularly those conducted on broad lines, is the better esprit du corps which now exists between the engineer and the manufacturer. The old situation where these parties held aloof and viewed each other with suspicion and often contempt was an intolerable one, and I am glad to say is rapidly disappearing. The advent of the technically trained assistant at the factory and in the laboratory of the consumer has done much to bring about this condition. Instead of working at cross purposes, both parties are bringing their combined knowledge and skill to bear on the perplexing and difficult problems which confront the producer and consumer alike, and are coming more closely together in an endeavor to effect a solution.

At the present time only a few of the better equipped municipal laboratories compile and publish in a systematic manner the results of their tests. These tests serve as a guide to aid the engineer, the architect or the builder who possess no facilities for making tests of this character in selecting the best and most suitable material for their work.

As these results are made under different conditions they are therefore not related, and there seems to be no basis for a comparison. Without a knowledge of the methods in vogue it is impossible to form any idea of the relative quality of two cements where one is tested in one laboratory and the other in another. There is therefore a most urgent need for a central or reference laboratory, conducted under impartial conditions, at the service of the general public, where fixed standards can be maintained and to which all materials of construction can be referred in cases of dispute between the producer and consumer or, for the purposes of general information as to its properties. Several foreign laboratories, notably that at Charlottenburg, Germany, are conducted on these lines, under Government direction and are of immeasurable value. There is no Government laboratory of this character in this country at the present time. Most manufacturers and many engineers will no doubt agree that there is a growing need for the same. Such a laboratory could establish standards of excellence and could conduct its tests in such a manner that the published results would be related and be of general use. The compensation of the assistants in charge should be sufficient to secure and retain the services of competent persons of great skill and broad experience.

Neither municipal or private laboratories as a rule have the time requisite for carrying on research work of any magnitude. A government laboratory aside from its use as a standard reference laboratory could very properly conduct investigations with a view of solving some of the very perplexing problems connected with the production and use of cement.

We are now entering on a new era, an era which has been appropriately called the "age of cement." The varied applications of cement in constructive work, especially the rapidly increasing use of steel-concrete, render a better knowledge of the strength and properties of the principal material used highly essential. The accurate determination of the properties of this material are more difficult than is the case with any other material of construction. It is of vital importance that this material should not only harden rapidly and attain great strength, but what is far more essential, that it should maintain this strength. A knowledge of the quality and properties of cement becomes, therefore, a matter of the greatest importance and demands that the testing should be conducted in laboratories possessing the best possible equipment, using the best methods available and under the supervision of skilled technically trained assistants.

Retrimming Coal in Bunkers is provided for in the Bristol, Eng., central power station by the use of 12-inch steel pipes, which drop from the bunkers through the boiler room into the basement. Through jaw valves the coal is delivered to the conveyor and elevated for the desired distribution in the bunkers.

The Brooklyn-Manhattan Rapid Transit Railroad.

On July 21 the Board of Rapid Transit Railroad Commissioners of the city of New York will open tenders for the Brooklyn-Manhattan underground railroad, an undertaking which presents several features of the gravest engineering difficulty. Nowhere on the line of the railroad now under construction for the Commission are the conditions of the excavating or tunneling comparable in difficulty with those along certain portions of this new road, which, in places, must pass through a narrow, crowded street close to the foundations of some of the loftiest buildings in the world. Another section which will present unusual conditions for the contractor to overcome is the tunnel under the East River.

The new road begins under the southern terminus of the road now under construction, near Park Row and Broadway, and will have two tracks running down Broadway, Bowling Green, Battery Place, State Street and Battery Park to a loop under Battery Park and Whitehall Street. There will be five stations along this route and just south of that at Bowling Green there will be the branching point of the two tracks running to Brooklyn. These tracks will pass under the lines running to South Ferry, so as to avoid grade crossings. The Brooklyn tracks will be under Battery Park, State Street, Whitehall Street, South Street, the East River, Furman Street, Joralemon Street, Fulton Street and Flatbush Avenue to the Long Island Railroad station.

The contract requirements for the construction in Manhattan are drawn with minute attention to keeping the streets as clear as possible for traffic and particularly for the fire department. This part of the route lies through the most important business center in the country, and there is also a section of the route along Fulton Street in Brooklyn which is almost as important. Here the contractor must work at least two eight-hour shifts each day, and between 8 A. M. and 6 P. M. Broadway must be maintained in a condition for ordinary travel unless the chief engineer gives special permission for relaxing this requirement at some point. On both the Brooklyn and Manhattan shores the route lies under piers, and here the contractor is required to carry on his work so as to afford free access to the docks and wharves at all times. The subaqueous portions of the road will be driven by shields and compressed air; the other portions by such methods as seem most suitable for the several localities.

The general features of the construction do not differ materially from those on the road in Manhattan now approaching completion. Some of the special requirements looking to the comfort of the public during construction are more immediately interesting. For example, the needs of fire protecton are thus guarded:

"Wherever work is being carried on by open excavation, free access must be given to every fire hydrant and fire alarm box, and, when required, hydrants shall be extended by suitable tube or piping to an accessible point as approved by the engineer. At all times and in all places no materials must be piled within 10 feet of any fire hydrant or fire alarm box; and where materials are piled near to a fire hydrant or fire alarm box, and to such height as to obstruct a sight of the same, the position of such hydrant or fire alarm box shall be indicated by suitable signals, both day and night. All work in excavation must be so conducted or bridged if necessary as to give the fire department access at all times and in all places to any building or buildings for the extinguishing of a fire."

Readers of Mr. Charles Sooysmith's paper on foundation work in lower New York, presented a few years ago before the American Society of Civil Engineers, will recall his statements concerning the occasional unusual difficulties in constructing the foundations of lofty buildings in the neighborhood of the lower end of Broadway. The clause in the contract specifications governing work in these localities is as follows: "In the event of encountering quicksand, subsurface streams or similar dangerous contingencies, or where passing especially heavy buildings which by their construction or position might bring a great pressure on the trenches, the right is reserved by the Board for the engineer to direct that such buildings shall be underpinned or that special sheeting shall be driven in such manner and to such depth as the engineer shall direct, or that but a short length of trench shall be opened at one time, and furthermore to direct, if necessary, that the same shall be securely sheeted and braced on all sides after the manner of a shaft, and that the permanent work be constructed in such shaft and backfilled before another opening is made. Whenever water is encountered in trenches, the same shall be removed by baling or pumping, great care being taken when pumping that the surrounding particles of soil be not disturbed or removed. If necessary to prevent such disturbance, the pumping must be done by a series of driven wells whose points are protected by fine wire cloths and the rate of flow at each well being made so slow as not to remove the particles of soil; or the pumping must be done by other means approved by the engineer. The delivery from all pumps shall be conducted into the adjacent sewers and the delivery pipes shall be so arranged as to be readily inspected at all times to ascertain if the water is free from particles of soil."

Peat Fuel is manufactured by the aid of electricity at Stangfiorden, Norway. The wet peat is brought to the factory direct from the bog by water, in lighters of about 100 tons capacity. The boats are discharged by mechanical power and the peat is dried and pressed in a 5-horsepower press which can turn out 2,500 pressed blocks of peat per hour, each measuring 31.5x3.15x3.15 inches. The average weight of dried peat in each block is 4.4 pounds. The briquettes are then dried on wagons in drying tunnels, 140 briquettes per wagon on 10 shelves. The air draft through the tunnels is set up by fans electrically operated and is heated by the waste gases from the retorts. The air has a temperature of 194 to 212 degrees Fahrenheit at the top end of the tunnel where the wagons emerge and of 104 to 122 degrees at the lower end when they enter. From the tunnels the briquettes are carried to the retorts which are upright cylindrical vessels of iron, about 6.56 feet in height and 3.28 feet in diameter. The retorts are provided with spiral resistance coils and the blocks of peat are built up in actual contact with these, until the retort is entirely filled with a pigeonholed mass of peat, in the center of which the heating agent lies. Losses by radiation are minimized by lining the retorts with asbestos. The gaseous products pass away by openings in the retort cover, and after scrubbing are employed for heating the air used in the drying tunnels. The tarry liquid condensed in the gas pipes and in the scrubbers contains tar oils, ammonia and other compounds. The peat fuel remaining in the retort is allowed to cool down to 235 degrees Fahrenheit before being discharged. According to "The Engineer" the average yield of air dried peat is as follows: peat fuel, 33 per cent.; peat tar, 4 per cent.; tar water, 40 per cent.; gaseous products, 23 per cent.

The Financial Questions in Water-Works Valuations.

Abstract of a paper read before the American Water-Works Association by John W. Alvord.

The large number of water-works plants originally built in this country by private capital is lessening in number year by year, as the desire for municipal ownership stimulates cities to acquire such plants, either through the purchase provisions in the original franchises, or through special negotiations, or by reason of the expiration of the franchise itself. This general movement on the part of the American cities to acquire municipally operated plants has given rise to very many interesting financial questions as to the proper and just returns to be made to the original investor or owner of such securities.

It often happens that water-works men and hydraulic engineers, skilled in the construction and designing of water plants, are selected as arbitrators under some special clause of the franchise, or are requested to present the claims of one or the other of the interested parties. Such men are unquestionably well qualified to judge of the physical value and depreciation of the plant which it is desired to purchase, but it is observable that not every engineer or water-works man charged with such responsibilities, has clear and distinct notions of the financial questions involved.

The usual method is for an arbitration board to meet and after careful inspection of the plant to proceed to estimate its cost in detail, at the prices for materials and labor prevailing at the time of such appraisal. This being accomplished, the depreciation is then estimated. Here the skilled water-works man or hydraulic engineer is at great advantage; they are the men best fitted to know intimately from practical experience the life of the various parts of the plant under varying conditions. But from this point on, the arbitration board faces problems which necessarily fall under the head of financial, rather than engineering. The main questions of this kind which invariably arise are three in number and may be described as follows:

First: What is the business value of the plant, built up as it has been by the energy, perseverance and solicitation of the officers in charge, as distinct from the inert plant itself, without customers or connections? This feature of value has been aptly termed by the Judge in the Kansas City case where its distinguishing characteristics were pointed out as the "going value."

Second: What is the value of the franchise, if any, and how shall it be computed?

A third class of financial problems is often encountered which more commonly occurs in court cases; this is the problem of adequate return upon the property in the form of hydrant rental or rates to consumers. This class of problems has been and will be specifically encountered under a recent decision of the United States Supreme Court in the Rogers Park case, where it is determined that cities have the right to regulate water rates, even though fixed apparently by contract in the franchise, provided a fair return upon the capital invested is allowed.

The Business Value.—The element of "going value" has been before described as the element of growth in the plant irrespective of its physical condition. It is comparable somewhat to that indefinable quantity known in other lines of business as "Good Will." Nevertheless it is something more than good will in water-works business, as it represents what might be more aptly described as "connected good will," that is to say, the acquisition of customers who have invested considerable sums in actually connecting their premises with the plant of the company, and provided appliances for the use of the water which it can deliver. In the case of the National Water-Works Company, of New York, vs. Kansas City, in the Circuit Court of the United States for the Western District of Missouri (Fed. Rep. 62-853), the question of the value which attaches to the water-works plant because of its being a "going concern" in use and earning, was brought to a clear cut issue, and it was decided that such value was properly a part of the plant which should be added to the cost of reproduction. This decision has been now well nigh universally accepted by water-works arbitrators as well settled, and is applied whenever this consideration is not specifically excluded by the terms of the franchise or agreements between the parties in interest.

It is not intended here to discuss the merits or demerits of this decision in that particular case or its justice in general application, but rather to point out a method for rationally applying it to actual conditions. It is the writer's belief that the best and most rational method of determining the going value of an ordinary plant was first pointed out by Mr. Benezette Williams, one of the arbitrators in the purchase of the Dubuque water-works by the city. Briefly described the method was as follows:

It is assumed that a new plant will be constructed, the inception of which is coincident with the date of arbitration. Such new plant is to be of an equal capacity with the older plant under consideration, and a due allowance of time in which to construct this new plant, and the necessary capital to be invested in it from time to time is estimated. At the completion of this new imaginary plant, it is assumed that it commences to obtain business in that community from those who are not previously accustomed to the free use of public water, except in a general way; that it is to acquire the business ability and consequent increase in number of customers which the earlier and older plant went through within the early years of its existence. An assumption of the amount of business thus created for each year for a period of years in advance is carefully computed and estimated by the board of arbitrators. The losses of interest upon capital invested are duly fixed, as well as the first absence and later addition of revenue from hydrant rentals, and a table is prepared showing each year, the total business developed and the total losses if any. After this is completed a forecast is made of the business of the older works for the same period of time in the future that it takes the business of the new works to equal the business of the old works. If the business of the old works is found to be a growing one it will be a longer period that the new works will require to overtake it than will be the case if the business of the older works is stationary or decreasing. In general, the differences which might be called the debits and credits of this new imaginary plant and the debits and credits of the older working plant are reduced to their present worth at the time of appraisement, and an estimate is made up which will adequately represent the financial advantage which the old works (already fully equipped and in running order and having a large number of profitable customers) will have over the new works, where everything must be built and customers secured.

It is necessary in making this suppositious estimate of the new plant to consider it in no way a competitor of the older works; there is not supposed to be competition between the new and the old, but it is left to the experience of the board of arbitration to consider how long it would take a new company to build new works, and build up business for the new works until they have overtaken the business of the old company should it continue to occupy the same territory. It is observable, of course, at once, that such a method requires experience in financial matters, as well as experience covering the financial management of a large number of water-works plants.

The writer has applied this method in a considerable number of cases of a varying nature, and has observed its application in other cases outside of his experience, and believes that it is coming to be understood as being the rational way of determining this perplexing question to the satisfaction of the expert who may be called in, and the more wide the experience of the expert the more just will be the application of the method as a rule.

The Franchise Value.—The second item which is to be considered in fixing the value of the water plant is the question of the value of the franchise, if any. This is an exceedingly difficult financial question, and is first of all often excluded from the consideration by the terms of the franchise itself. Of course, it is not a consideration in cases where the franchise has expired. But where negotiations are under way for amicable adjustment irrespective of the opportunity of purchase offered by the terms of the franchise itself, or where it is not excluded from consideration by the terms of the franchise, it becomes a problem of some difficulty. There are two methods by which it may be estimated. First: The physical value of the plant and its depreciation and going value may be entirely neglected and the entire valuation of the plant fixed upon the basis of its earning power throughout the remaining life of the franchise, and its probable value for sale or franchise renewal at the same time. It is evident that it cannot be considered as a revenue producer for all time to come, but the time in which it may earn revenue being limited, the probable net revenue for each remaining year of the franchise life must be estimated and capitalized at a sum which if put at interest would pay such yearly revenue and extinguish itself at the end of the franchise period. To this must be added the value of the plant as physical property at the end of the franchise period giving due consideration to what it may be worth at that time to the city as possible purchaser or parties obtaining a renewal of the franchise, or the cost to the original company for the renewal of its franchise.

The question of the element of value in the physical plant at the termination of the franchise is also a difficult one. In many instances radical changes in the water supply are expected by the citizens. Purification works may be demanded, or expensive alterations may be insisted upon which will have a great bearing upon the element of value of the plant to the city.

A second method of determining franchise values, if any, is to proceed first to estimate the physical value of the plant as shown by its cost of reproduction, less its depreciation. Secondly, to compute the going value. Thirdly, to determine whether the net revenue is paying interest on a capitalized value greater than that indicated by the sum of the physical value and the business value added together. If such capitalized value is less than the sum of the physical and business value, then there is evidently no additional value to the franchise as such, but if the income of the plant capitalized is found to be greater than the sum of the physical and business value, it is evident that in the majority of cases there is to be added a third element of value, created by the amount which the franchise itself is worth over and above any other values which may have been estimated. To determine the present worth of such an added franchise value, the excess income over and above that necessary to cancel all other obligations (including the payment of interest upon the sum of the physical and business values), should be estimated throughout the remaining years of the franchise, and the several sums should be carefully reduced to their present worth and added in as a portion of the final value of the plant.

Now, all this seems somewhat complicated, and indeed is complicated not only in the abstract, but by local considerations, and by the language in the individual franchise. But the writer is convinced from such experience as he has had that the above outline furnishes a rational and just method of determining such values, and is capable of being carefully studied and worked out in each case indicated.

The Fair Return.—The third class of financial questions often arises in connection with what is known as hydrant rental. It is sometimes the case that the franchise is quite silent upon the allowance to be made for additional hydrants, after fixing the amount to be paid for the first installation. Often the franchise states that the value of the additional hydrants will be fixed at a *fair rate*, though not specifying by what manner or means such rate shall be determined. A great many efforts have been made to show what the average hydrant rental is in different communities, or in different States, or in the country at large, but about all the satisfaction that can be derived from such tables is the opportunity to observe that there is a wide variance in the amounts paid for hydrant rental at different places and under different circumstances.

One view of this problem is that hydrant rental, although apparently a specific payment for a specific service, is in reality a bonus given by the city to the water company as an inducement for it to locate, operate and maintain its works, it being found that private capital cannot afford ordinarily to establish works and operate them for the revenue derived from domestic consumption alone. When this is fully understood, it will be perceived that consideration of the hydrant rental question is indeed but a consideration of the more important question as to what may constitute a fair return to the water company upon its capital invested.

Another view of the hydrant rental problem is that it is a specific payment for a specific service, viz., for means of extinguishing fires, and as such it should be made proportional to the service rendered. This view, it can be shown, will lead either to an absurdity or to the precise method of considering hydrant rental as a bonus. For if fire service is to be paid for in proportion to the service rendered, millions of dollars must be used to measure the possible losses due to the absence of suitable mains and fire hydrants in a city of even the ordinary size where the actual investment for fire prevention may be measured in thousands of dollars. A few moments reflection will convince any one that such a measure of value for fire hydrants is out of the question.

But it is often assumed that the measure of value of fire hydrant rental is the investment necessary to provide mains of a suitable size, and pumping machinery of sufficient capacity, and other appurtenances sufficient to provide fire protection rather than domestic consumption. If it is attempted to carry this theory into practice, we must estimate the cost of two separate works: one proportioned for domestic service only, and the other proportioned both for domestic consumption and fire service, the difference between the two representing the cost of increased capacity necessary for fire service. But fire service cost not only depends upon differences in first cost, but operating expenses, interest, sinking fund, and all other fixed charges as well. Therefore it is necessary to know the "*fair return*" upon each of these hypothetical works as well, in order to arrive at the true investment for fire protection alone.

Therefore, it will be seen that to consider hydrant rental as anything else than a portion of *fair return* is to involve oneself in a complicated problem where a simple problem will answer better.

It is indeed too often true that hydrant rental is not fixed with the consideration in mind that it is only a portion of the fair return, but it does not vitiate the final conclusion that this is the real problem at issue. It has been the writer's fortune to study this question in several recent important cases where it was in issue, and so far as he has observed the problem, it is clearly not a question of the remuneration to the company for special services but a question of the fair return to the company upon its invested capital after considering it in the possession of certain private revenues and privileges which assist in rewarding that capital to a limited extent.

This broad method of treating this question eliminates many difficulties which have heretofore surrounded the question of hydrant rental.

Another class of questions involving the fair return is brought up by the recent decision of the Supreme Court in the Rogers Park case before mentioned. If we assume, as it would seem from this decision that we must, that a franchise for water supply is not a contract in so far as the fixed rates therein mentioned are concerned, and that city councils have the right from time to time to readjust such rates, as they may see fit, providing always that in determining on such revised rates, a fair return be made upon the capital invested in such plants, the question as to what is a fair return becomes an exceedingly interesting and important one, not only to the investor, but to the municipality, its citizens, and the courts as well.

What then is the fair return for capital invested in a water-works franchise, and how shall it be determined?

It is evident that municipal plants do not furnish sufficient data for us to determine this question, for municipal works as a rule do not consider interest on original investment unless represented by outstanding bonds. Municipal works provide no sinking fund such as has been described in this paper, nor do they pay taxes. As a rule, improvements in well established municipal works are often paid out of revenue and do not show an increased capital expenditure. Discarded machinery or other appliances in municipal works is never written off as depreciation, but the total cost or investment, if ever known at all, is known as a constantly increasing sum which represents all classes of investment and renewal. Municipal works are therefore quite useless as a guide to the fair return on capital invested.

In the author's opinion the fair return will be found under natural conditions to consist of the following items:

1st. Interest on capital invested.

(a) On bonds and their discount or renewal.

(b) On cash advanced by the promoters.

2d. Proper and reasonable operating expenses including fair salaries for good business management.

3d. Maintenance and renewals to make good not only actual depreciation but necessary alterations.

4th. Taxation, if any.

5th. A sinking fund to make good possible loss in value of plant at end of franchise period due to forced sale or altered requirements which decrease value of some portion of plant.

6th. A reasonable profit.

The method of procedure believed by the writer to be the best for the purpose of deriving the above items of fair return is to take into consideration the whole investment and revenue producing power of the plant, and to determine its future revenue by comparison with its past history. After estimating the physical value of the plant less its depreciation and adding its business value, it should be determined if the franchise has any value by the method discussed under the second head of this paper, and if it has, the final value of the plant may be summed up from these three items. Upon this final value as a basis should be determined in percentages the items of the fair return.

Interest upon capital invested in water-works franchises generally commands a high rate due to the shortness of the term of franchise, and often to the possibility that before the term is over altered conditions of supply may vitiate the value of the works. A new source of supply may be demanded, or purification works may be desired, thus compelling before many years the investment of new capital and the obliteration of a large portion of the original values. The sentiment for municipal ownership now common all over the country, prompts many communities thoughtlessly to try to depreciate the value of works in the hopes of securing them at advantageous rates, thereby engendering much bitter feeling on both sides to the controversy, and often succeeding in seriously depreciating the value of the security.

Interest on bonds should include cost of selling them and renewing them when necessary.

A large amount of practical experience is necessary to determine what are fair and reasonable operating expenses. Oftentimes plants are wastefully and carelessly managed and the operating expenses are abnormally high. At times lack of suitable investment in economical appliances prevents economical operation. In some franchise plants salaries of the higher officers are abnormally high; in others they are abnormally low, due to the officers being stockholders, etc. Operating expense account in many plants often erroneously contains charges properly belonging elsewhere, such as maintenance, renewals, or even new investment.

Maintenance and renewal should be an amount which will keep the plant not only in good repair but in such condition that it may be economically operated. Maintenance should make good depreciation, but should not cover additions to the works such as would fall under the designation of "New Capital Invested." The line here is a hard one to draw in many cases, as for instance where a new main of large size replaces an old main of smaller size.

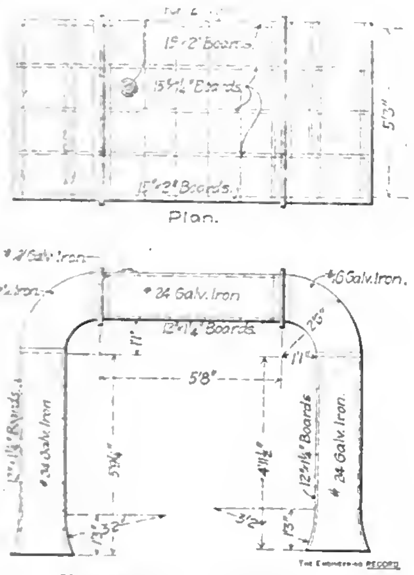
Taxes are generally made against waterworks after certain dates specified in the franchise.

The sinking fund should be such that it will make good all element of uncertainty. If the entire plant is certain to be sold to the city at the end of the franchise period, so that its cost is made good to the original investor, no sinking fund is necessary. But if the city may desire to secure the distribution system only, and will wish perhaps to locate a new pumping station, or develop a new source of supply, then the sinking fund should be calculated in a sufficient amount to make good the loss to the company upon the pumping station. Or, take another case where there is no probability of change in the system, or desire for a new or different water supply, but where difficulties may be encountered in renewing the franchise, then the sinking fund should be so calculated as to cover all possible loss to the original investors produced by negotiations for new franchises, or for the necessity of selling to the city under pressure at the termination of the franchise.

An element in the fair value of any plant is the return to the investor not only of interest upon that portion of actual cash which he has put into the plant, but a reasonable profit upon his money. Were water-works franchises perpetual a reasonable profit might be a comparatively small one, and the interest to the investor might be comparatively low, but with water-works investments in this country terminated as a rule at periods of 25 to 30 years, a higher rate of interest to the investor must of necessity be expected, than would be the case with a higher class security. This last element of fair value is of course the most difficult one to determine, but with considerable experience in the financing of new enterprises, a water-works expert may, in any individual case, arrive at what seems to him to be a fair return under the local circumstances, together with the outlook as it may be at the time of appraisement.

Experiments on the Clarification of the St. Louis Water Supply.

Experiments with the water supply of St. Louis to determine the comparative merits of clarifying the water by passing it through settling tanks connected in series and in parallel have been begun by Mr. Edward Flad, water commissioner of that city, at Chain of Rocks. Heretofore the clarification has been performed entirely by tanks connected in parallel. Now, however, one-half of the water from the low



Experimental Syphon.

service pumps will flow continuously into one end of basin No. 1, through some large syphons at the other end into basin No. 2, and then through syphons at the opposite end from the inlet into basin No. 3, from which the clarified water will flow into the drawing conduit. The other half of the water pumped will flow continuously and equally into basins 4, 5, and 6, and over weirs on the opposite side into the drawing conduit.

During the tests the inflowing and outflowing water will be sampled occasionally and the turbidity measured by the U. S. Geological Survey turbidity rod of 1902, described in The Engineering Record of June 14. The suspended solids will also be determined, thus giving data as to the comparative merits of using the basins in parallel and in series.

The syphons, being for experimental purposes only, are of wood framing covered with galvanized iron. The iron flanges connecting the lengths of galvanized iron are riveted onto the latter and bolted together with ⅝x1¾-inch bolts, the joint being made air tight by using a rubber gasket. Three syphons are used over each wall, and there are four compartments 1 foot 3 inches square in each syphon, making something over 18 square feet total area of cross section of the three syphons. The height to which the water is to be raised is from 3 to 4 feet. The intake ends of the syphons are 4 feet below the water surface, and both ends are flared. The first series of syphons has a summit 5 feet 8 inches long, and the second 37½ feet. A hand vacuum pump can be used to prime the short ones, while a similar pump operated by a 1 horse-power electric motor is used to prime the others, this operation taking about 20 minutes. If the results of these experiments warrant it, it is expected that a permanent system of cast iron syphons may be installed and the entire six basins operated in series.

Sewage Disposal Works at Bury, England.

A rather unusual combination of sewage purification methods is chemical precipitation followed by bacterial treatment in contact beds. This is the system adopted at Bury, England, as described in an article in "The Surveyor" some time ago, from which the following account was prepared:

Upon entering the works the sewage is received into an inlet chamber controlled by shuttles, so as to regulate the quantity of sewage to be treated. It then passes through the detritus tanks, where the heavier matters contained in the sewage are deposited, while the lighter floating matters, such as rags, paper, corks, etc., are intercepted by the screens. The matters intercepted in this way are taken to the destructor to be burnt.

After leaving the detritus tanks the sewage is conveyed by a channel of considerable length to the precipitation tanks. Across this channel and immediately at the west end of the screening tanks is the chemical mixing-house; the upper floor of this house is reserved for the storing of chemicals, etc. On the ground floor are two grinding mills in which to prepare lime or other precipitants, should they be employed. There is also on the ground floor an electric motor of 10 horse-power, which works the grinding mills, screens and elevator and conveyors.

The chemicals used are aluminoferric and ferrozone. The cakes are placed in cages in the channel between the screening tanks and the mixing-house, where they are dissolved by the action of the sewage and thoroughly mixed by a pair of agitators placed in the conduit. The precipitation tanks are circular, 24 feet in diameter and 20 feet deep. On the outside of each tank is a channel into which the sewage is first received. In this channel are six cast-iron pipes, all carefully turned and set level. The sewage flows over the periphery of each pipe in a very thin sheet and is conveyed to the bottom of the tank. Immediately on its arrival the treated sewage commences to deposit the sludge, and the clarified effluent rises to the top of the tanks, overflows in a very thin sheet into a series of steel channels, and is then led by a conduit to be further treated in the contact beds.

The contact beds are filled with coke and engine ashes. After being charged the sewage is allowed to remain in contact for about two hours. It is then run off into the channel conveying it to the river, the bed is allowed to stand two hours to aerate, and is then refilled. Preparations are in hand to increase the number of tanks and contact beds, and ultimately it is intended to have a double contact. This completes the cycle of treatment of sewage proper; there is still the sludge to deal with. The sludge deposited at the bottom of the precipitation tanks is extracted by syphonic action through a perforated arm, which is caused to revolve just clear of the bottom of the tank, the outlet of this pipe being at a lower level than the top water of the tanks. The sludge then gravitates through pipes and along an underground sludge channel on the west front of the main building to a sump opposite the engine house. From this sump the sludge gravitates into the ejectors, which are of the Shone type, worked by compressed air, by which it is lifted into a high-level tank on the south side of the main buildings. The sludge then gravitates to the press, where on its way to the sludge rams placed in the chamber below the floor it receives a quantity of milk of lime, and being passed through a mixer the sludge and lime are thoroughly incorporated.

From these rams it is forced by compressed air into the sludge presses on the upper floor. These presses are of the usual type, consisting of a series of flat cast-iron filtering cells lined with filter cloth and mounted on horizontal steel bars with arrangementa for screwing the plates tightly together when in use. Provision is made for the admission of the sludge into each of the 40 cells of one set simultaneously under the compressed air pressure of 100 pounds per square inch.

When the presses are opened the cake falls on to a conveyor belt traveling under the presses, and is discharged either through a disintegrator and into a hopper where carts may be loaded or on to other conveyors communicating with the pressed cake store, or to the destructor. In order better to prepare the sludge as a fertilizer, a Tatham's patent sludge disintegrator has been erected, to break up the cakes so as to assume the form of a fine garden mould.

The destructor consists of six cells or furnaces. The cells are built in a compact block, and are fed from the top. The destructor is guaranteed to burn about 60 tons per day of the ordinary house refuse of Bury, mixed in the proportion of one-half to two-thirds house refuse and the remainder sludge extracted from the sewage.

In order to produce the high temperatures, forced air draught has been adopted. There is a special flue arrangement to ensure complete combustion of all noxious gases. The forced air draught is provided by a high-speed engine, coupled direct to a fan, which supplies the necessary quantity of air to the fires, which air on its way thither is heated by passing through hot chambers provided in the interior of the destructor, so that the effect of a hot blast is produced. The fan derives its air from the upper part of the building, thereby ventilating and purifying this, notwithstanding the objectionable material which is constantly being brought to the destructor to be burnt. The hot gases from the destructor are utilized to raise steam in two 200 horse-power Babcock & Wilcox water-tube boilers. Mortar mills are provided to grind up the clinker, which can be used to advantage in making lime mortar. The cost of the disposal works was $224,000. They were designed by Mr. Joshua Cartwright, M. Inst. C. E., and were erected under his supervision.

The Asphalt Plant of Winnipeg, Man., which has been operated by the city for three seasons, now requires some renewals and additions, according to the last report of City Engineer H. N. Ruttan. It is expected that by the contemplated improvements a saving of at least 10 cents per square yard in the cost of the pavement can be made. During 1901 51,252 square yards of asphalt pavement were laid by day labor at an average total cost of $2.78 per square yard.

Stream Pollution Enjoined in New Jersey.

Decision of N. J. Court of Chancery in State ex rel. Board of Health v. Diamond Mills Paper Co.; written by Vice-Chancellor Stevens. Somewhat condensed from 51 Atl. Rep. 1019.

This is a bill filed in the name of the State, on the relation of the State Board of Health, for an injunction to prohibit the defendant from discharging its factory refuse into the Rahway River. The bill is filed under the fourth section of the act of 1899 entitled "An act to secure the purity of the public supplies of potable waters in this State." The act provides as follows: "No sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever, which either by itself or in connection with other matter will corrupt or impair or tend to corrupt and impair the quality of the water of any river, brook, stream or any tributary or branch thereof or of any lake, pond, well, spring or other reservoir from which is taken or may be taken any public supply of water for domestic use in any city, town, borough, township or other municipality of this State, or which will render or tend to render such water injurious to health, shall be placed in or discharged into the waters . . . of any such river, brook, stream or any tributary or branch thereof or of any lake, pond, well, spring or other reservoir, above the point from which any city, town, borough, township, or other municipality shall or may obtain its supply of water for domestic use." The proviso is that the section quoted shall not be held to apply to any municipality "which at the date of the passage of this act has a public sewer or system of sewers, drains or system of drains, legally constructed under municipal or township authority discharging its drainage or sewage into such river," etc. The act further provides that any penalty for a violation of the act (fixed at $100 for each offense) may be recovered before a justice of the peace in a summary proceeding in the name of the State or local board of health, or that the State Board may institute in the court of chancery the injunction proceedings here under consideration.

Two things are conceded: First, that the defendant does discharge factory refuse into the Rahway River above the point from which the city of Rahway obtains its supply of water; second, that at the point where such supply is taken there is no visible or appreciable deterioration of the water, in so far as observation or chemical analysis can detect it. The distance between this point and the point where the refuse is discharged is six or eight miles.

It is contended that the act is unconstitutional (1) because its title is defective; (2) because it is special and local; and (3) because it attempts to confer upon the court of chancery a jurisdiction which it cannot exercise.

1. Giving the word "secure" the meaning of "guard," "protect," which is one of its ordinary meanings, it seems to me that the title accurately expresses the object. The case is so obviously within the decision of the court of errors in Johnson v. Borough of Asbury Park, 39 Atl. 693, that discussion is unnecessary.

2. It is next contended that the act regulates the internal affairs of towns and counties, and is special and local in that regard. The law is not open to this objection. So far as I have to deal with it, it does not, through the instrumentality of municipal authority, regulate the internal affairs of towns and counties. The prohibition against impairing the waters of the State is imposed by the legislature itself, and not by the municipalities. The subject-matter of the act concerns all the people of the State. Its execution is intrusted to a State board. It is true, as pointed out in Bingham v. Mayor, etc., 40 N. J. Law, 156, and Alexander v. City of Elizabeth, 28 Atl. 51, that there is often conferred upon municipalities the power to legislate locally with respect to like subjects, and, if the legislation were of this character, it would have to conform to the constitutional provision under consideration; but if, as in the case in hand, the legislature chooses to exercise the power itself, it is not, at least, fettered by this restriction.

It is further insisted that the act violates that provision of the fundamental law which declares that the legislature shall not pass special or local laws granting to any corporation, association, or individual any exclusive privilege, immunity, or franchise. This provision, as I understand the decisions, applies only to private corporations. Pell v. Mayor, etc., 40 N. J. Law, 76. The constitution provides that no private, special, or local bill shall be passed unless public notice of the intention to apply therefor, and of the general object thereof, shall have been previously given. As to this provision, the legislature, in conformity with the power expressly conferred upon it, has declared (Rev. St. p. 3197, Sec. 50) "that the publication of any law in the Pamphlet Laws published by the State shall be prima facie evidence, that the notice required by the constitution has been duly granted." This law has been so published, and there is no proof that notice was not given. Freeholders v. Stephenson, 46 N. J. Law, 173. But aside from this objection, I think the law is neither special nor local, within the meaning of this clause. The subject dealt with is the maintenance of the purity of the now existing supplies of potable water.

It is urged that the act is objectionable because it exempts from penalty municipalities which at the date of its passage have legally constructed sewers discharging their sewage into rivers and streams; that it is, therefore, special, because its prohibitions act upon some municipalities, and not upon others, and local, because it exempts from its operation parts of some streams, viz., those into which sewage is now flowing. The argument, of course, goes to this extent: that the legislature has no power, except by private, local, or special bill, of which notice is given, to preserve the waters of the State in their present condition of purity, without exacting the impossible requirement that all water courses, from their source to their mouth, shall be hereafter kept pure and potable. I think that waters which either are, or, under existing law ought to be, pure and potable, may properly be put into a class by themselves. I think, further, that, having regard to the geography of the State, and the shortness of its water courses, the potable waters of the State may be properly classified as those which are above the points of lawful sewage discharge, and the nonpotable as those which are below such points. There is always a possibility that the germs of disease and epidemic may be present in streams and waters of the latter class, however much the sewage and drainage may be diluted; and it is reasonably certain that even if, in some cases, conditions may be improved, the waters below the points of present discharge will never regain their original purity. As to the class of potable waters, the prohibition binds all alike. On the principle on which the courts have heretofore acted, it would seem, therefore, that the potable waters of the State may be classified together as a proper object of legislation. Their marked characteristic is their potability, and the legislation has reference to this characteristic, and tends to perpetuate it. The legislation is within the long line of cases in which it is held that, where the classification is founded upon a substantial difference, it is good. Benson v. Inhabitants of Bloomfield Tp., 33 Atl. 855.

It is next contended that the legislature cannot vest this court with jurisdiction over this matter. All it has done is to give an alternative remedy by injunction. That the legislature may direct the exercise of the injunction power by this court in a new class of cases, to which the remedy is appropriate, seems to me clear. The legislature not infrequently extends the jurisdiction of courts, both of law and of equity, to new cases, and it assigns them to the one court or the other in conformity with the remedy each is accustomed to administer. In the case in hand it must be conceded that the exercise of the injunction power is an appropriate remedy to attain the end in view, viz., the prevention of the pollution of potable waters. It is true that heretofore the rule in equity has been not to exercise its jurisdiction to restrain nuisances unless a serious public injury has been shown to exist—an injury not remediable in the ordinary tribunals. The reason is that the remedy at law has been found adequate. Here, however, we are dealing, not with the jurisdiction ordinarily exercised by this court, but with a jurisdiction conferred by statute. To deny the constitutional validity of the act is to assert that the legislature cannot afford what is undoubtedly an appropriate remedy for a new and threatening wrong; that it may, indeed, punish, but that it cannot prevent.

The next question is whether the defendant has in fact violated the provision of the act. What does the act prohibit? It is first to be noted that what is prohibited may be something less than a nuisance, ordinarily so called. The provision is that "no . . . factory refuse, . . . which either by itself or in connection with other matter will corrupt or impair, or tend to corrupt or impair, the quality of the water of any river . . . from which is taken or may be taken any public supply of water for domestic use in any city, . . . or which renders or tends to render such water injurious to health, shall be placed in the waters of any such river . . . above the point from which any city . . . shall or may obtain its supply of water for domestic use." The language here used is plain and unambiguous. The prohibition is against placing in the water of the river, anywhere above the point from which the city obtains its supply, any factory refuse which will either impair or tend to impair its quality. If at the place of discharge the factory refuse put into the river impairs it, or even tends to impair it, the prohibited act is done.

On this branch of the case, also, State v. Wheeler, 44 N. J. Law, 88, seems to be directly in point. The defendant was indicted for polluting the waters of a brook used to supply a reservoir. The act under which the indictment was framed provided that if any person should throw, or cause or permit to be thrown, into any reservoir, or into the waters of any creek, pond, or brook, the waters of which were used to supply any reservoir, any offal or offensive matter whatever, calculated to render said waters impure, he should be guilty of a misdemeanor. Mr. Justice Magie said: "The question turns on the meaning and relation of this clause, viz., 'calculated to render said waters impure.' What waters are thereby intended—those of the reservoir where waters are collected for distribution for public use, or those of the creek, pond, or brook which supply such reservoir? The grammatical connection of the clause is only consistent with the latter meaning. . . . The whole act plainly shows a design to protect from pollution the waters of creeks used as the feeder for reservoirs for public use, without any reference to whether such pollution appreciably affects the waters when arrived at the reservoir."

The act now under consideration is quite as explicit on this head. I do not understand that there is any question made by defendant that the purity and potability of the waters of the river are impaired at the point of discharge. It is contended that the solids held in suspension in the water as it passes out of the raceway into the river soon sink to the bottom, leaving the water as pure as it was when it entered the mill, but it is not seriously pretended that the waste water at the point of discharge is either pure or potable. The bottled samples demonstrate that it is not.

It would seem plain then that an injunction should issue. The city of Rahway is not shown to have been injured, but this is a bill filed, not by the city of Rahway, which is not a party, but by the State Board of Health. I cannot better state the design of such a statute as that under which the board of health is proceeding than by quoting from Sir George Jessel, M. R., in Attorney General v. Cockermouth Local Board, L. R. 18 Eq. 172. "The defendants are a public body authorized by act of parliament to construct sewage works so that they shall not be a nuisance. Under the powers originally conferred on them, they could not make outfall works outside their district, but a subsequent act of parliament authorized them to go outside. They may now take people's lands. . . . But these powers are subject to this proviso: 'Provided, always, that nothing herein contained shall give or be construed to give powers to any local board to construct or use any outfall drain or sewer for the purpose of conveying sewage or filthy water into any natural water course or stream until such sewage or filthy or refuse water be freed from all excrementitious or other foul or noxious matter such as would affect or deteriorate the purity and quality of the water in such stream or water course.' I do not mean to say that clause might not by possibility have been better drawn, but I think the meaning is pretty plain, and it means this: 'You shall not send your sewage into a natural stream until you have made it wholesome water—until you have got rid of all the noxious matter in it.' That, I think, is the effect of the clause; and, if that is the meaning, the next point is, what water is it that is not to be affected or deteriorated? You are not to affect or deteriorate the water in the river. What portion of the water? I cannot accede to the argument of the defendants that it merely means that you must not poison the whole river. For a river may be hundreds of miles long. I think it must mean that you are not to affect or deteriorate the water in the river at the point where the outfall is, and that, if you at that point pollute the water, you shall not enjoy the privilege given you by the act of parliament of making an outfall outside of your district. . . . Then this is an information by the attorney general against a public body to enforce the terms of a public act of parliament. Now, if I understand the law upon this subject, it is not necessary for the attorney general to show any injury at all. The legislature is of the opinion that certain acts will produce injury, and that is enough. The case I have already referred to, of the attorney general against the Oxford, Worcester & Wolverhampton Railway Company, is in point. There the attorney general would not even answer the affidavits of defendants to show there was no injury caused by the proceedings they were adopting. The legislature is of opinion that it is desirable to preserve our streams in at least their present state of purity. It therefore has said, 'You shall not affect or deteriorate the water at all,' and that the court must assume that the deterioration of the water is an injury which is prohibited for good and sufficient cause. Again, if I look at the evidence in the case, I can see very good reason for the course adopted by the legislature. We had the evidence of scientific men to this effect: that there is always a probability of danger when sewage matter is thrown into a stream, because people may drink of that stream, and, if an epidemic disease is prevalent in a town from which the sewage matter proceeds, that disease may be communicated to the inhabitants of another. Well, that alone would be sufficient justification for the legislature, if it entertained that opinion, inserting this enactment in the act of parliament. That being so, I think I am bound, as regards the information, to grant an injunction to restrain the defendants infringing the provisions of the act of parliament."

I am of opinion that the Board of Health are entitled to an injunction.

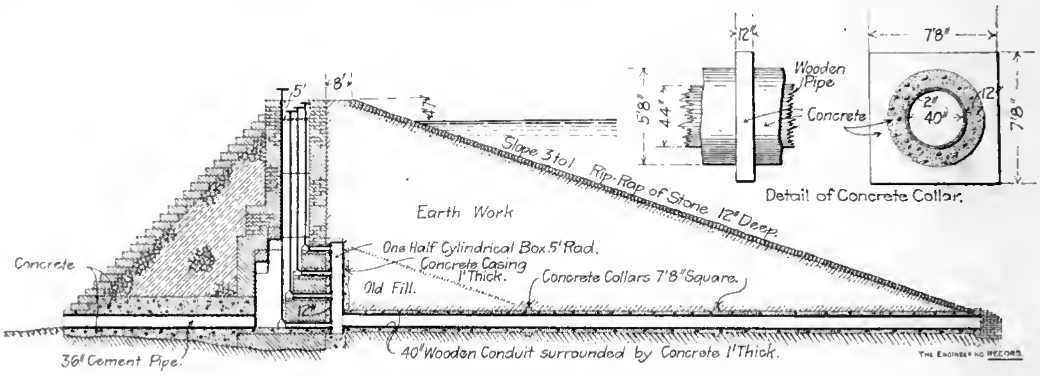
Reconstruction of the Castlewood Dam.

The Castlewood dam, near Denver, Colorado, together with the adjacent property has been purchased by the Denver Sugar Land & Irrigation Company and extensive repairs are now being made on the structure. The construction of this dam was described in The Engineering Record of December 24, 1898, by Mr. A. M. Welles, its designer, and in the issue of May 19, 1900, an account was given of some rather serious leaks which had occurred just previously. At that time the State Engineer ordered the dam to be emptied and kept empty until thoroughly repaired.

To review briefly the facts stated in those articles, the dam as originally built consisted of a masonry retaining wall 600 feet long, 70 feet high above the surface and 4 feet thick at the top. It was battered 10 on 1 on the water face, and was vertical on the other, against which dry rubble was dumped. The downstream face of this rock-fill was covered with large blocks of stone forming a series of steps. The foundation was a dense sandy clay, 5 to 22 feet below the natural surface. A rollway 100 feet long in the center of the dam, and a spillway 40 feet wide at one end was provided for overflow water. The valve chamber was built in the dam proper, and eight 12-inch iron pipes led to it at four different levels through the low earth fill which was placed against the water face some time after the dam was completed. It was stated that this earth fill was carried up somewhat more than half the height of the masonry wall. A 36-inch concrete conduit carried the water from the valve chamber through the rock-fill to the downstream face of the dam.

On April 30, 1900, as a result of a heavy rainfall, it was reported that 500 cubic feet of water per second were passing over the rollway and through the by-pass, the discharge pipes being of course wide open. In some manner the water found a way through the masonry wall and poured in a large stream out of the cracks in the stepped downstream face at about 30 feet from the top of the dam.

Mr. William C. Johnston, president of the Denver Sugar Land & Irrigation Company, states that "the sole cause of the break before was the iron pipes running through the embankment breaking under ground, and part of the flow went under the dam and part through the dam." The use of the iron pipes through the earth embankment, which, as shown in the accompanying cut, is being built up to the full height of the masonry, is avoided in the present plan by laying a single 40-inch wooden conduit reinforced with concrete leading to a steel box also encased in concrete, in which are the entrances to the eight 12-inch pipes through the masonry wall, controlled by valves on the other side. The old spillway, the lower end of which was badly washed out in the flood, is being repaired, and a new one 12 feet wide with 1 to 1 sides is being built at the other end of the dam. The completion of the earth fill will make the structure practically an earth dam with masonry core wall backed by rock fill to give weight. These additions and repairs it is expected will do away with any fears for the safety of the structure.



THE METHOD OF RECONSTRUCTING THE CASTLEWOOD DAM.

The Gallipolis, Ohio, Water Supply is drawn from wells made by sinking 6-foot lengths of 4-foot cast-iron pipe in a sand and gravel bar in the Ohio River. The top of each pipe is about 5 feet below the surface of the bar, at the low-water level, and is covered over so that all the water entering the well must come in at the bottom. The wells are only 12 feet apart, which has been found much too close, but they yield a clear supply no matter what may be the condition of the river water.

The New England Water-Works Association will hold its annual convention on September 10 to 12 at The Brunswick, Boston.

A Large Toll Bridge will be built across the Missouri River at St. Charles, Mo., by the St. Charles & St. Louis Counties Bridge Company. The trusses will be spaced 22½ feet apart on centers, and the space between them will be used at first by a double-track motor road and vehicles, although there will be 10-foot roadways cantilevered out from the trusses as soon as the traffic makes them desirable. The structure includes 145 feet of earth embankment held by concrete retaining walls on the St. Charles side, 525 feet of timber trestle, three 416-foot through spans, a 300-foot through span, and several hundred feet of timber trestle on the east side. The river spans will rest on cylinder piers sunk by the pneumatic process. The structure was planned by Waddell & Hedrick, Kansas City, and the contract for the entire construction was awarded to the Midland Bridge Company of the same city.

Experiments on the Purification of the Springfield Water Supply.

The water supply of Springfield, Mass., has for many years been the source of much concern to the city on account of the large quantity of organic matter in the Ludlow storage reservoir and the consequent rapid growth of algae, notably anabaena, in the warm months, giving the water a very objectionable taste and odor in addition to its high color. In the early spring a further source of trouble sometimes is the presence in the water of great numbers of certain infusoria. In December, 1900, experiments were begun to determine whether sand filtration would be practicable as a means of purifying the Ludlow water, or whether some entirely different scheme of supply would be the best way out of the difficulty. These experiments were concluded in February of this year, and the results are presented in a special report of the Water Commissioners of Springfield, from which the following account was prepared.

For purposes of experimentation a 20x40-foot frame building was divided into two rooms, one for keeping records and for microscopic work, and the other as a general test room for making minor experiments in filtration, chemical determinations, etc. The small filters used consisted of galvanized iron tanks 20 inches in diameter, some 42 inches high and others 6 feet. The two main filters were constructed of cypress staves held together with iron hoops and lined inside with Portland cement mortar plastered over expanded metal lathing nailed to the woodwork. Both filters were carefully covered over so that there was no freezing of the water in them during the coldest weather. The area of each was $^{1}/_{200}$ acre, or about 218 square feet. On the cement floor of each filter was laid a system of open brick drains surrounded with 6 inches of clean gravel 1 to 2 inches in diameter. The successive layers above this were 2 inches of 1 to ½-inch gravel, 1½ inches of ½ to ¼-inch gravel, ½ inch of ¼ to ⅛-inch gravel, and finally 5 feet of sand having an effective size of 0.28 millimeter and a uniformity coefficient of 2.8. This sand is somewhat coarser than that used in the Lawrence, Mass., filter, and was used because a large quantity of it appeared to be easily available in the neighborhood.

One of the large filters was reserved for the reservoir water and the other was used in connection with the so-called canal water before it reaches the reservoir. A 7½x7½x6-inch duplex Deane steam pump supplied the water to two 25,000-gallon tanks, from which it flowed by gravity to the filters except when pumping was taking place, when the water went directly from the reservoir or canal to the filters. The effect of pumping the water was to break up and thoroughly mix the organisms with the water. It did not add to the water any measurable amount of dissolved oxygen. After being in service about 8 months the tanks were emptied and thoroughly cleaned, the deposit of organic matter in each tank being then about ¼ inch in depth. At the end of the experiments, 5 months later, there was only a small accumulation of such deposit.

The condition of the reservoir water during 1901 is stated in the following extract from the State Board of Health's report on the experiments: "The condition of the water in the winter and spring of 1901 was not materially different from its condition at this season in previous years, and the experiments carried on during this time were under conditions such as have usually existed at this season of the year. In the later spring and early summer, on the other hand, the quality of the water was better than usual, and in the months of June and July it was better than has ever been known before during these months. The quantity of organic matter in the water increased rapidly in August, great numbers of anabaena appearing in the water, and from early in August until after the middle of September, a period of about six weeks, the quality of the water was as bad as ever known at this season of the year. After the middle of September, however, the quality of the water improved rapidly and became, during the remainder of the year, much better than it was in the latter part of any previous year."

The principal filter used in the experiments on the purification of the Ludlow reservoir water was "operated, except for a short time, as a continuous filter at a rate of 2½ million gallons per acre per day, and in the latter part of the year at a considerably higher rate, and was successful in removing the objectionable odors from the reservoir water except at the time of the presence of the excessive quantities of organic matter in August and September, when the effluent of the filter had for a time the odor and characteristics of the water of the reservoir and in nearly as pronounced a degree.

"The results obtained by filtering the water through other similar filters at a rate nearly twice as great as that employed during the greater part of the year with the large filter were nearly equal to those obtained with that filter. None of the filters, however, to which Ludlow reservoir water was directly applied removed the characteristic odor during the time in August and September when this water contained excessive quantities of organic matter.

"An experiment upon the refiltration of the reservoir water was begun early in August and continued until the end of the experiments. This experiment consisted in applying the effluent of the large filter to another similar filter at a much more rapid rate. This secondary filter successfully removed the taste and odor from the effluent of the large filter and the effluent of the secondary filter was at all times during the operation of good quality and suitable for the purposes of a public water supply."

During 1901 the canal water flowing into the reservoir contained, according to the Board of Health, "much smaller quantities of organic matter and organisms than were found in reservoir water, and the largest number of organisms were present at a time when the water from Belchertown reservoir entered the canal accidentally. The water of the canal is much more highly colored under ordinary conditions than the water of the reservoir, and a smaller proportion of the color was removed by filtration. The results show that, under conditions similar to those which existed in 1901, objectionable tastes and odors and a considerable portion of the organic matter can be removed from this water by filtration, and the color can be noticeably reduced, so that this water would be of good quality for the purposes of a public water supply, though the color would probably at times be quite noticeable."

The accompanying table taken from the report of Percy M. Blake, consulting engineer to the Water Commissioners, gives the main results of the experiments.

From August 12, 1901, to January 30, 1902, the reservoir water was subjected to a second filtration at the rate of nearly 10 million gallons per acre per day. The average albuminoid ammonia in the effluent from this secondary filter was 0.0098; the maximum 0.0130. The average color was 0.13, and the maximum 0.29. It was found necessary to use aerating devices in order to recharge with oxygen the effluent from the primary filter before applying it to the secondary one. This of itself would greatly complicate plans for the purification of any large amount of water.

The Results of Filtering Ludlow Reservoir Water.
(In parts per 100,000, with color by Mass. State Board scale.)

	Raw water.		After primary filtration.	
	Color.	Alb. am.	Color.	Alb. am.
Ludlow Reservoir.				
Av.	0.41b	.0325a	0.23b	.0130b
Max.	0.86b	.1380a	0.44b	.0218b
Canal Water.				
Av.	0.50b	.0184b	0.34b	.0102b
Max.	0.98b	.0440b	0.74b	.0190b
East Branch, Westfield River.				
Av.	0.15c	.0107c		
Max.	0.32c	.0200c		

NOTE.—Values marked "a" are from experiments June 12, 1899, to March 4, 1902; those marked "b" from February 23, 1901, to January 30, 1902; and those marked "c" from April 10, 1900, to March 4, 1902.

It will be noticed that in the table there are given analyses of the water of Westfield River. These are given for purposes of comparison, as careful surveys have shown this to be by far the best source of supply should it be determined to discontinue the Ludlow reservoir.

Coming now to the financial part of the problem, while it is admitted that a system of double filtration is possible, it would seem to be impracticable on a scale large enough for the supply of a large and growing city such as Springfield, except as a last resort. On this subject the Board of Health is very emphatic: "A comparison of the estimated cost of engineering structures and mill damages for taking water from the Westfield River with the estimated probable cost of filtering the Ludlow and Jabish brook sources and making the necessary additions and enlargements, indicates that the cost of a supply from the Westfield River is likely to be less to the city of Springfield than the cost of a supply from the present sources developed to their fullest capacity, and very much less than the cost of a supply from the present sources increased by water from Swift River, which increase would probably be required within ten years."

Accordingly preliminary plans have been prepared for a dam across the East branch of Westfield River above Norwich bridge, the proposed dam being of monolithic masonry 170 feet long and 60 feet in height above the bed of the stream. The high-water area will be about 77 acres, and the total storage capacity about 360 million gallons. (The total storage capacity of Ludlow reservoir is 2,000 million gallons.) Nearly the whole length of the dam will be required for the safe overflow of storm waters. It is proposed to utilize the surplus water in generating power to partly pay for the damages to mill privileges on the river below.

The experiments outlined above are among the most interesting conducted recently in this country because they have led to a result which is the opposite to the customary outcome of such investigations. Generally it is found that filtration affords a more economical means of procuring a satisfactory supply than the construction of works for bringing to a city the waters of some distant stream or lake. The fact that the experiments with the Ludlow reservoir supply have shown it to be unsuitable points definitely to the best sources of the new supply for Springfield, and the fixing of that fact beyond reasonable expense is well worth the expense of the investigation. From the historical point of view this decision is of much general interest, for the Ludlow reservoir has been for years one of the "habitual criminals" of the water-works world. It has been the subject of many special reports, a field of investigation of a number of specialists in water analysis, and the despair of the local water commissioners.

Duty Test of a 6,000,000-Gallon Pumping Engine, Haverhill, Mass.

A duty trial of a 6,000,000-gallon pumping engine showing very good results was conducted last fall in an interesting and rather unusual manner at the new Kenoza pumping station of the Haverhill, Mass., water-works. The machinery was furnished by the Barr Pumping Engine Company, of Philadelphia, under a contract which called for a horizontal, cross-compound, fly-wheel pumping engine having a capacity to lift 6,000,000 gallons in 24 hours a total of 215 feet, including friction in the force main and a possible suction lift of 25 feet; two horizontal tubular boilers each having a shell 6 feet in diameter and 140 3-inch tubes, 16 feet long, and the necessary heaters, feed and air pumps and a jet condenser. The contractor gave a guaranty that the whole plant should have a duty of 105,000,000 foot-pounds per 100 pounds of coal, with no allowance for ashes and waste, the coal not to contain more than 2 per cent. of moisture. The conditions under which the plant should be run in the test were stated as follows: The plant should be started cold; the boiler fired up and the plant run for 10 hours out of the 24 for four consecutive days, banking the fire each night, except the last. All the fuel used should be charged against the test, including wood used in starting, three pounds of wood being considered as equivalent to one pound of coal. The conditions are practically the same as those of the actual running of the plant in regular service. The steam pressure was not to exceed 150 pounds.

A type of reheater designed by Mr. F. W. Dean, of the engineering firm of Dean & Main, of Boston, is used, taking the place of the usual form, which heats the exhaust steam from the high-pressure cylinder before it enters the low-pressure cylinder by means of live steam from the boilers. The Dean reheater is placed in the smoke flue from the boiler to the chimney and utilizes the escaping gases to heat the exhaust from the high-pressure cylinder.

As to general dimensions of the pump, the diameter of the right-hand plunger is 16¼ inches, that of the left-hand, 16 9/32 inches. The length of stroke, 35 27/32 inches; diameter of plunger rod, 3½ inches; net effective area of plunger, 202.99 square inches; total displacement per revolution, 29,092.99 cubic inches, equivalent to 125.51 gallons; net displacement less 1½ per cent. for slip, 124.05 gallons.

The test was undertaken by Mr. Freeman C. Coffin, of Boston, the consulting engineer retained by the Board of Water Commissioners of Haverhill to design the works, and Mr. W. H. Bodfish for the contractor. In his report of the test, Mr. Coffin says that arrangements were made to begin on the morning of August 28, 1901. It was found at that time, although the fire had been drawn for several days, that the water in the boiler was still hot, having a temperature of 160 degrees Fahrenheit. As the postponement would have made considerable additional expense, it was decided to compute the weight of coal required to raise the boiler and the water in it from the temperature of the water in the lake, namely, 70 degrees, to 160 degrees and add this to the actual coal consumed. It was also found that the steam pressure on another boiler (20 pounds) had been on the jackets of the engine all night and the whole of the steam cylinders were heated. The weight of coal added to that actually consumed on account of these corrections was 459 pounds, made up as follows: To raise the temperature of the water in the boiler, 158 pounds; of the metal in the boiler, 23 pounds; of the setting, 175 pounds; and of the engine, 103 pounds. The principal results of the tests for the four days, together with the results for the entire test, are given in an accompanying table.

Results of Four Days' Duty Trial.

Duration, hrs.	Total coal, lbs.	Gals., millions.	Lift, ft.	Duty, million ft.-lbs.	Gals. per lb. coal.	Developed H. P.	Coal per H.-P.-hr., lbs.
10.	4,383	2.508	196.63	93.83	572.22	207.92	2.108
10.	3,570	2.498	196.4	114.63	699.87	206.69	1.727
10.	3,400	2.576	198.28	125.3	757.76	215.17	1.58
10.	3,490	2.545	198.31	120.45	729.40	212.32	1.644
40.	14,843	10.128	197.40	112.27	682.37	210.54	1.763

Results of Two Steam Tests.

	I.	II.
Duration, hours	9	9
Pressure at throttle, lbs.	145.11	144.58
Vacuum near l.-p. cyl., in.	25.72	25.72
Receiver press., lbs.	7.5	7.5
M. E. P. h.-p. cyl., lbs.	47.102	....
M. E. P. l.-p. cyl., lbs.	10.045	....
I. H. P. h.-p. cyl.	106.61	....
I. H. P. l.-p cyl.	110.45	....
Total H. P.	217.06	212.47
Friction power, per cent.	5.12	....
Total head, ft.	191.62	196.78
Moisture in steam, per cent.	2.5	2.5
Dry steam per H. P. per hr.	12.46	....
Duty per 1,000 lbs. steam; million ft.-lbs.	150.796	149.389

Although no allowance was made for ashes, they were weighed and found to be 8.65 per cent. of the total coal used. A record was kept of the coal used for the different purposes of starting, running and banking, which, though not strictly accurate, Mr. Coffin reported, is interesting as showing what proportion of the total was required for each purpose, and as showing the duty which was obtained under the conditions of an ordinary test, that is, while actually running. On the basis of the entire test of four days, 14.3 per cent. was used in starting, 82 per cent. for running, 3.7 per cent. for banking. If the average amount used for starting when the fire was banked were substituted in the first day, and the average amount for banking were added in the last day, the condition of every day's running would be approximated and the percentages would be as follows: Starting, 8.6 per cent.; running, 86.1 per cent.; banking, 5.3 per cent. That is, in a plant run 10 hours every day under the stated conditions the coal used for banking and firing would be about 15 per cent. of the total. For these figures, Mr. Coffin also calculated that a duty of 137,000,000 foot-pounds were obtained per 100 pounds of coal used in actual running time.

After the tests described were made, two other tests were made for the Barr Pumping Engine Company by Messrs. Dean & Main, in which the duty was based on the steam used in the engine instead of on the coal consumed under the boilers. In these tests, the results of which are also given herewith, an average duty of 150,092,000 foot-pounds for each 1,000 pounds of steam was obtained. Mr. Coffin concluded that if it is assumed that the engine was doing about the same duty in the test of the entire plant, based on coal consumption, as in that of the engine alone, based on steam consumption, the performance of the boiler can be obtained by a comparison of the results of the tests, using the duty based on the coal used in the actual running time, thus:

$$\frac{137{,}000{,}000 \div 100 \text{ (coal)}}{150{,}000{,}000 \div 1{,}000 \text{ (steam)}} = 9.13.$$

That is, 9.13 pounds of water evaporated for each pound of coal consumed under a pressure of 145 pounds with feed water at approximately 135 degrees, or an equivalent evaporation from and at 212 of 10.3 pounds.

A Concrete Retaining Wall 9 feet high and 2 feet wide at the base was built at Sea Girt, N. J., to retain a mass of sand at some rifle-range butts. The concrete was strong and hard but the dimensions of the wall were so slight that about 125 feet of it was pushed over, killing three men.

The Mechanical Plant in the Rogers Peet Building, New York.

Rogers, Peet & Company, a New York clothing firm, have recently moved one of their stores to a new building at the corner of Broadway and 13th Street, in which an interesting mechanical plant has been installed. The structure is eight stories high and of fire-proof construction. It is lighted by both arc and incandescent lamps, and is equipped with complete fire apparatus, including an automatic sprinkler system. A considerable amount of current is demanded throughout the building for lighting and power purposes, the latter for running motors for fans, a coal conveyor and the machines in a cutting department. Electricity is also used to heat a number of flat-irons in the pressing establishment on the basement floor. A pneumatic cast system, inter-room and general telephone services, heating and ventilating plants, and a hydraulic and electric elevator apparatus are part of the general outlay. In addition to the steam used in the heating and power apparatus there is a certain amount used in a cloth steaming outfit on the seventh floor, which is somewhat similar to a French mangle arrangement, and also in several cookers in a restaurant on the eighth floor, provided solely for the convenience of the employees of the building.

The building itself is of irregular shape, facing on Broadway for a distance of 63 feet and extends along 13th Street to Fourth Avenue, covering an approximate area of 20,000 square feet. It is of steel-skeleton construction and is fitted with the most modern improvements. The first floor is of course used as the main sales floor and is without any partitions. A small mezzanine story is located in the rear of this floor and is used by the wrappers. Two or three sales departments are contained on the floors above, which are arranged in much the same way. As mentioned, the steaming-room and space for the storage of cloths is on the seventh floor, while on the above floor there is a restaurant and a large cutting department. The mechanical plant, a sample department, and the pressing department equipped with about 35 electric irons, occupy the basement.

The steam plant includes three Babcock & Wilcox water-tube boilers, located on the north side of the basement. Two have a capacity of 200 horse-power and the other is of 150 horse-power; all three are fitted with McClave shaking grates. Coal for the furnaces is carried from a chute on the side street to a vault with a capacity of about 200 tons, by means of an electrically driven Robins belt conveyor. The motor for this is situated in a vent shaft near the bunkers for the purpose of keeping it away from the heat of the boiler room. In front of the boilers, a trolley is rigged with a bucket for conveying ashes to a pit. The boilers are built to stand a pressure of 200 pounds per square inch, and the working pressure which is being carried is 110 pounds. Over the front of the boilers, as shown in the accompanying illustration, is a main steam header and over the rear is an auxiliary header. A Potter mesh separator is inserted in each steam drum outlet.

Steam, generally taken from the main header supplied from 7-inch boiler outlets, is carried over into a 10-inch power main serving four generator sets in the engine room. They consist of three 120-volt multipolar compound-wound Western Electric dynamos of 75 kilowatts capacity and one 50-kilowatt unit of the same type, which are direct-coupled to 15x14-inch and 13x12-inch Payne single expansion horizontal high-speed engines, respectively. At a point in the power main a little in advance of where the first engine is taken off, there is inserted a Bundy steam separator which is trapped back to a drip tank. Steam is also supplied to two boiler feed pumps, each 7½x4½x10 inches in size, of the Worthington type, located as shown on the plan, which pump water of condensation from the heating system, first through a Ward filter for removing grease, and then through a 550-horse-power Berryman feed-water heater to the boilers. The pumps are operated in connection with a governor to insure automatic working, and are cross-connected to a house pump, so that the latter may be used as an auxiliary feed pump.

Among other steam apparatus is a 5¼x3½x5-inch duplex pump of the same make, which, also automatically governed, drains a blow-off tank 42 inches in diameter and 8 feet long, tested to withstand a pressure of 150 pounds per square inch. Within the tank is the usual cooling coil composed of 100 feet of 2-inch brass pipe, for cooling the waste water before its discharge into the sewer by means of an indraft of fresh feed water from the city mains. There is also an additional coil of 500 feet of the same size pipe to be cooled by the air, when necessary or desirable. Two other Worthington pumps are located in the farther end of the engine room. One is used as a house pump which is 12x6x10 inches in size and is connected to a tank 10x8x7 feet. The other is a 12x6x12-inch fire pump, with which the house pump is cross-connected.

The electrical equipment comprises the dynamos mentioned, a switchboard, motors for several fans, the wiring, etc. A two and three-wire system is provided and an Edison circuit is brought into the building. In the case of the three-wire lighting circuit the middle or neutral wire is, as usual, of the same current carrying capacity as that of the two outside wires. No more than eight incandescent lamps are placed on any branch circuit and only one arc light. The arc lamps used are of the Manhattan direct current 120-volt enclosed type. There are about 2,000 incandescent lamps throughout the building and approximately 450 arc lights. In the ironing room each iron is connected to a small panel board from which the current is governed, each iron taking about 7 amperes.

The main switchboard, which is situated at one side of the engine room, is 17 feet long by 11 feet high. It is composed of six panels of white Italian marble and stands clear of the wall by about 8 feet, the space between one end and the wall being barred by a heavy bronze wire netting, and the other by a door of similar material. The instruments carried on the board are as follows: Two voltmeters, four ammeters and three Thomson recording wattmeters, two of 600 amperes capacity and one of 400. There are 40 different switches for controlling various circuits, and four double-pole circuit-breakers of the same current capacity as the wattmeters, for the dynamos. Four pilot lamps are also contained on the board for the dynamos as well as for rheostats of the Ward-Leonard make. There are three general centers of distribution in the building, one for the central portion, one for the eastern section and another for the western. This arrangement necessitates three sets of switches on the switchboard, each set controlling the panel boxes on each floor. The Broadway floor is controlled independently. The panel boxes are fitted throughout the house with bases of white marble, on each of which space is left for two extra branch circuits. All generator feeders to switchboard have been run in loricated conduits laid under the floor in wooden trenches filled with tar. The maximum load, which has been carried on the lighting and power circuits since the plant has been in operation, is 1,800 amperes.

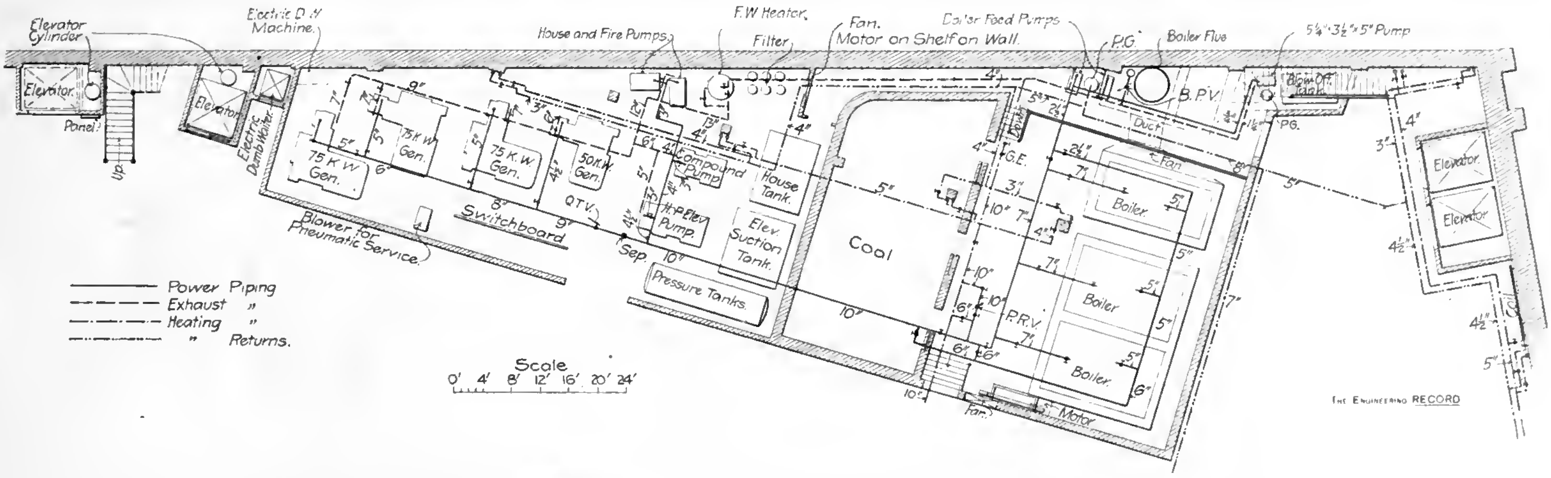
The ventilation of the structure is accomplished entirely by natural means, with the exception of the basement, boiler and engine rooms, where disk fans and duct work are installed. One ventilating duct, with a 40-inch Seymour disk fan within, is run from an inside partition wall of the boiler room to the base of a ventilating flue. Two other Seymour fans, each 60 inches in diameter, are also installed for the ventilation of both rooms. The fans are belted to Western Electric multipolar shunt motors of 5-horse-power each. The ventilation of a 40x50-foot steam room on the seventh floor is accomplished by means of two 30-inch disk fans, one placed in each window of the room.

Direct radiation is installed throughout the building with the exception of the main floor, where floor registers discharge warm air from twelve heating stacks. There is a single register to each stack, the latter being suspended from the ceiling of the basement. Exhaust steam from the engines and pumps is used in the heating system. A back-pressure valve allows exhaust steam to pass upward to the roof through a 10-inch pipe when the back-pressure becomes excessive. Live steam may be used for heating when necessary. From the basement system of heating mains there are taken off nineteen steam and return lines from 2 to 4 inches in size. Returns have been made in general one size smaller than the corresponding supply risers. A ½-inch air line is run in connection with each pair of vertical lines and all lead into a 1-inch main air line in the basement draining into a slop sink. The total amount of radiation is about 21,000 square feet. On the top floor steam coils have been suspended from the ceiling, giving more floor space and counter-balancing the skylight surface.

The elevator equipment, comprising a 14x20x10x12-inch Epping-Carpenter compound pump, an 18x10x12-inch high-pressure pump of the same type, tanks, etc., is installed near the engines. There are six passenger hydraulic elevators and one electric elevator for the transference of material. The suction tank for the elevators, 10x10 feet in plan and 7 feet in depth, is of about 15,000 gallons capacity, and is located in close proximity to a 10,000-gallon pressure tank, supported on pedestals. The hydraulic elevators have a carrying capacity of about two tons and are designed to travel at the speed of 400 feet per minute.

The sprinkler fire system installed is extensive. Two pressure tanks are located in an enclosure on the roof. Each is 35 feet long and 7 feet in diameter, being generally filled to about three-quarters of its capacity. The water is kept under a constant pressure of 75 pounds per square inch, which is maintained by a small vertical duplex air compressor on one of the walls of the engine room. The same pressure exists in the piping for this system, which has been fitted with Grinnell automatic sprinklers. Electric gauges connected to the pressure tanks register the pressure present in them, making and breaking a circuit controlling the compressor in the basement, and operating upon a fluctuation of two pounds above or below the required pressure. The tanks are connected to a 10-inch standpipe dropping to the basement which has two branches, one for the eastern side of the building and one for the western. A city fire alarm box is installed in the building and there is also a house system. A roof gravity tank may be used in place of the fire pressure tanks in case of an emergency, the water being kept from freezing by a coil of steam piping within. The tanks have intermediate connections which are provided with check valves as usual.

While there is no water-cooling machinery installed in the building, ice boxes made by the Lorillard Refrigerator Company, of New York, are provided, two to each floor. The cutting department is located on the top floor and the cutting machines are run from small Lundell electric motors supplying power through flexible shafting to the cutting wheel of each. On the floor below, four cloth steaming machines made by the Hebdon Machine & Finishing Company, of New York, the steel cylinders of which are 8 feet long and 18 inches in diameter, take high pressure steam. A cash system has been installed by the Lamson Consolidated Store Service Company, of Lowell, Mass., and a blower made by the Connersville Blower Company, of Connersville, Ind., is located near one end of the switchboard for maintaining an air pressure throughout the system of tubing. There are thirty interior telephones in the building,



THE ARRANGEMENT OF THE MECHANICAL PLANT IN THE BASEMENT OF THE ROOERS-PEET BUILDING.

which were installed by Stanley & Patterson, of New York.

The architects for the building, which is owned by Mr. W. W. Astor, were Messrs. Clinton & Russell, of New York, and the plant was designed by Col. J. Hollis Wells, their engineer. The general contractor was Mr. John Downey. The contractors for the heating and mehcanical equipment were Baker, Smith & Company, of New York, and the electrical installation was furnished by the Western Electric Company, of New York.

The Grand Avenue Bascule Bridge, Milwaukee.

The Grand Avenue highway bridge at Milwaukee carries a large traffic at a low level across the Milwaukee River, on which navigation must be maintained for tugs and vessels. The banks of the river are curved at this point and are about 200 feet apart between the docks which line them. The bridge connects Grand Avenue on one side of the river with Wisconsin Avenue on the opposite side; these streets make small angles with the river and with each other and their center lines are more than 50 feet apart in the center of the river so that the structure is skewed in every direction. The old bridge was a swing span 180 feet long from out to out, as indicated by dotted lines in the general plan. It was supported on a center pier about 40 feet wide and 220 feet long in the direction of the river; this left a minimum space of less than 60 feet between each abutment and the center pier and compelled all boats to pass through a long and crooked channel. For the new bridge it was determined to provide a wider, shorter, straight channel and dispense with the center pier, and this was done by the adoption of a bascule with two leaves mounted on trunnions and operated by rack and pinion gears.

The new structure has a total width of 64 feet and a length of 180 feet, and consists of two stationary and two movable parts. The movable parts are about 69 feet long over all and revolve on horizontal axes about 21 feet from the shore ends. They have floor platforms about 60 feet long, meeting in the center line of the bridge and carry a 36-foot roadway and two sidewalks about 12 feet wide in the clear. When open the bridge affords a clear center channel opening which for 65 feet opposite the abutments, has a minimum width of 95 feet in the line of the axis, 70 feet in the direction of the river, these widths being rapidly increased both sides of the abutments.

The fixed approach spans from the old abutments to the new piers have two lines of deck lattice girders and the channel spans have two lines of half through revolving cantilever plate girders. There are four 16x32-foot piers, each of which supports one approach girder and one cantilever girder, or one-fourth of all the superstructure which is not carried by the abutments. Heavy vertical steel columns are built into the piers and extend above their tops to carry the pivots which support the cantilever girders and around which the shore ends revolve into slots in the masonry when the bridge is open. The bridge requires no clearance for operation beyond either side or either end, all the operating machinery is located under the bridge floor and when the bridge is open no part of it projects above the clear channel space between fenders.

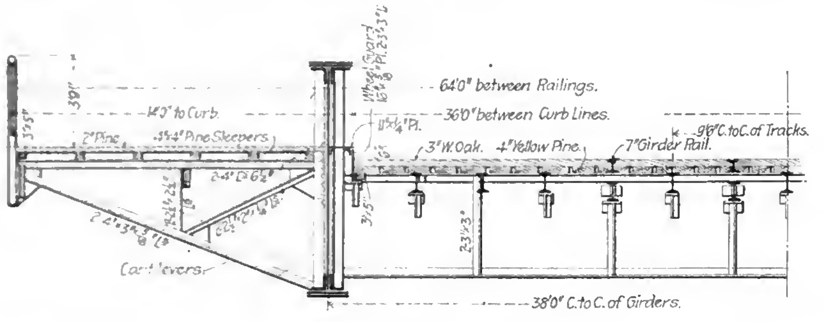
The four piers are symmetrically arranged about the center lines of the bridge and are duplicates, except that two of them have one corner beveled for clearance to navigation. The rectangular piers are supported on 106 and the other piers on 102 piles each, and are built of concrete laid inside a sheet pile permanent cofferdam. Under the pivots the piles are driven in staggered rows 21 inches apart, elsewhere they are 3 feet apart on centers. They are not less than 45 feet long, 9 inches in diameter at the tip and 14 inches at the butt. The outer rows were cut off at about high-water mark and supported a 12x12-inch guide frame in which Wakefield sheet piles, 9 inches thick and 30 feet long were driven to form a cofferdam with the upper edges braced by 8x12-inch white oak horizontal waling pieces and tie rods. The cofferdams were braced inside, pumped out and the piles cut off 20 feet below water level. The earth was excavated 2 feet below the pile tops and 1:3:5 Portland cement concrete made with 2-inch broken stone was rammed in to a general level of 1½ feet below water line, wells being left in all the piers for the tail ends of the girders.

The front fenders each have two rows of white oak piles about 2 feet apart with the piles 30 inches apart in the rows. They are cut off 7 feet above water level and are faced on the insides to receive, above water line, two lines of 12x12-inch white oak waling pieces bolted between them, 4 feet apart on centers, with a 1¼-inch bolt through each transverse pair of piles. Between the piles in the front row 12x12-inch blocks are bolted to the waling piece to make a continuous outside vertical surface to which a 6x½-inch iron band is attached with countersunk bolts, from end to end of the fender. The ends of the fenders terminate with groups of ten white oak piles fastened together with three turns of a 1-inch chain.

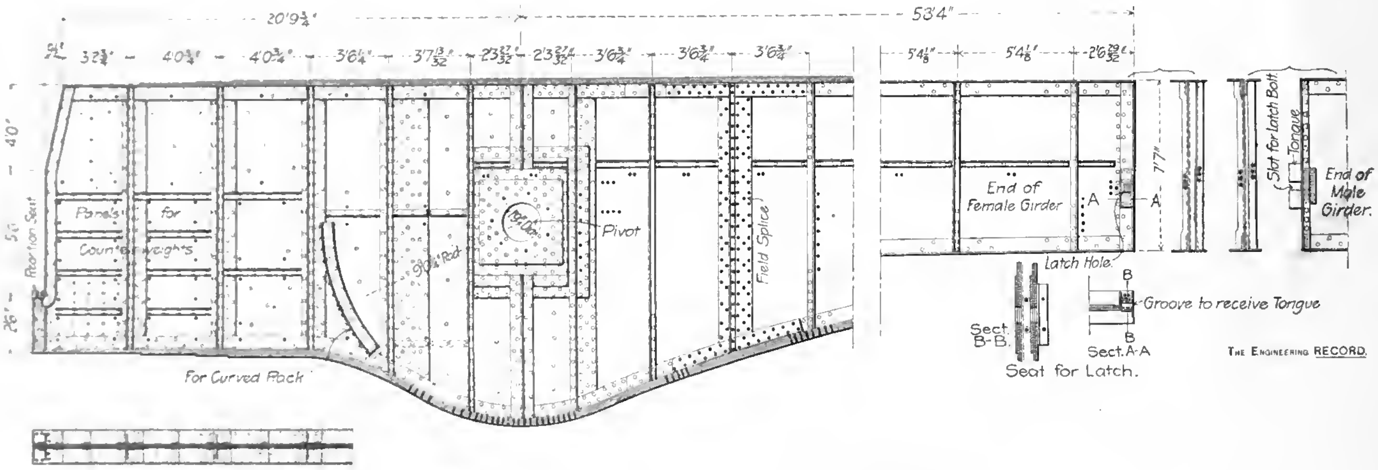
In each pier the concrete was reinforced by eight horizontal lines of 2½x2½x¼-inch angles bedded in it about 2 feet apart vertically, each being bent to a U-shape and extending continuously around the river end and two sides of the pier. There is also a line of 1-inch horizontal anchor bolts from 3 to 5 feet apart which are screwed up on the waling piece at the top of the cofferdam, extend 6 feet into the concrete and are turned down at right angles at the inner ends.

About 4 feet above the pile tops five 12-inch transverse I-beams are bedded in the concrete and extend across the pier to form a footing for the pivot columns. The pivot columns are 24 feet long and are made with four 12-inch channels and two 45-inch flange cover plates. They are seated with extended base plates on the top flanges of the grillage beams, and have the lower ends of each pair connected by a horizontal oak beam in the bottom of the girder well. At the shore end of each pier there are two 24-foot anchor posts, each consisting of a 15-inch channel slightly inclined from the vertical and having riveted across the lower end of the web a transverse piece which takes bearing on a distributing girder under a grillage of 12-inch I-beams bedded in the concrete in a plane at right angles to the anchor post and about 2 feet from the pile tops on the center line of the anchor post.

The superstructure consists of the two bascule leaves and their two approach deck spans. Each bascule leaf consists essentially of a platform about 64 feet wide and 61 feet long which is pivoted on a horizontal transverse axis very near the shore end. It has two main double-cantilever girders 38 feet apart on centers, which project beyond the platform at the shore end to carry the counterweights. The girders are 79 feet 1¾ inches long and 15¹/₈ feet in maximum depth, with horizontal top flanges



Half Cross-Section of Swinging Span.



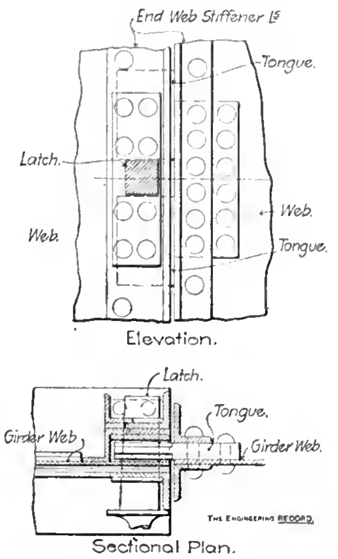
General Features of one of the Bascule Girders.

and curved bottom flanges. They are pivoted on pins 21 inches in diameter that pierce their solid webs 58 feet 4 inches from the extremity of the long arms and about 6 feet below the top flanges. The long arms of opposite girders in the same longitudinal plane meet and when the bridge is closed are locked together over the center of the channel. The short arms revolve downwards into the pier-pits when the bascules are open and when it is closed react against offset seats on the upper sides of the short arms.

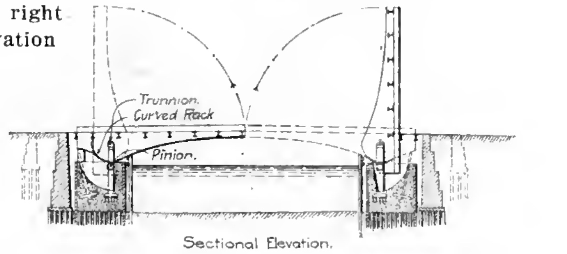
The two main girders in each bascule are connected by floorbeams 8½ feet apart, and by X-brace lateral struts 50-inches deep which have top and bottom flanges made with single 5x3-inch angles latticed together with 2x2½-inch web angles. The top and bottom angles of the struts engage the top and bottom flanges of the floorbeams and virtually form top and bottom lateral systems under the roadway. Cantilever brackets about 13 feet long are riveted to the outsides of the girders to carry the sidewalks and are connected by a system of 4x4-inch zigzag angles in the planes of their top flanges. The roadway stringers are 9-inch longitudinal I-beams about 3 feet apart. The sidewalk joists are 4-inch transverse channels 2½ feet apart. The roadway floor has a lower course of 4x8-inch diagonal yellow pine planks, secured to each stringer with hook spikes, and bottom plates, pockets to receive the cast-iron counterweight sections. These are made in various sizes, all about 20 inches thick, 1½ to 4 feet wide and from 2 to 6 feet high, fitted between the vertical and horizontal web stiffening angles and secured by horizontal bolts through the girder web.

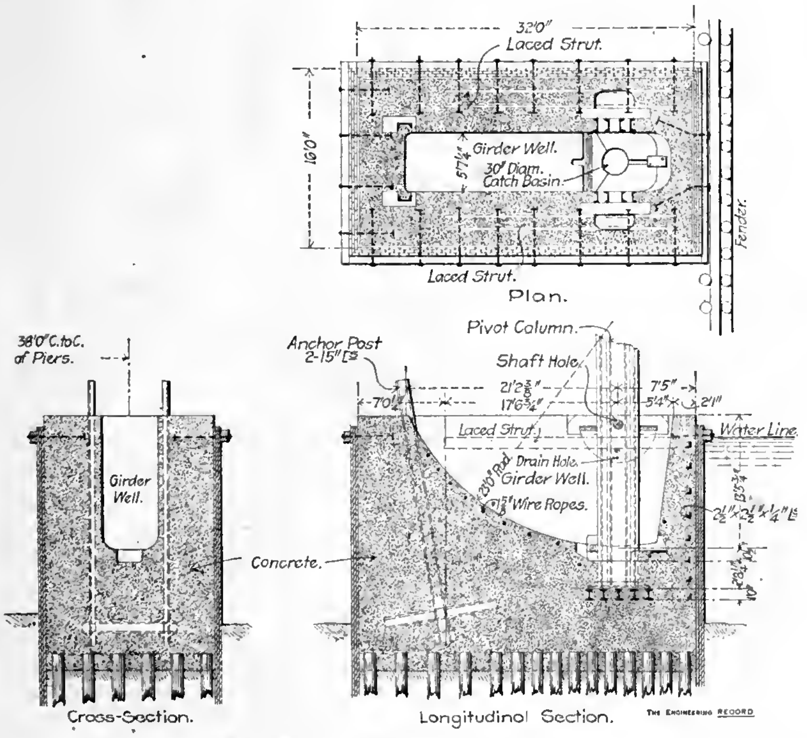
Between the piers at each end of the bridge there is a 50-horse-power electric motor with a transverse horizontal driving shaft which has at each end a pinion engaging a gear wheel keyed to the inside end of a short parallel shaft that passes through the lower part of the pivot column and has a pinion keyed to its outside end engaging the segmental rack on the main bascule girder. By this direct mechanism the bascules can be opened or closed separately or simultaneously in 45 seconds. A two-man hand gear is also provided to operate the driving pinion and swing the leaves if necessary. When closed the bascule leaves are locked together by bolts engaging the adjacent ends of the long arms at mid-span. The bolts do not transmit any stress and the bascules act under both dead and live loads as independent cantilevers, anchored at the shore ends.

The bascule girders are made right and left and the extremities of their long arms are made male and female with reference to the connection details. The female end of the right hand girder is shown in the general elevation ing slightly to the points. The shoulder is attached to the end of a horizontal square guide bar sliding in slots through the stringer webs. It is riveted between top and bottom plates which connect it to the operating bar parallel to it and 6 inches away. One end of it is pin-

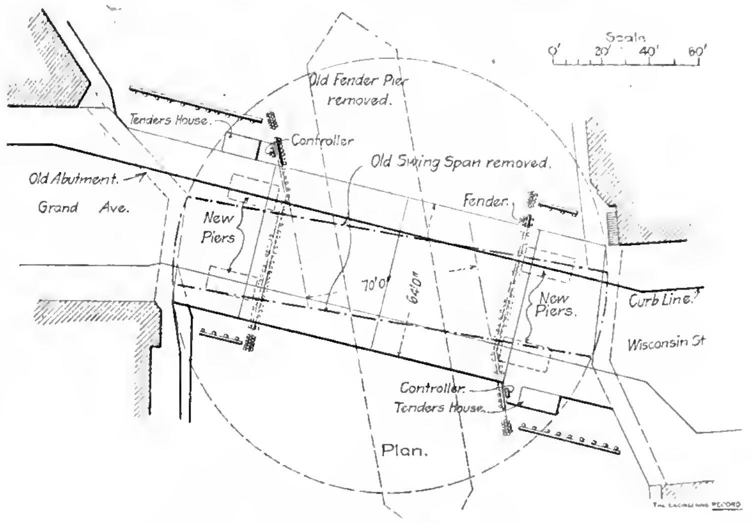


BASCULE LOCK.





PIER SUPPORTING BASCULE GIRDER.



LOCATION OF OLD AND NEW BRIDGES.

an upper course of 3x8-inch transverse white oak planks. The sidewalks are of 2x6-inch transverse white pine planks.

The main girders are made with ⅜-inch web plates, and 8x8-inch flange angles, 18-inch flange cover plates and 3x3-inch vertical web stiffener angles. At the pivot the web is reinforced to a thickness of about 5½ inches for the bearings, and the lower flange is curved around it to a radius of about 9 feet. On this segment and on a continuation of it formed by an angle bent to the same radius and riveted to the side of the web plate, there is bolted a rack by which the girder is revolved with a pinion. At the shore end of the girder, beyond the pivot, 20-inch horizontal plates about 14 feet long are riveted to the upper sides of the bottom flange angles and project beyond them to form a support or case for the counterweight castings. The plate is stiffened by transverse diaphragms or gusset plates riveted across them and to the vertical web stiffeners so as to form, with the and has double end vertical web stiffener angles spaced 2¼ inches apart in the clear as shown in the cross section at A A. The offset vertical web stiffener angle is reinforced with angles and plates so as to form a rigid side for a vertical slot in the end of the girder. The end of the adjacent male girder is similar with lighter end vertical angles between which is riveted a tongue casting with a front projection which, when both bascules are closed engages the slot in the female girder. It has a horizontal slot across the middle which corresponds with a square horizontal hole through the web and end angles of the female girder. A square horizontal bar can be passed through the hole in the female girder and the slot in the tongue of the male girder and lock both girders together as indicated in the sketch of the assembled latch. The bearings for the tongue and latch are fitted with a slight clearance and are ground smooth. Each of the two latch bolts is about 8 inches long and 4 inches square at the shoulder, taper- connected to toggle bars in a horizontal plane which are operated by the short arm of a lever, the long arm of which is moved back and forth by a longitudinal horizontal gas pipe worked by a lever in the operating house. There is also a simple heel latch at the shore end of each leaf. It is merely a wooden strut hinged at the bottom and arranged to have its top jammed tight against bottom chord of the girder when closed. Each leaf has also at the heel two rods running up to dashpots on the adjoining fixed approach span.

From the abutments to the pivots the floor platform is carried over the piers and the river on deck girders. Those which connect the anchor and pivot columns are lattice girders with special ends, having the upper sides of the river ends notched for clearance with the bascules. The I-beam stringers support a roadway floor of 5/16-inch buckle plates convex side up which are covered by asphalt pavement on a concrete base. The stationary sidewalks have

5/16-inch buckle plates, concave side up, covered with 2 inches of 1:2:5 Portland cement concrete finished with 1 inch of 1:1 Portland cement and fine crushed granite. The sidewalks have steel curbs and substantial hand rails 3 feet 9 inches high which weigh 30 pounds per lineal foot. At each end of the bridge there is, on an extension of the stationary sidewalk, on opposite sides of the street, an 8x15-foot wooden operating house.

The bridge is figured for live loads produced by uniform loading and by two electric cars, one on each pair of 7-inch girder rails, and moving in opposite directions. Each typical car is 43 feet long and 8½ feet wide, weighs 55,000 pounds, and is carried on two trucks 17¾ feet apart with 6-foot wheel bases. The roadway outside the tracks and the sidewalks is assumed to be loaded to 100 pounds per square foot. Wind pressure is assumed to be a moving load of 400 pounds per lineal foot applied at floor level. A wind pressure of 25 pounds of exposed surface is assumed when the bridge is opened and the machinery is proportioned to operate it in any position under such pressure. The counterweights are calculated to be proportioned and arranged to balance exactly the revolving leaves in any position and enable them to remain stationary without the use of the brakes.

All principal members are made of medium steel with a tensile strength of 60,000 to 68,000 pounds per square inch. The allowed stresses in pounds per square inch are: For tension, lateral and sway bracing, 18,000; I-beams, 13,000; girder flanges, 13,000. Shop rivets are proportioned for 15,000 pounds bearing and 7,500 pounds shearing stresses and field rivets for 12,000 and 6,000 pounds respectively. The bed plates are laid in Portland cement and are proportioned for a pressure of 35,000 pounds per square foot on the masonry.

The bridge was designed and constructed under the general direction of the Commissioners of Public Works of Milwaukee, by the Wisconsin Bridge & Iron Company of that city. Mr. Charles J. Poetsch, city engineer, and Mr. B. W. Perrigo were in general charge for the city.

Letters to the Editor.

The American Water-Works Association.

Sir:—Your account of the meeting of the American Water-Works Association was most gratifying. There are other members of the organization as well as myself who have no sympathy with much of the criticism passed upon it of late, yet are perfectly willing to acknowledge that in many respects the opportunities for its improvement are great. Inasmuch as you have treated the Association so fairly in your comments and have reported as successful a gathering that really was so, possibly you will allow me the privilege of making a few comments on its purposes, comments based on a knowledge of its history perhaps not possessed by some of its critics.

In the first place it must be distinctly understood that the American Water-Works Association is only indirectly an engineering organization. While most of its members are interested in the results of engineering practice, whenever they have important works to construct they retain the services of a professional expert. The members are mostly operating officials and the Association is intended to be for them what the American Street Railway Association is to the street railway superintendents. Purely engineering subjects, with but few exceptions, are better presented to the national engineering societies, where the technical details are understood by a larger proportion of the members. This is in no sense any criticism of the Water-Works Association; it is merely the statement of a fact, which has been so often overlooked that I am sometimes led to wonder what good the Association would be to most of its members were the suggestions of its critics carried out. The fact that papers on engineering subjects are rarely read at the conventions is more to be commended than deplored, and the absence of such papers, which some critics consider a sign of the Association's lack of utility, is an indication that it is confining its attention to its proper field.

The true criticisms of the Association are rarely made in print but it is time they were given general attention. The administrative problems of the superintendent of a water plant are fully as important as those of the electric light or the street railway manager, yet the great fault of the Association is its neglect of them. These problems will be much simplified by a free discussion of them, and the only way in which such a discussion can be held is to secure from each member a full statement of any difficulty that may arise in his work, for submission to the Association directly or through a committee. If an earnest endeavor is made to secure from all members such items of interest as occur to them in the next six or eight months, and these items are turned over to the publication committee for its consideration, the latter body can doubtless arrange for a series of papers and discussions at Detroit next summer which will surpass in interest and value anything accomplished in the past. To do this it is necessary to have the members frequently reminded of their duty to the Association, but with the present officials it goes without saying that any plan for the welfare of the organization that meets their approval will be pushed with the same energy that has won for them their position in the water-works fraternity. A Member.

New York, July 3.

Tunneling for Water at Los Angeles.

Sir:—A tunnel now in process of construction here is designed to cross the mouth of the San Fernando valley for the purpose of obtaining whatever waters may be passing through that neck by sub-flow in the gravel and sand detritus, which borings across the valley have demonstrated to have an average depth of 60 feet and a greatest depth of 95 feet. The watershed of the San Fernando valley and the mountain slopes tributary thereto have a combined area of about 480 square miles. In the present year the surface yield is 55½ cubic feet per second. This water is all diverted from the stream, which is known as the Los Angeles River, above the neck across which this tunnel is being driven, by various ditches, the main one of which supplies the domestic consumption of the city of Los Angeles.

The rock system at the neck consists of stratified argillaceous sandstone and shales which are soft enough to be easily tunneled and yet firm enough generally speaking to stand up without timbering. The detritus lying in the neck of the valley and from which we expect to develop the water is derived from crystalline rocks, mainly granitic, and yields water of very superior quality.

A shaft 12 feet in diameter has been sunk in the rock at one side of the valley to a depth sufficient to head a tunnel in the bed rock beneath the water-bearing gravels and sand in the valley. It is the purpose to perforate the casing of the wells which were originally driven to and below the bed rock to determine primarily the depth to bed rock, and permit the water to be drained into the tunnel, from which it can be pumped to a reservoir closely adjacent to the mouth of the shaft and distributed in the domestic mains of the water supply system.

The progress so far has been at the rate of about 6 feet in 24 hours in the tunnel which has now reached a distance of nearly 300 feet. No trouble so far has been experienced.

Yours truly, Wm. Mulholland,
Supt. Water Works.

Los Angeles, June 28.

A Boat's Motion in a Restricted Waterway.

Sir:—I regret to find on reading your observations on my letter published in the last (June 28) issue of The Record, that I failed to remove your misconception of the theory and the analysis based by Haak on his experiments on the Dortmund-Ems Canal. His hypothesis, as I have repeatedly stated, is not that the work represented by the negative velocity produced by a vessel moving in a narrow channel equals the entire resistance to the boat's motion, but that this negative velocity is a function of the whole resistance. He was aware that the energy represented by this velocity was but a fraction of the boat's resistance, and therefore sought an expression which should include all the complex elements of frictional resistance.

Such an expression necessarily includes the length of the boat as a factor, and required the elaborate system of measurements employed by him to record the position of the water surface the whole length of the boat, enabling him to determine the mean velocity and the weight of the mass of water, in which all the elements of resistance act, to which he applied the coefficient of all the resistances in his expression for the work.

Had he adopted the hypothesis you attribute to him, he would simply need to have measured the maximum depression of the water surface, instead of the mean depression the whole length of the boat, and the wet section of the boat in the vertical plane of this maximum depression instead of its mean wet section, thus determining the maximum negative velocity which is the only experimental element required by this hypothesis to determine the resistance of the boat.

If the notation of my paper be employed premising that ΔQ represents the maximum instead of the mean depression of the water surface and that q represents the wet section of the boat at the section of maximum depression instead of its mean section, the boat's resistance would be represented by the equation: $R = w\,(Q - \Delta Q - q)\,v^2 \div 2g$, affected only by the constant coefficient $1/2g$. That this is not an approximately true expression for canal resistance all experiments directed to its determination clearly demonstrate.

Truly yours, E. Sweet.

Albany, July 4.

[The Engineering Record regrets that Mr. Sweet cannot accept its analysis, which is based on the premises set forth by Haack and is the logical outcome of those premises. The formula for the resistance R, as given in its analysis, is correct as to form, but, as was stated, it needs the variable coefficient C to be determined by experiment.]

The Patrol System of Street Cleaning in use in Somerville, Mass., is briefly described in the 1901 report of Street Commissioner J. P. Prichard. The city is divided into districts, to each of which is assigned a man supplied with a hand cart and the necessary implements for removing waste paper and other rubbish, loose stones, etc. He is also required to fill depressions in the streets, replace loose bricks in sidewalks, and cut grass on borders of the walks.

Personal and Obituary Notes.

Mr. Robert Gray and Mr. Frank Collman have been elected city engineer and street and water commissioner, respectively, of Bristol, Va.

Mr. J. Hampden Dougherty has resigned as commissioner of water supply, gas and electricity of New York City, and Col. Robert Grier Monroe has succeeded him.

Mr. John Hays Hammond has accepted a professorship in the Sheffield Scientific School, of Yale University, to direct the practical part of the course in mining engineering.

Col. P. C. Hains, Lieut.-Col. Charles J. Allen and Maj. James B. Quinn, Corps of Engineers, U. S. A., have been appointed to superintend the improvement of the Norfolk, Va., harbor.

Capt. John S. Sewell, Corps of Engineers, U. S. A., has been appointed superintendent of the construction of the Army War College and auxiliary buildings at Washington Barracks.

James Stewart, head of the prominent contracting firm of James Stewart & Company, died July 5 in Pittsburg, in his eighty-first year, from the effects of an attack of pleurisy.

Mr. Burton J. Ashley, chief engineer in the founding of Zion City, Ill., a place of about 5,000 inhabitants, has moved his office from Chicago to the Administration Building of that city.

Col. H. M. Adams, Maj. George Derby and Capt. W. V. Judson, Corps of Engineers, U. S. A., have been appointed to prepare plans for the protection of the port of Galveston, Tex.

Harvey Farrington, Assoc. M. Am. Soc. C. E., has opened an office at 115 Broadway, New York City, for the general practice of engineering, making a specialty of water-front improvements, docks, foundations, masonry, etc.

Mr. J. W. Peterson, who was formerly connected with the Chicago sales department of the Stanley Electric Manufacturing Co., and the Northern Electrical Manufacturing Co., has been elected vice-president and general manager of the Electrical Equipment Co., 939 Monadnock Block, Chicago.

Mr. George T. Prince, M. Am. Soc. C. E., has been appointed first assistant engineer of the Bureau of Water Filtration, Philadelphia. He has been connected with the water-works of Boston, Oswego, Towanda, St. Paul, Atlantic City and Omaha, as well as engaged in railway and sewerage works, and some valves designed by him while engineer of the Omaha works were illustrated in this journal a few years ago.

William Fraser Garrison, of Guild & Garrison, pump manufacturers of Brooklyn, N. Y., died July 8, at his country home in Morristown, N. J., after a four months' illness. He was born about 69 years ago in Brooklyn, where he has since resided. He began his career as an apprentice and became successively journeyman, inventor and employer. At the time of his death he was a prominent factor in local industries.

The Engineering Department of the New York Central & Hudson River Railroad has appointed a number of inspectors to secure the observance of standard plans and specifications on work in progress and to assist in general supervision. Mr. W. A. Pettis has been appointed general inspector of buildings; Mr. J. H. Watson, general inspector of bridges; Mr. H. Latimer, general inspector of masonry work; Mr. A. M. Clough, general inspector of track; and Mr. C. A. Miller, general inspector of mechanical and electrical work.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

SUNDRY CIVIL APPROPRIATIONS.

Public Document No. 182, as passed by Congress, provides for the following additional appropriations for public buildings, etc.:

Alabama.—Montgomery, P. O. and Ct. H., $25,000.

Arkansas.—Fort Smith, P. O. and C. H., $25,000.

California.—Fresno, P. O. and C. H., $25,000; Los Angeles, Ct. H. and P. O., $200,000; San Francisco, C. H., $25,000.

Colorado.—Colorado Springs, P. O., $30,000.

Connecticut.—Hartford, P. O., Ct. H. and C. H., $50,000; Meriden, P. O., $45,000; Waterbury, P. O., $45,000.

District of Columbia.—National Bureau Standard Laboratory, $75,000; Treas., Butler & Winder Bldgs., $35,100; Bureau Eng. & Print., add. vaults, $50,000; heat. app., Pub. Bldgs., $150,000; vaults, safes and locks for Pub. Bldgs., $30,000; Municipal Bldg., $600,000.

Florida.—Pensacola, Quarantine Station, $30,000.

Georgia.—Atlanta, P. O. and C. H. and Ct. H., $170,000; Brunswick, C. H. and P. O., $50,000; Brunswick, P. O. and C. H. add., $30,000; Savannah, Marine Hospital, $50,000.

Idaho.—Boise, Pub. Bldg., $50,000.

Illinois.—Chicago, P. O. and C. H., $1,000,000; Joliet, P. O., $30,000; Springfield, P. O. & Ct. H., $25,000.

Indiana.—Indianapolis, P. O., Ct. H. and C. H., $100,000; Hammond, P. O. and Ct. H., $30,000.

Iowa.—Burlington, P. O., $25,000; Creston, P. O., $50,000; Des Moines, P. O., Ct. H. and C. H., $150,000; Waterloo, P. O. and Ct. H., $35,000.

Kentucky.—Paducah, P. O., Ct. H. and C. H., $25,000

Louisiana.—New Orleans, P. O., $200,000.

Maine.—Augusta, P. O., Ct. H. and C. H., $25,000.

Maryland.—Baltimore, C. H., $150,000; Cumberland, Ct. H. and P. O., $25,000.

Massachusetts.—Fitchburg, P. O., $25,000; Holyoke, P. O., $40,000.

Minnesota.—Fergus Falls, C. H. and P. O., $25,000; Minneapolis, P. O., Ct. H. and C. H., $25,000; St. Paul, C. H., $50,000.

Montana.—Helena, Pub. Bldg., $50,000.

Mississippi.—Biloxi, P. O. and C. H. and Ct. H., $25,000.

Missouri.—Joplin, P. O., $25,000; St. Louis, P. O., $210,000.

Nebraska.—Lincoln, P. O., Ct. H. and C. H., $25,000; Omaha, Ct. H., C. H. and P. O., $25,000.

New Hampshire.—Nashua, P. O., $25,000.

New Jersey.—Atlantic City, P. O., $30,000; Elizabeth, P. O., $60,000.

New York.—Buffalo, Marine Hospital, $60,000; Buffalo, P. O., C. H. and Ct. H., $35,000; Elmira, P. O. and C. H., $107,000; Jamestown, P. O., $40,000; Lockport, P. O., $25,000; New York, P. O., $25,000; New York, Marine Hospital, $250,000; New York, C. H., $150,000; New York, Ct. H. and P. O., $35,000; Niagara Falls, P. O., $25,000.

North Carolina.—Elizabeth City, C. H. and P. O., $50,000.

North Dakota.—Grand Forks, P. O. and Ct. H., $25,000.

Ohio.—Cleveland, P. O. and C. H. and Ct. H., $150,000; Toledo, P. O., $82,000; Zanesville, P. O., $25,000.

Oregon.—Portland, P. O. and C. H., $25,000.

Pennsylvania.—McKeesport, P. O., $25,000; New Castle, P. O., $25,000; Philadelphia, Mint, $25,000; Pittsburg, Marine Hospital, $60,000.

Rhode Island.—Providence, P. O., Ct. H. and C. H., $25,000.

So. Dakota.—Aberdeen, P. O., $56,500; Deadwood, P. O. and Ct. H., $30,000.

Tennessee.—Memphis, P. O., Ct. H. and C. H., $25,000; Nashville, P. O., Ct. H. and C. H., $25,000.

Texas.—Abilene, P. O. and C. H., $25,000; Dallas, P. O. and Ct. H., $25,000; Laredo, P. O., Ct. H. and C. H., $35,000; Sherman, P. O. and Ct. H., $30,000; Waco, P. O. and C. H., $25,000.

Utah.—Salt Lake City, Ct. H. and P. O., $50,000.

Vermont.—Burlington, P. O. and C. H., $25,000; Newport, Ct. H., P. O. and C. H., $50,000.

Virginia.—Newport News, P. O. and C. H., $50,000.

Washington.—Tacoma, P. O., Ct. H. and C. H., $100,000; Seattle, Ct. H., C. H. and P. O., $250,000; Spokane, P. O., Ct. H. and C. H., $100,000.

West Virginia.—Huntington, P. O. and Ct. H., $25,000; Wheeling, P. O., Ct. H. and C. H., $125,000.

Wisconsin.—Green Bay, P. O., $25,000; Janesville, P. O., $25,000; Superior, P. O., Ct. H. and C. H., $35,000.

Wyoming.—Cheyenne, Pub. Bldg., $74,983; Evanston, P. O. and C. H., $25,000; Laramie, P. O., $25,000.

Alaska.—Sitka, repairs, etc., Pub. Bldgs. and Wharf, $400,000; Light House and Fog Signal Stations in Alaskan waters, $126,013.

River and Harbor Work.

California.—San Pedro harbor, breakwater, $311,085.

Connecticut.—New Haven harbor, $67,000.

Dist. of Columbia.—Improv. Gray's Harbor, $156,775.

Florida.—Improv. Tampa Bay (from Gulf of Mexico to Port Tampa), $86,675.

Georgia.—Improv. Cumberland Sound (Ga. and Fla.), $400,000; improving Ocmulgee River, $56,000; improving Savannah River (between Augusta and Savannah), $86,000.

Illinois.—Calumet Harbor, $215,000; Ill. & Miss. Canal, $733,220.

Kentucky.—Improv. Kentucky River, $200,000.

Massachusetts.—Improv. Boston Harbor, $175,000.

Michigan.—Improv. Detroit River, $136,500; Hay Lake Channel, St. Mary's River, $144,115.

Minnesota.—Improv. harbor at Duluth (Minn. and Superior, Wis.), $459,727.

Mississippi.—Gulfport Harbor, $150,000; Mississippi River (from mouth of Ohio to Minneapolis, Minn.), $250,000.

New York.—Improv. harbor at Buffalo, $200,000; Gowanus Bay Channels, $100,000; N. Y. Harbor (Ambrose Channel), $150,000.

Ohio.—Improv. Ashtabula Harbor, $200,000; improving Cleveland Harbor, $107,000; Black River, $300,000; Toledo Harbor, $223,000.

Pennsylvania.—Locks and dams in Allegheny River (Herr Island), $118,500; Ohio River (below Pittsburg), dams Nos. 13 & 18, $46,600.

Rhode Island.—Improv. Providence River and Narragansett Bay, $84,560.

South Carolina.—Charleston Harbor, $50,000; Improving Congaree River, $50,000; Improving Winyaw Bay, $35,000.

Washington.—Everett Harbor, $117,000.

West Virginia.—Improv. Monongahela River (const. locks and dams), $350,000.

National Homes for Disabled Volunteer Soldiers.

Central Branch, Dayton, O.—Total appropriation $579,500, of which amount $56,500 is for repairs of roads and permanent improvement, and $6,000 for improving water supply.

North Western Branch, Milwaukee, Wis.—Total appropriation $316,625, of which amount $15,700 is for extension of electric light plant and $29,725 for repairs.

Eastern Branch at Togus, Me.—Total appropriation $335,275, of which amount $30,000 is for new barrack.

Southern Branch at Hampton, Va—Total appropriation $389,100, of which amount $28,050 is for repairs and $8,000 for water tube boilers.

Western Branch at Leavenworth, Kan.—Total appropriation $431,625, of which amount $11,500 is for extension of electric light plant, and $7,500 for extension of boiler house, and $6,500 for additional boilers, and $40,000 for one combination barrack, and $17,500 for headquarters bldg.

Pacific Branch at Santa Monica, Cal.—Total appropriation $324,150.

Marion Branch at Marion, Ind.—Total appropriation $347,150, of which amount $100,000 is for heating plant and $16,000 for combination barrack.

Danville Branch, Danville, Ill.—Total appropriation $306,700.

Mountain Branch at Johnson City, Tenn.—Total appropriation $3,723,969.

Miscellaneous.

Arkansas.—Hot Springs Reservation, protection and improv., $48,562.

California.—San Francisco Bay, Mile Rocks Light and Fog Signal Station, $100,000.

District of Columbia.—Bldg. to accommodate offices of President in grounds of Executive Mansion, including heating apparatus and light fixtures, $65,196; Government Hospital for Insane, general repairs and improvements $25,000, Administration Bldg. $145,000 central heating and lighting plant for entire Hospital, $260,000 (including $10,000 for sewers); Grant Memorial, $50,000; Nat. Zoological Park, improvement, $90,000; improving Potomac Park, $70,000.

Florida.—Hillsboro Inlet Light Station, $45,000.

Georgia.—Atlanta, for construction, residence of warden and deputy warden, and various other bldgs., $100,000; Sapels Light Station, light and keeper's dwelling, $40,000.

Kansas.—Fort Leavenworth, for continuing construction U. S. Penitentiary, $250,000.

Louisiana.—Government Bldg., La. Purchase Exposition (add.), $200,000.

Maine.—Portland Harbor, Ram Island Ledge Light and Fog Signal, $83,000.

Massachusetts.—Castle Island Lighthouse Depot, $25,000; Boston Harbor (Northeast Grave), Light and Fog Signal, $75,000.

New Jersey.—Port Penn Range, Reedy Island Range and Twins Point Range (Del. River), $30,000.

New York.—Staten Island Lighthouse Depot (oil house), $60,000.

Pennsylvania.—Phila., Schulykill Arsenal completion, add. to fireproof store house, clothing depot and installing elevators, $25,000.

Erection of barracks and quarters for artillery at military posts, $2,000,000.

Yellowstone Nat. Park, improvements, $250,000.

Chickamauga and Chattanooga Nat. Park, $50,000.

Shiloh National Military Park, $40,000.

Gettysburg National Park, $75,000.

Vicksburg National Military Park, $100,000.

WATER.

Whatcom, Wash.—It is stated that bids are wanted Aug. 3 for $60,000 bonds, the proceeds to be used to extend the water works. E. E. Hardin, Mayor.

Stoneboro, Pa.—Bids are wanted July 21 for constructing a water works system to consist of a 224,000-gal. concrete-lined reservoir, 12,000 ft. of 6-in. and 2,000 ft. of 4-in. cast pipe, standard weight, 10 hydrants, 75 taps with boxes, valves, etc. Frank McSweeney, Boro. Treas.

Beaumont, Tex.—Bids are wanted for constructing 25 miles of rice canal work from Pine Island bayou to Sour Lake, Tex. Address Brooks Bros. & Co., care Dutton Hotel, Beaumont.

San Diego, Cal.—City Engr. G. A. d'Hemecourt writes that the proposition to install additional auxiliary pumps for the purpose of pumping the water from San Diego River has been discussed by a Com. of the Common Council, but no definite report has as yet been made.

Ronceverte, W. Va.—Engr. in Charge F. R. Van Antwerp writes that bids will be received July 15 for 2 50-H. P. boilers, 2 pumps, 400,000-gal. capacity each per 24 hours; also pipe, hydrants, etc. John F. Weber, Town Recorder.

Centerville, Miss.—Town Clk. R. T. Quinn writes that on July 1 it was voted to issue $15,000 bonds for the construction of water works.

New London, Conn.—W. H. Richards, Engr. Water Dept., writes that a small high service water works system to include water power pump and small reservoir, the whole to cost about $25,000, is under consideration.

Shelby, O.—John B. Weddell, of Mansfield, O., has been engaged as Engr. in Charge of the construction of purification works for the Shelby Steel Tube plant, at Shelby.

Cleveland, O.—The lowest bid received July 2 by Chas. P. Salen, Dir. Pub. Wks., for building the superstructure of a boiler and cold storage house at Kirtland St. Pumping Station, also for a brick chimney at the same station, was from John Gill & Sons, of Cleveland, at $119,969.

Austin, Pa.—The time for receiving bids for the construction of water works has been extended from July 10 to July 17, as advertised in The Engineering Record.

Findlay, O.—City Engr. John W. S. Riegle writes that the City Council is about to receive bids for the sale of $150,000 water works improvement bonds. Contracts for work will also soon be let.

Consulting Engr. L. E. Chapin, of Canton, is stated to have approved the suggested project of using vitrified tile in bringing spring water to the city. The Water Works Bd. is about to engage an engineer to have charge of the water works construction.

Elkland, Pa.—Bids are wanted July 16 for a quantity of cast iron pipe, special castings, valves and fire hydrants, as advertised in The Engineering Record.

Hammonton, N. J.—Bids are wanted July 24 for furnishing all materials and plant for the laying of water pipe and appurtenances; separate bids are wanted until the same date for furnishing materials and erecting a steel standpipe, as advertised in The Engineering Record.

Mt. Gilead, O.—Bids are wanted July 23 for the construction of a complete water works system, Engr. John B. Weddell, of Mansfield, O., as advertised in The Engineering Record.

Boston, Mass.—Bids are wanted by the Metropolitan Water & Sewerage Bd. until July 25 for laying 2,600 lin. ft. of 60-in. cast iron water pipe in Weston and Newton, including the construction of a coffer dam, the laying of 3 lines of pipe each about 350 ft. in length under Charles River, and the placing of about 800 cu. yds. of concrete, as advertised in The Engineering Record.

Monticello, Minn.—Village Recorder W. J. Thompson writes that on July 29 a vote will be taken on the issue of $10,000 bonds for water works and $4,000 bonds for a gas plant.

Whitehouse, O.—S. B. Eipler, Clk. of Water Wks. Trus., writes that it is proposed to construct water works, at a probable cost of $7,000. Bids for bonds will be opened July 30, and after that bids for construction will be received.

Washington, D. C.—Col. A. M. Miller, in charge of the Washington aqueduct, has sent to the Ch. Engr. of the Army his project for the completion of the filtration plant, which contemplates a filter plant of 75,000,000-gal. daily capacity. Appropriation available, $600,000.

Caldwell, Idaho.—A press report states that bids are wanted July 24 for water works, according to plans of Engr. Cummings, which provide for wells at Frosts Springs.

Munhall, Pa.—The Council has passed an ordinance authorizing the issue of $70,000 bonds, of which amount $25,000 is for a water system and $20,000 for a municipal building.

Burlington, Ia.—Judge Withrow, of the Dist. Court of Des Moines County, has granted the application of W. W. Baldwin and others for an injunction to restrain the city of Burlington from entering into the contract with Hayes & Sons, of Cleveland, O., for the purchase of the water works.

Cornwall, Ont.—The Town Council has awarded the contract for the new hydraulic pumping plant to the Goulds Manufacturing Co., of New York and Boston, who agree to furnish a pump with a capacity of 1,500,000 gal. per day and a Jenckes water wheel set up for $7,490.

San Jose, Cal.—Local press reports state that plans prepared for the extension of the water system include the doubling of the pumping capacity and extension of pipe lines.

Youngstown, O.—Local press reports state that the Water Works Trus. propose to put in an experimental filter plant, to decide the question of whether or not Mahoning River water can be successfully filtered.

Belleville, Ill.—The plant of Mother Earth Water Co. is reported to have been destroyed by fire.

Birmingham, Ala.—The Birmingham & Suburban Water Works Co. has applied for a franchise in East Lake, Avondale, Woodlawn and West End.

Trenton, O.—C. D. Lewis, of Greenville, O., is stated to have submitted a report on the proposition to establish a water works system.

Lewisville, Idaho.—The Little Feeder Canal Co., Ltd., has filed its articles of incorporation. The incorporators are: S. G. Marier, Ed. Ellsworth, Sr., Erastus Walker and others.

Deerfield, Mass.—The voters of South Deerfield Fire Dist. have accepted the provisions of the recent legislative act enabling the district to take water from Whately Glen brook for domestic and fire purposes.

New Albany, Ind.—The City Council has granted the Indiana Water Co. the right to pump water from the river instead of from wells in the eastern part of the city.

Brooklyn, N. Y.—Asst. Ch. Engr. Van Buren is said to be preparing plans for a new 36-in. main, which it is proposed to lay on Atlantic Ave., between Carlton and Flatbush Ave.; probable cost about $60,000.

Oakland, Md.—Pres. L. A. Yoder, of the Mountain Lake Water Co., has submitted a proposition to establish water works in Oakland.

La Grande, Ore.—This city is said to be considering a proposition for the installation of a new water and electric light plant by Robt. Strathon, who proposes to purchase the present water system, to construct a sewerage system, to develop power for manufacturing and other purposes and to operate an electric light plant. Total estimated cost about $200,000.

Golden, Colo.—Local press reports state that this city proposes to construct a new gravity system of water works.

Belleville, Wis.—The proposition to issue water works bonds is reported to have carried.

Sacramento, Cal.—Mayor Clark has signed the contract with Geo. F. Day for a 2,000,000-gal. pump for the water works, at $1,600.

Buffalo, N. Y.—Local press reports state that Col. Francis G. Ward, Comr. of Pub. Wks., is in favor of a new and second pumping station.

Chariton, Ia.—The City Council has under consideration a proposition for the installation of a water works plant at a cost of $4,800.

Johnstown, O.—It is stated that bids are wanted Aug. 2 for $12,000 water bonds. H. B. Ruslin, Mayor.

Mitchell, S. D.—Bids are wanted July 17 for several blocks of water mains. W. M. Herbert, City Aud.

Whatcom, Wash.—It is stated that bids are wanted Aug. 18 for the purchase of $60,000 water bonds. W. H. Hildebrand, City Clk.

Oriskany Falls, N. Y.—The following bids are stated to have been received for the construction of a system of water works: Wm. T. O'Connor, of Syracuse, $19,700; John N. Siegrist, Utica, $19,600. All bids were rejected because of recent upward prices of cast iron pipe and inability to go beyond the amount voted for. Another supply at less cost is being examined into by F. K. Baxter, C. E., Utica, N. Y., and if possible the work may be let yet this season.

Charleston, S. C.—The stockholders of the Charleston Light & Water Co. are stated to have authorized an increase of the company's capital to $1,000,000, and authorized the issue of $1,500,000 bonds. A. H. S. Post, of Baltimore, Pres., and Morris Israel, Vice-Pres. The contract for constructing the water works plant has been let by the Charleston L. & W. Co., to the American Pipe Mfg. Co., and it is stated that work will be started at once.

Artesian, S. D.—Press reports state that bids are wanted July 21 for sinking an artesian well.

Edgerton, Minn.—Village Recorder C. I. Ring writes that the contract for constructing water works has been awarded to W. D. Lovell, of Des Moines, Ia., for $6,043.

Gueydan, La.—J. G. Neelis, Secy. & Treas. of the Gueydan Water & Power Co., recently incorporated, with a capital of $15,000, writes that the company proposes to put in a system of water works, manufacture ice, light, etc.

Carthage, Mo.—J. T. Lynn, of the James T. Lynn Water Co., writes that his company, which recently secured control of the plant of the Carthage Water Co., proposes to improve said plant at a probable cost of $50,000, including filter. G. G. Bayne, of Joplin, Mo., Engr. in Charge.

Brooklyn, N. Y.—Bids will be received by J. H. Dougherty, Comr. Dept. of Water Supply, Gas & Electricity, Room 1536, Park Row Bldg., N. Y. City, until July 24, for furnishing, constructing and erecting a pumping plant, with all appliances complete, at the Milburn Engine House, Baldwins, L. I.

Bridgeburg, Ont.—Bids are wanted July 21 for $32,000 water bonds. H. Emrick, Village Clk.

Lancaster, Ky.—The Artesian Well Supply Co., of Providence, R. I., has received the contract for drilling a well for the town supply.

Chinook, Mont.—City Clk. M. F. Marsh writes that it is proposed to construct water works at an estimated cost of $24,000 to $26,000. Wolf & Roth, of Minneapolis, Minn., are to prepare estimates, and bonds will be voted July 26.

Portsmouth, N. H.—The Water Comrs. recommend the issue of $50,000 for the acquirement of Peverley Brook in Newington for an increased water supply.

St. Ansgar, Ia.—The Com. on Water Works is stated to have received plans and specifications for a new system from the Des Moines Bridge & Iron Co.

Columbus, O.—The State Bd. of Health is reported to have approved the revised plans for a 30-ft. dam in Scioto River, with the proviso that he water so stored be purified before being used by this city.

Pony, Mont.—In a report to the City Council as to the best system of water works for this place, Harper & McDonald, of Butte, recommended that a reservoir be built for the storage of spring water; estimated cost, $14,326.

Yonkers, N. Y.—The Bd. of Water Comrs. has voted to have John A. Byrne and W. F. Washington, of the Hydraulic Const. Co., which has the contract for lowering the suctions at the tube well plant, and Wm. H. Baldwin, Engr. to the Bd., each present a separate report, with plans, for filter beds at the tube well plant. In reports already submitted Mr. Byrne and Mr. Washington favor the natural sand filtration system, and Mr. Baldwin favors the mechanical system of filtration, and he estimates the total cost of such a plant at $66,000.

A. W. Kingsbury, Clk. Bd. of Water Comrs., writes that the following bids were opened July 9 for furnishing and delivering 425 lengths of 12-in. pipe, 1,060 lbs. per length of 12 ft.; prices are per ton: U. S. Cast Iron Pipe & Fdy. Co., Philadelphia, Pa., $32.90; Chas. Millar & Son Co., Utica, N. Y., $34.08; R. D. Wood & Co., Philadelphia, Pa., $31.45; M. J. Drummond & Co., New York City, $33; Wm. Y. Briggs, New York City, $37; John Fox & Co., New York City, $33.55; Warren Foundry & Machine Co., New York City, $31 (awarded); Camden Iron Wks., Camden, N. J., $31.45.

SEWERAGE AND SEWAGE DISPOSAL.

Bronxville, N. Y.—The time for receiving bids for sewerage and septic tank has been postponed from July 15 to July 21, as advertised in The Engineering Record.

Redfield, S. D.—Bids are wanted July 21 for constructing sewers in several streets. J. S. Huston, City Aud.

Youngstown, O.—Bids will be received by the City Comrs. until July 19 for grading, draing and improving Forest Ave. and constructing sewers in Himrod and Foster Sts. C. E. Cross, Clk.

Des Moines, Ia.—Bids are wanted July 23 for a 12-in. vitrified clay pipe sewer on E. 13th St. and a 15-in. vitrified clay pipe sewer on E. Washington St.; also on July 24 for a 12-in. vitrified clay pipe sewer in portions of 16 streets. J. E. Stout, Chmn. Bd. Pub. Wks.

Carthage, N. Y.—Plans prepared by Brownell & Eaton for the West Carthage sewer system are stated have been submitted to the State Bd. of Health for approval.

Columbia, Mo.—The City Council will receive bids until July 22 for furnishing labor and material necessary to construct sewers in Dists. Nos. 9 and 10. John S. Bicknell, City Clk.; E. B. Cauthorn, Engr. Probable cost, $4,000.

Wilmington, Del.—Ch. Engr. J. A. Bond, of the Water Bd., writes that the contract for constructing a concrete sewer (about 700 ft. long) in Brandywine Park, has been awarded to Harry A. Miller, 617 Shipley St., Wilmington, at $5.66 per lin. ft.

Meadville, Pa.—City Engr. W. A. Doane writes that resolutions have been passed for the construction of sanitary 8-in. sewers on Mercer and West Sts. Cost about $10,000.

Derby, Conn.—City Clk. John W. Larkin writes that bids received July 2 for sewer construction have been rejected and that the city will do the work under the supervision of the Comr. of Streets, Jas. J. Sweeney.

Mt. Gilead, O.—John B. Weddell, of Mansfield, O., has been employed as Engr. in Charge of the construction of a sewer system and purification works for this place.

Kendallville, Ind.—Bids are wanted July 15 for the construction of a sewer on Oak St. E. P. Lash, City Clk.

Canton, O.—Bids will be received July 21 for the following quantities of "first quality" salt-glazed vitrified shale sewer pipe, f. o. b. Canton, breakage and inspection guaranteed: 7,500 ft. 18-in. double strength, 2,000 ft. 15-in. d. s., 800 ft. 12-in. standard strength, 6,000 ft. 10-in. s. s., 45,000 ft. 8-in. s. s., and 8,500 ft. 6-in. s. s., with necessary branches.

Bids are wanted Aug. 4 for constructing sanitary sewers in Dist. No. 1, said work, 15 miles in all, to be let in 3 sections. Blank forms of bids will be furnished by the City Engr. Plans and specifications are on file at the office of City Engr. Phil. H. Weber.

Quincy, Mass.—The City Council on June 30 appropriated $60,000 for sewer extensions. H. Flood, City Engr.

Monticello, Ind.—City Clk. W. J. Gridley writes that bids received June 30 for constructing sewers Nos. 8, 9 and 10 were rejected and new bids will be opened July 25.

White Plains, N. Y.—Bids are wanted by the Village Bd. of Trus. until July 22 for building an engine and pump house, building pump well or suction chamber, furnishing and setting two 20-H.-P. gasoline engines, 2 triplex power pumps of 500 gals. per minute capacity combined, together with all necessary pipes and fittings to connect and operate a sewage pumping station with present system of sewers. Peter Paulding, Village Clk.

Lockhart, Tex.—Bids will be received until about July 23 for constructing a sewer system. Address the Mayor.

Gainesville, Ga.—It is stated that bids are wanted July 18 for $20,000 sewer bonds.

Cincinnati, O.—Bids are wanted Aug. 2 by the Hamilton Co. Comrs. for constructing a concrete semi-circular arch culvert in Ross Run Creek on Carthage Pike; also for constructing a concrete semi-circular arch culvert in Bloody Run Creek, on Carthage Pike. Eugene L. Lewis, Co. Aud.

New York, N. Y.—Bids are wanted July 18 for the following sewer construction: In 157th St., 222 ft. 15-in. salt-glazed vit. stoneware pipe, 50 cu. yds. of rock excavation, etc. In W. 186th St., 180 ft. 15-in. salt glazed vit. stoneware pipe, 425 cu. yds. of rock excavation, etc. In Wicker Pl., 215 ft. brick sewer 3 ft. 6-in.x2 ft. 4-in., 1,260 ft. 15-in. stoneware pipe, 1,925 cu. yds. rock excavation; also for 12 receiving basins. Jacob A. Cantor, Pres. Boro of Manhattan.

Mansfield, O.—Bids are wanted July 18 for the construction of 2 sanitary and 1 storm water sewers. D. S. Koontz, City Clk.

De Pere, Wis.—Bids are wanted by the City Clk. until July 26 for the construction of 3 sewers, 20 to 12 ins. in diameter. John Cook, Chmn. Com. on Sewers.

East Liverpool, O.—Bids are wanted July 15 for the construction of 6-in. sewers on Ravine St. and Thompson Ave. F. H. Croxall, Secy. Bd. of Sewer Comrs.

Cleveland, O.—Bids are wanted July 15 for the construction of sewers in Clement, Crane, Ditton and several other streets; bids are also wanted until July 22 for the construction of sewers in Detroit and Prescott Sts. Chas. P. Salen, Dir. of Pub. Wks.

Olathe, Kan.—Bids are wanted July 15 for constructing lateral sewers, about 1,000 ft. of 8-in. pipe, with Y connections, etc. S. F. Garwood, City Clk.

Zanesville, O.—Bids are wanted July 19 for a sewer in Pierce St., and until July 26 for a sewer on Harrison St. C. W. McShane, City Clk.

Fayette, O.—Bids are wanted July 21 for constructing a 5-in. sewer commencing at the creek on N. Fayette St. and running to Fayette and Union Sts. Fred. L. Bird, Village Clk.

Long Island City, L. I., N. Y.—Bids will be received by Jos. Cassidy, Boro. Pres., until July 24 for furnishing labor and material for constructing sewers in portions of 5 streets.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until July 21 for constructing sewers and drains in Slack St. and Beresford and James Aves.; also on Aug. 4 for constructing sewers and drains in numerous streets. Geo. F. Holmes, Clk.

Jeffersonville, Ind.—Bids are wanted Aug. 5 for a sewer 804 ft. long, 24-in. tile pipe double strength, with 3 manholes and 4 catchbasins; average cut 6 ft. Victor W. Lyon, City Engr.

Abilene, Kan.—Bids are wanted Aug. 6 for the construction of a system of public and district sewers, as advertised in The Engineering Record.

Norristown, Pa.—Bids are wanted July 14 for the construction of storm sewers in several streets. John H. Rex, Chmn. Sewer Com.

Cincinnati, O.—The Bd. of Pub. Service has approved specifications for an $11,000 trunk sewer to be built in the ravine west of Torrence Road.

Wellsville, O.—H. E. Riggs, of Riggs & Sherman, Toledo, is stated to have been employed as Consulting Engr. for the proposed sewerage system.

Atkin, Minn.—Geo. Ralph is said to be making surveys for the 40 miles of ditches to be constructed this year in Aitkin Co. by the order of the State Drainage Comn., Minneapolis.

San Diego, Cal.—The City Engr. has prepared estimates and plans for sewer extensions under the proposed bond issue for the part of the city south of N St. and west of Chollas valley; the total length of 6 to 20-in. vit. pipe is given as 70,647 ft., with 28 flush tanks, and 212 manholes; estimated cost, $67,-081. For the extension in the northern part of the city the estimate calls for 54,956 ft. of 6 to 12-in. vit. pipe, with 25 flush tanks, and 144 manholes; estimated cost, $69,012.

Oneida, N. Y.—See "Paving and Roadmaking."

West Hazleton, Pa.—The lowest bids received for the construction of a sewer system are stated to have been from Ludwig Kramer at $7,819 for the stone arch sewer and from Chas. Kehoe at $8,446, $3,[illegible] and $5,433 respectively for Sections 3, 4 and 5.

Hicksville, O.—The Council has adopted a resolution providing for the construction of a sewer from the n. w. side of town to the east side, 5,700 ft.

Manchester, Conn.—The Directors of the Manchester Sanitary & Sewer Dist. are considering a plan for sewers for the North End. Estimated cost, [illegible].

Grafton, N. D.—A vote was taken at the recent election in favor of drainage and paving.

Independence, Mo.—See "Paving and Roadmaking."

St. Paul, Minn.—Bids are wanted July 17 for constructing sewers in Cook and Bellows Sts. R. L. Gorman, Clk. Bd. Pub. Wks.

Ardmore, Pa.—It is stated that bids are wanted Aug. 4 for constructing 41 miles of pipe sewers, sewage disposal and pumping plant, etc. W. E. Barrett, Chamn. Com. Chester E. Albright, Engr., Land Title Bldg., Philadelphia.

Grafton, N. D.—Bids are wanted July 26 for the construction of a sewerage system, consisting of 3,202 ft. of main sewer, 12,243 ft. of laterals, 35 manholes and 87 catch basins. Benj. A. Provoost, City Aud.

Schenectady, N. Y.—Local press reports state that bids are wanted July 15 for constructing a 28-in. sewer in Nott St. and also on same date for paving the street.

Waterbury, Conn.—Bids are wanted July 15 for the construction of storm water conduits in 3 streets. R. A. Cairns, City Engr.

Kansas City, Mo.—Bids are wanted July 16 for constructing sewers in Sewer District No. 148. Robt. W. Waddell, City Engr.

Carbondale, Ill.—Bids are wanted July 21 for constructing a sewerage system. Sewer 6,500 ft. long, 8, 10 and 12-in. pipes, 6 manholes, flush tank, etc. F. M. Caldwell, City Clk.

Westfield, Mass.—It is reported that bids are wanted about July 19 for the construction of a sewerage system; appropriation $105,000. O. E. Parks, Town Engr.

Syracuse, N. Y.—Bids are wanted July 14 for furnishing materials and constructing an 18-in. pipe sewer in Fulton St. Geo. J. Metz, City Clk.

Cincinnati, O.—The City Engr. estimates the cost of constructing a sewer in Considine, Murdock and Hawthorne Aves. at $14,583; he states that if this sewer is constructed it will be necessary to also construct sewers in Bassett and Grand Aves., making the total cost $31,000.

Morgantown, W. Va.—Sewer and paving bonds to the amount of $30,000 have been sold by this city.

Camden, N. J.—The Street Com. has instructed City Engr. Farnham to prepare plans for sewers for the Line Ditch meadows. It is stated that the cost of said sewers may be $75,000.

Newark, N. J.—The following bids were opened June 26 for building Section 4, 2d and 3d Division, of the West Branch of the Joint Outlet Sewer. Alexander Potter, 150 Nassau St., New York City, Ch. Engr.:

Items and Quantities.	Earl & Dougherty, Jersey City.	David Peoples, Phila.	Harrison Cons. Co., Newark.	Batt & Martin, S. Orange.	Wm. Hanna, Newark.
24-in. pipe sewer:					
0—6 ft. deep, 3,215 ft.	$2.40	$2.60	$2.10	$2.43	$2.75
6—10 ft. deep, 6,990 ft.	2.56	2.70	2.75	3.25	3.25
10—14 ft. deep, 1,390 ft.	2.72	2.80	3.35	3.65	3.50
14—18 ft. deep, 870 ft.	3.00	2.90	4.00	5.00	3.75
18—22 ft. deep, 50 ft.	3.25	3.10	5.00	5.65	4.00
24-in. C. I. pipe, 200 lbs. per ft., 0—6 ft. deep, 396 ft.	5.00	6.00	6.00	7.00	7.00
22-in. pipe sewer:					
0—6 ft. deep, 2,310 ft.	2.16	2.20	1.95	2.25	2.75
6—10 ft. deep, 1,470 ft.	2.33	2.30	2.60	2.75	3.25
10—14 ft. deep, 530 ft.	2.60	2.40	3.20	4.50	3.50
Manholes:					
10 ft. deep or less, 44 ft.	35.00	35.00	40.00	35.00	40.00
10—15 ft. deep, 27 ft.	4.00	4.00	4.00	3.25	4.00
15—20 ft. deep, 2 ft.	5.00	4.00	5.00	4.00	4.00
Sheeting, 30,000 ft. B. M.	35.00	30.00	35.00	30.00	30.00
Rock excavation, 1,000 cu. yds.	3.00	3.00	3.00	1.25	.50
Extra concrete, 50 cu. yds.	10.00	8.00	10.00	8.00	10.00
Extra brick work, 50 cu. yds.	10.00	12.00	12.00	13.00	12.00
22-in. pipe branches, 20	3.50	3.00	3.00	2.50	2.50
24-in. pipe branches, 50	4.00	4.50	4.00	2.75	3.00
Asphalt joints:					
On 22-in. pipe, 600	.15	.40	.20	.10	.40
On 24-in. pipe, 1,000	.15	.50	.20	.15	.50
6-in. tile drain, 1,000 ft.	.60	.30	.60	.15	1.00
Totals	$51,754	$53,794	$54,967	$60,016	$61,959

Lima, O.—The City Council has sold sewer bonds to the amount of $50,000.

Saranac Lake, N. Y.—Village Clk. S. A. Miller writes that the following bids were opened July 8 for constructing approximately 43,405 ft. of 6-in. to 24-in. pipe sewers, with 130 manholes and 12 flush tanks; the trench to average 10 ft. in depth and be excavated in sand, loam and rock: Fitzpatrick & Costello, Plattsburg, N. Y., $52,455 (awarded); Albert M. Banker, Gloversville, N. Y., $64,871; B. Gaffney & Sons, Saratoga Springs, N. Y., $63,619; W. H. Cooke, Niagara Falls, N. Y., $55,750.

San Juan, P. R.—City Engr. I. A. Canals writes that the following bids, which were opened June 20, were both rejected by the Municipal Council: Bidders: A, Larrinaga & Co., 27 William St., New York City; B, Sucesores A. Mayol & Co., Allen St., San Juan: 2,800 ft. 8-in. vit. salt-glazed sewer pipe, A, 26½ cts.; B, 27¾ cts. 4,800 ft. 10-in. vit. salt-glazed sewer pipe A, 40 cts.; B, 43 cts. 1,300 ft. 12-inch vit. salt-glazed sewer pipe, A, 51 cts.; B, 57 cts. 100 Y pieces, 8 in.x6 in., A, 94 cts. each; B, $1.26. 200 Ys, 10 in.x6 in., A, $1.40; B, $1.69. 50 Ys, 12x6, A, $1.85; B, $2.50.

Eureka, Cal.—City Engr. Frank E. Herrick writes that bids were opened June 20 for the construction of a sewerage system, the work to include 57,000 ft. of 6 to 24-in. pipe sewers, 2,655 ft. of outfall sewer, sectional area 36-in. in diameter, wood stave pipe; 116 manholes, and 71 lamp holes; the trench to average 6½ ft. in depth and be excavated partly in sand with some water, and partly in clay and compact sand. The contracts have been awarded as follows: To Wm. Heafey, of Oakland, sections 2, 3, 4 and 5, at $23,525, $33,182, $5,360 and $5,950, respectively; to J. Simpson, of Eureka, sections 1 and storm sewers, for $14,532. Total, $82,549.

Brockport, N. Y.—Village Clk. H. E. McArthur writes that the following bids were opened July 3 for the construction of a sewerage system, the work to include $12^2/_3$ miles of pipe sewers 4 to 18-in. in diameter, 123 manholes and 52 flush tanks; also about 1 mile of storm sewers and disposal works: Casey & Murray, Rochester, N. Y., $63,403.36; E. H. Denniston & Co., Syracuse, N. Y., $64,825; Holahan & Kearns, Rochester, N. Y., $65,695.61; W. W. Read & Co., Niagara Falls, N. Y., $68,600; W. H. Cookman, Niagara Falls, N. Y., $69,525; Miller & Franklin, Niagara Falls, N. Y., $73,150.

BRIDGES.

Marinette, Wis.—The Counties of Marinette, Wis., and Dickinson, Mich., are asking for plans and specifications for an iron bridge to be built across Menominee River at Niagara. Appropriation, $16,000. Address J. B. Woods, Amberg, Wis.

Highshoals, Ga.—C. M. Harrison, Clk. Bd. of Comrs. & Revenues, Walton Co., Monroe, Ga., writes that the contract for constructing a 375-ft. steel highway bridge at Highshoals has been awarded to the Virginia Bridge & Iron Co., Roanoke, Va., for $4,995. The contract for the stone work was let separately to C. M. Howlson.

San Antonio, Tex.—See "Paving and Roadmaking."

Monticello, Ill.—Contracts will be let July 22 for an 80-ft. and a 60-ft. highway bridge on stone masonry. Plans and specifications may be had of Ira O. Baker, Engr., Champaign, Ill., or of the Town Clerks in Monticello and De Land.

Columbus, O.—Co. Surveyor Henry Maetzel writes that he is preparing plans for 2 bridges to cross the railroad tracks on Cleveland Ave. Contracts will be let after Aug. 1.

Camden, N. J.—A new bridge and 400-ft. approaches will probably be built to avoid grade crossing at Phila. & Atlantic City R. R. at Broadway.

Vicksburg, Miss.—See "Government Work."

San Saba, Tex.—Co. Clk. L. W. Rector writes that the contract for constructing a bridge between San Saba and Burmwood has been awarded to the Midland Bridge Co., of Kansas City, Mo., for $8,300 (bids opened June 30).

Walker, Minn.—See "Paving and Roadmaking."

Mauston, Wis.—Bids are wanted Aug. 1 for the construction of a single span steel bridge across Lemonweir River on Union St.; it will be 140 ft. long, with 16-ft. roadway and 6-ft. sidewalk. R. S. Joslin, City Clk.

Tupperville, Ont.—Bids are wanted July 26 for the construction of a steel drawbridge across Sydenham River in this village. Address Archie McArthur, Municipal Clk. Twp. of Chatham, Tupperville.

Tipton, Ind.—Bids are wanted by the Bd. of Comrs., Tipton Co., until July 26 for building 10 small steel bridges and 2 small stone arch bridges. E. Perry, Co. Aud.

Wilkesbarre, Pa.—Bids are wanted July 26 for building numerous small bridges, mostly stone, in Luzerne Co. Geo. R. McLean, Co. Compt.

Mansfield, O.—Bids are wanted July 18 for constructing a bridge across Touby's Run, and for constructing 2 arches across Ritters Run. D. S. Koontz, City Clk.

Boston, Mass.—Bids are wanted July 17 for building 2 masonry abutments for Cambridge bridge. Patrick A. Collins, Chmn. Cambridge Bridge Com., Boston.

Cambridge, Mass.—It is stated that an order was voted by City Council for a loan of $100,000 for the new Cambridge bridge.

Chillicothe, O.—Bids are wanted July 21 for furnishing all material and constructing the substructure for a bridge to be built over Walnut Creek on the Mooresville and Londonderry road; bids will also be received at the same time for building the superstructure of said bridge, which is to have 1 span 64 ft. out to out. Harry S. Adams, Aud., Ross County.

Chicago, Ill.—Bids are wanted Sept. 3 for constructing the substructure of 18th and Loomis St. bridges across Chicago River, both bridges to be of the Scherzer rolling lift design. Thos. A. Smyth, Pres. Bd. of Trus., Sanitary Dist. of Chicago.

New Bedford, Mass.—It is reported that the Common Council has adopted an order for a special appropriation of $25,000 for the approach to the park bridge.

Sioux City, Ia.—Press reports state that City Engr. Lewis has recommended the construction at once of an 800-ft. viaduct on Wall St. from Fourth to Grand Sts. Probable cost, $100,000, to be borne by Ry. Co.

Kankakee, Ill.—The 187-ft. steel wagon bridge over the Iroquois River at Sugar Island is reported washed away. Cost, $11,000.

Waterloo, Ia.—The Black Hawk Co. Supervisors are reported to have estimated loss by recent high water as $20,000, 20 bridges having been washed away.

Toledo, Ia.—It is stated that $20,000 is needed to replace and repair bridges wrecked in Tama Co.

Sand Point, Idaho.—Local press reports state that contracts have been awarded to Geo. S. Deeks & Co., of St. Paul, for the construction of 46 piers for the steel R. R. bridge across Lake Pend d'Oreille, to replace wooden trestle bridge.

Zeeland, Mich.—Press reports state that the Grand Rapids Bridge Co. was awarded the contract for concrete arch bridge over Black River.

Cambridge, O.—Press reports state that the Pennsylvania R. R. bridge north of here has been washed from its abutments. Several street bridges are also reported washed away.

Zanesville, O.—It is reported that over 50 Co. bridges, ranging in length from 10 to 100 ft., have been destroyed by storm.

St. Paul, Minn.—Press reports state that action is to be taken to compel the Chicago Great Western R. R. to replace the State St. bridge over the tracks by a steel structure.

Wakefield, Can.—It is reported that at a recent vote of the township it was decided to build a bridge over the Gatineau River just above Wakefield.

North Yakima, Wash.—It is reported that ¼ of the $30,000 required to be raised by citizens to secure terminal grounds for the Yakima-Sunnyside R. R. and to build a bridge across Yakima River has been raised.

Bay City, Tex.—Matagorda Co. is reported to have sold $23,000 bridge bonds.

Stewartville, N. J.—Press reports state that the Bd. of Freeholders has voted to issue $25,000 in bonds to replace bridges destroyed by flood.

Ballard, Wash.—It is stated that F. Berzoue has applied to the Council for a franchise to build a drawbridge across Salmon Bay, the trestle to extend from Shilshole Ave. in Ballard west along Second Ave., and would connect with 23d Ave. in Seattle.

Grassport, Pa.—Press reports state that a charter has been granted to the West Elizabeth & Dravosburg Bridge Co., which will commence the erection of a bridge across the Monongahela River. W. T. Pierce, McKeesport, Pres.

Toronto, Can.—Press reports state that the Glen Road bridge near Rosedale is to be thoroughly strengthened.

Danville, Ill.—Bids are wanted July 17 for the construction of a steel bridge across the Vermillion River in Ellsworth Park. R. E. Lloyd, City Clk.

St. Louis, Mo.—Bids will be received by the Bd. Pub. Improv. until July 29 for the construction of a storage coal shed and steel railroad bridge over conduit at Bissels Point. Hiram Phillips, Pres.

Le Roy, N. Y.—It is reported that the Highway Comrs. are in favor of having the town co-operate with the Buffalo & Depew Ry. Co. in building a bridge over the Oatka River at Main St.

Como, Mont.—Press reports state that the Ravalli Co. Clk., Hamilton, Mont., will soon let the contract for rebuilding Como bridge.

Orange City, Ia.—Press reports state that a steel bridge will be erected over Rock River, 2½ miles from Rock Valley.

Hondo, Tex.—It is reported that the Comrs. have authorized the issue of $30,000 bonds for bridge purposes.

Cincinnati, O.—The Bd. of Pub. Service has been petitioned to issue $200,000 in bonds to build a viaduct connecting the end of Grandin road with Delta Ave.

Joliet, Ill.—It is stated that $12,000 will be needed to repair the Red Mill wagon bridge over Hickory Creek.

Rockwood, Tenn.—It is stated that the Tennessee Central R. R. has decided to put a 3-span steel bridge over the Cumberland River 300 ft. below the Hyde's Ferry bridge. Estimated cost, $150,000. J. E. Rodes, Gen. Mgr., Rockwood, Tenn.

Buffalo, N. Y.—Bids are wanted July 22 for the construction of the substructure and approaches for a bascule bridge on S. Michigan St., as advertised in The Engineering Record.

Rome, N. Y.—The contract for constructing a bridge over Mohawk River at E. Dominick St. has been awarded to Owego Bridge Co., Owego, N. Y., for $14,-500.

Buffalo, N. Y.—Bids are wanted July 22 for the superstructure of a bridge on South Park Ave. over Cazenovia Creek. Francis G. Ward, Com. of Pub. Wks.

Washington, Pa.—Press reports state that E. Jay Iams, Lee Grimes and Jesse Gibson have been appointed viewers to pass on the advisability of erecting a new county bridge over Pike Run Creek in West Pike Run Township.

Coldwell, Idaho.—It is stated that bids are wanted Sept. 9 for the construction of a bridge across Fayette River, to be 352 ft. long, 16 ft. wide, of 2 spans, with steel tubular piers. J. N. Bernard, Chmn. Bd. Co. Comrs.

PAVING AND ROADMAKING.

Red Bank, N. J.—The contract for building the Red Bank and Oceanic stone road has been awarded to the Rocky Hill Construction Co. at 72 cts. per sq. yd.; total, $21,560.

Jersey City, N. J.—The Freeholders of Hudson Co. have sold $65,000 bonds, the proceeds of which are to be used in the improvement of Paterson plank road from Monroe St., Hoboken, to Leonard St., Jersey City Heights.

Lead, S. D.—Press reports state that the City Council is about to let contracts for paving Main and Mill Sts., probably with asphalt.

New Bedford, Mass.—The Council has adopted an order appropriating $67,500 for highways and streets.

Schenectady, N. Y.—The City Clk. writes that bids will be received in about 30 days for the paving of College St. with sheet asphalt.

Gainesville, Fla.—The City Clk. & Treas. writes that on July 1 it was voted to issue $20,000 bonds for the erection of a city hall and for paving.

Fulton, N. Y.—City Clk. W. M. Hinsdale writes that brick and asphalt paving contemplated will cost about $150,000. D. C. Breed, City Engr.

San Antonio, Tex.—Asst. City Engr. John D. Rullman writes that it is contemplated to issue bonds to the amount of $300,000 for more asphalt paving and iron bridges.

Vicksburg, Miss.—See "Government Work."

Washington, D. C.—Bids are wanted July 26 for paving with sheet asphalt; bids are also wanted until the same date for paving with asphalt block, as advertised in The Engineering Record.

Portsmouth, O.—Bids are wanted July 29 for furnishing materials and labor necessary for the improvement of a portion of new East 5th St.; approximate quantities: 9,649 sq. yds. paving, hard burned or vitrified brick or blocks; 4,276 lin. ft. straight curb; 75 ft. circular curb, etc. Frank L. Sikes, City Clk.; B. C. Bratt, City Engr.

Woburn, Mass.—The City Council has passed to its second reading a $10,000 loan for highways.

Columbus, O.—Clarence M. Addison, Clk. Bd. of Pub. Wks., writes that the contract for paving Norwich Ave. has been awarded to A. G. Pugh, of Columbus, for $9,000.

Walker, Minn.—It is stated that bids will be received by the Co. Comrs. until July 15 for $20,000 road and bridge bonds.

Celina, O.—Village Clk. Chas. R. Rohrer writes that the contract for 7,700 sq. yds. of paving on W. Fayette St., has been awarded to T. G. Mulligan, of Lima, O., for $14,869.

Trenton, N. J.—East Hanover and North Warren Sts. are to be repaved with asphaltum over Belgian blocks by the passing of a resolution appropriating $35,000 to repave streets and carrying with it a bond issue to provide the money.

Peoria, Ill.—It is stated that bids are wanted July 30 for 9,800 sq. yds. brick paving, 5,950 cu. yds. excavation, 5,800 lin. ft. curbing, etc., on Peoria and Wisconsin Aves. H. E. Beasley, City Engr.; E. A. Furry, Pres. Bd. Improv.

Gainesville, Ga.—It is stated that bids are wanted July 18 for $10,000 street improvement bonds.

Greenville, O.—It is stated that bids are wanted July 19 for constructing 4 miles of the Spencer pike in Allen Township. E. Culbertson, Co. Aud.

Upper Sandusky, O.—It is stated that bids are wanted July 24 for grading and stoning about 13,200 ft. of road in Eden Township. E. N. Halbedel, Co. Aud.

Alvinston, Ont.—Village Clk. Richard Code writes that the contract for constructing about 49,000 ft. of granolithic sidewalk (bids opened July 2), has been awarded to the Forest City Paving Co., London, Ont., at 9¾ cts. per sq. ft.; total, $4,775.

Lancaster, O.—Bids are wanted Aug. 1 for constructing sandstone curbing and brick sidewalks on Fair Ave. H. T. Mechling, City Clk.

Springfield, O.—Bids are wanted July 28 for the following kinds of street work, as required by the city from Aug. 1, 1902, to Nov. 1, 1903: artificial stone, combined curb and gutter; limestone, sandstone and freestone curbing; crosswalks, brick and cement sidewalks, etc. R. N. Lantz, City Clk.

Kansas City, Mo.—Bids are wanted July 21 for the construction of curbing on numerous streets. Robt. W. Waddell, City Engr.

Baltimore, Md.—Bids are wanted July 16 for grading, curbing and paving with wooden blocks a portion of Calvert St.; also until same date for grading, curbing and paving with cobblestones portions of Montford Ave. and Brunt St. B. T. Fendall, City Engr.

Boston, Mass.—The Mass. Highway Comrs. have announced the apportionment of $500,000 for highway construction, and maintenance of State roads.

Pembroke, Ont.—Bids are wanted July 19 for building a macadam road on Pembroke and McKay Sts.; also for building granolithic pavements on said streets. W. H. Bromley, Chmn. Pub. Wks.

Buffalo, N. Y.—Local press reports state that the Park Comrs. will receive bids on July 16 for macadamizing the north drive in Riverside Park; length, 1,154 ft.; width, 35 ft.

Union, N. J.—Bids will be received by Emil Bautz, Jr., Town Clk., July 21, for paving a portion of 3d St. with brick and a portion with asphalt, curbing to be reset at the present grade.

Mansfield, O.—Bids are wanted July 18 for improving Prospect alley and Hedges St. D. S. Koontz, City Clk.

New York, N. Y.—Bids are wanted July 18 for regulating and repaving with asphalt on present pavement relaid as foundation in numerous streets; in all there will be required about 63,471 sq. yds. of asphalt, including binder course, and 31,640 lin. ft. of new curbstone, furnished and set. Jacob A. Cantor, Pres. Boro. of Manhattan.

North Adams, Mass.—Bids are wanted July 23 for about 2,300 sq. yds. of vitrified brick paving, as advertised in The Engineering Record.

Boston, Mass.—Bids are wanted July 19 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing vitrified brick, concrete and granolithic pavements at the Navy Yard, Boston. Mordecai T. Endicott, Ch. of Bureau.

Cleveland, O.—Local press reports state that the contract for improving Euclid Road between Collamer St. and Euclid Creek, has been awarded to Thos. J. McManus for $52,750.

St. Paul, Minn.—The Bd. of Aldermen has approved the measure providing for the paving with sandstone of W. 7th St., from Ramsey to Tuscarora. The total cost of the work, not including the street car company's portion inside the tracks, will be $98,416.

Bay City, Mich.—The Common Council has voted in favor of paving a portion of Center Ave. with bituminous macadam.

Montreal, Que.—The Finance Com. has decided to vote $27,000 for the laying of permanent sidewalks.

Hillsdale, Mich.—The contract for paving 3 streets is stated to have been let to W. J. Berry, of Bellaire, O., at his bid of $1.75 per sq. yd. for Metropolitan block on a concrete foundation. Total about $24,000.

Cincinnati, O.—The Bd. of Pub. Service has ordered the City Engr. to submit plans and estimates for the improvement of Fern and May Sts. with asphalt.

Jersey City, N. J.—The Bd. of Boulevard Comrs. has notified the Bd. of Freeholders that it will need $140,000 to maintain the boulevard for the fiscal year commencing Dec. 1 next.

New York, N. Y.—The Bd. of Estimate & Apportionment on July 8 approved the following improvements: To pave with asphalt E. 19th St., Flatbush, at a cost of $14,000; to pave with granite on Hamburg Ave., Brooklyn, at a cost of $31,300; to regulate and grade the Grand Boulevard and Concourse from E. 161st St. to Mosholu Parkway, at a cost of $1,052,153, and to pave Cauldwell Ave. with asphalt from E. 161st St., to Westchester Ave., at a cost of $33,000.

Philadelphia, Pa.—Local press reports state that the Bureau of Highways will receive bids on July 22 for a large amount of grading, paving, regrading and macadamizing.

Ottawa, Ont.—Local press reports state that the contract for asphalt paving has been awarded to the Canadian Asphalt Co., of Ottawa, at $9,248 for Clarence St. and $8,558 for St. Patrick St.; the price per sq. yd. is said to be a little less than $3.

Portland, Ore.—The City Council has passed an ordinance for the improvement of 4th St. at a probable cost of $28,598.

Baltimore, Md.—The County Comrs. have passed an order directing Roads Engr. W. W. Crosby to prepare specifications for the construction of Park Heights Ave. extension, for a distance of about 5 miles.

Jellico, Tenn.—Bids are wanted July 21 for grading and macadamizing certain streets, as advertised in The Engineering Record.

Bids are wanted Aug. 1 for the purchase of $10,000 paving bonds. Jack Smith, Mayor.

Rome, N. Y.—The Council has ordered about 10,000 sq. yds. of paving on one street; work to be done as soon as plans, etc., can be prepared.

Three Rivers, Mich.—The City Council has under consideration the question of issuing $25,000 bonds for paving purposes.

Nashville, Tenn.—Press reports state that the Supt. of the Workhouse Comm., has been directed to purchase a portable rock crusher.

Centerville, Ind.—Bids are wanted July 24 for 40,-000 sq. ft. of cement or vitrified brick walks. Edw. King, Town Clk.

Sheboygan, Wis.—Bids are wanted July 19 for 2,-100 sq. yds. brick paving and 510 lin. ft. of stone curbing on 6-in. concrete foundation; also 2,100 sq. yds. 6-in. cedar block (instead of brick) on same foundation. C. U. Boley, City Engr.

Kansas City, Mo.—Bids are wanted July 16 for paving portions of 3 streets with asphalt. Robt. Waddell, City Engr.

Brooklyn, N. Y.—Bids will be received by J. E. Swanstrom, Pres. Boro. of Brooklyn, until July 23 for about 115,305 sq. yds. of asphalt paving, 18,815 sq. yds. macadam and 71,658 lin. ft. of new bluestone curb.

Warren, Pa.—The proposition to issue $20,000 bonds for street paving is reported to have carried.

Syracuse, N. Y.—Bids are wanted July 14 for paving Oak St. with asphalt. Geo. J. Metz, City Clk.

Jersey City, N. J.—Bids are wanted by the St. & Water Comrs. July 15 for the improvement of Duncan Ave.; 5,296 sq. yds. of Belgian paving, and 1,000 lin. ft. of curbstone will be required. Geo. T. Bouton, Clk.

Toledo, O.—Bids are wanted Aug. 11 for furnishing the necessary labor and material for the improvement of Walbridge Ave. by paving the central 26 ft. with block. Chas. H. Nauts, City Clk.

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until July 29 for paving portion of 33 streets with vitrified paving brick. Hiram Phillips, Pres.

Cincinnati, O.—Bids will be received at the office of the Bd. of Pub. Service on July 22 for paving Cassett Alley with brick; also on Aug. 5 for paving Forest Ave. with macadam, Halloway Ave. with brick and Eggleston Ave. with granite block. Geo. F. Holmes, Clk.

Benton Harbor, Mich.—City Clk. Willard J. Banyon writes that the contract for about 11,500 sq. yds. of asphalt paving (bids opened July 7), has been awarded to the Barber Asphalt Paving Co., Chicago, at $1.95 per sq. yd. The Western Paving & Supply Co., of Indianapolis, bid $2.06 on this contract.

Buffalo, N. Y.—Bids are wanted by the Dept. of Pub. Wks. July 22 for paving Berlin St. with various kinds of pavement, of which specifications are on file with Francis G. Ward, Comr. of Pub. Wks.

Boston, Mass.—Warren Bros. Co., 143 Federal St., are laying an experimental piece of bituminous macadam waterproof pavement on Hancock St., between Derne and Mt. Vernon Sts., which is a steep grade; a 10-year guarantee is given.

Cedar Falls, Ia.—City Engr. T. R. Warriner writes that all bids opened July 7, for 17,454 sq. yds. of vit. brick paving, were rejected on account of irregularities, and new bids will be received July 18.

Davenport, Ia.—Bids are wanted July 15 for about 9,357 sq. yds. of brick paving. Thos. Murray, City Engr.

Schenectady, N. Y.—See "Sewerage and Sewage Disposal."

Independence, Mo.—It is stated that bids are wanted July 15 for 6,370 sq. yds. of macadam pavement and also for constructing sewers in District No. 22. H. H. Pendleton, City Engr.

Marinette, Wis.—Bids are wanted July 31 for a macadam pavement on Marinette Ave. D. J. Madagin, Chmn. Pub. Wks.

Long Island City, L. I., N. Y.—Bids will be received by Jos. Cassidy, Pres. Boro. of Queens, July 24, for paving several streets of the borough with asphalt.

Oneida, N. Y.—Bonds to the amount of $25,000 have been voted as the city's share of the cost of paving Main St. and Lenox Ave., and $5,000 toward the construction of the north and west side trunk sewer.

Grafton, N. D.—See "Sewerage and Sewage Disposal."

Emeryville, Cal.—Local press reports state that the following bids were opened recently for the improvement of San Pablo Ave., Park Ave., Adeline St., Magnolia St. and Peralta St.: Bidders—A, Hutchinson, Ransome & Co., of Oakland; B, J. S. Bingham, of San Francisco: Grading, A, $5,228; B, $5,228. Curbing, A, $1,528; B, $2,292. Gutters, A, $5,008; B, $7,644. Crosswalks A, $1,676; B, $1,183. Culverts, A, $3,559; B, $3,101. Bridges, A, $327; B, $327. Macadamizing, $30,928; B, $30,928. Total, A, $48,256; B, $50,706.

Detroit, Mich.—Secy. Dept. of Pub. Wks. Robt. Ogg writes that paving contracts for which bids were opened June 30, have been awarded as follows: Buchanan St., to Thos. J. Kennedy, of Detroit, at $2.00 per sq. yd. for brick paving with Berea curb, total $3,514; Woodbridge St., to Henry Merdian Co., Detroit, at $2.11 per sq. yd. for brick paving with Medina curb, total $3,106; Madison Ave., to John McLoughlin & Co., Detroit, at $1.59 per sq. yd. for cedar block paving with Medina curb; total, $2,364.

Ashland, Wis.—City Engr. M. T. Dozer writes that the following bids were opened June 25 for 17,637 sq. yds. of asphalt paving: Ellis Ave.—Western Paving & Supply Co., Milwaukee, at $2.22 for paving and 84 cts. for Kettle River curb, total $7,641; for paving other than Ellis Ave., $2.21, and 16 cts. for resetting curb, total $34.234. Barber Asphalt Paving Co., Chicago, at $2.19 for all paving, Kettle River curb on Ellis Ave. at 80 cts., total for Ellis Ave., $7.457; resetting curb at 15 cts., total for paving other than Ellis Ave., $33,882

Albany, N. Y.—State road contracts in Monroe County have been awarded as follows: W. Henrietta road to Anderson, Thomas & Brown, of Glens Falls, for $52,200; Scottsville road, to John Dunfee & Co., Syracuse, for $17,990; Clifton road, section 1, to John Dunfee & Co., for $28,757; Scottsville, road, section 2, to Anderson, Thomas & Brown, for $55,555; Webster road, sections 3 and 4, to Harry L. Smith, Long Island City, for $45,000. The contract for building Lestershire road, Broome County, has been awarded to John Dunfee for $26,000.

Jersey City, N. J.—Bids for paving were opened July 8 as follows, in each case being per cent. on the engineer's estimates: *a*, Garfield Ave. and Wilkinson Ave.; *b*, Pavonia Ave.: J. M. Shanley, Jersey City, *a* 95, *b* 92; Wm. Ormsby, Jersey City, *a* 95, *b* 90; Henry Byrne, Jersey City, *a* 87½, *b* 99; P. Tumulty, Jr., Jersey City, *a* 86, *b* 83 (awarded); M. T. Conolly Co., Jersey City, *a* 84½ (awarded), *b* 97; E. W. Conlon, Jersey City, *b* 84. The engineer's estimate on the principal items was as follows: Garfield Ave. and Wilkinson Ave.—Earth excavation, 4,760 cu. yds. at 30 cts. per cu. yd.; rock excavation, 230 cu. yds. at $2 per cu. yd.; Belgian paving, 21,200 sq. yds. at $1.25 per sq. yd.; curb stone, 7,800 lin. ft. at 65 cts. per ft.; flagging, 3,300 sq. ft. at 15 cts. per sq. ft. Pavonia Ave—Earth excavation, 270 cu. yds. at 10 cts. per cu. yd.; Belgian paving, 1,822 sq. yds. at $1.25 per sq. yd.: 550 lin. ft. stone curb at 65 cts. per lin. ft; 1,800 sq. ft. flagging at 15 cts. per sq. ft.

POWER PLANTS, GAS AND ELECTRICITY.

Parkersburg, W. Va.—The City Council is stated to have granted the Hocking Valley Gas Co. permission to pipe natural gas through the streets of the city and to residences and business places.

New Haven, Conn.—The Directors of the New Haven Gas Light Co. are reported to have voted to issue about $750,000 bonds to be used in betterments and extensions, mainly in this city.

Steelton, Pa.—A charter is reported to have been granted to the Home Electric Light, Heat & Power Co., of Steelton, with a capital of $1,000. Incorporators: Arthur P. Rupley and W. B. Boyd, Carlisle, and Stephen J. Boyd, Steelton.

Danville, Ky.—The City Council is stated to have appointed a committee composed of Dr. J. C. Bogle, E. R. Dilehay and W. G. Dunlap to investigate ways and means for the building of an electric light plant.

Cynthiana, Ky.—The Cynthiana Electric Light Co. is stated to have filed amended articles of incorporation with the Secretary of State providing for an increase of its capital stock from $33,000 to $50,000 for the purpose of enlarging its plant.

Elyria, O.—The American District Steam Co., of Lockport, N. Y., is stated to have secured the contract for installing a heating plant at Elyria for the Elyria Gas & Electric Co., for about $40,000.

Ada, O.—The Ada Hot Water Heat & Lighting Co. is reported organized, with a capital of $50,000. Morris Myers, Pres., Forest.

Bowling Green, O.—The Co. Comrs. are reported to be considering the question of installing a heating, lighting and power plant.

New Decatur, Ala.—See "Electric Railways."

Montclair, Colo.—The branch power house of the Denver Gas & Electric Co., in Montclair, is stated to have been destroyed by fire June 27.

Grand Island, Neb.—City Engr. C. A. Baldwin writes that there will not be anything done toward securing a municipal electric light plant until next spring, when it is probable a vote of the people will be taken on the matter.

Chicago, Ill.—A press report states that the Wells Bros.' Co., Girard Bldg., Philadelphia, Pa., have secured a $6,000,000 contract to erect a group of buildings for the Metropolitan Heat, Light & Power Co., in Chicago. Ten buildings will be included in the plant, which will cover an area of over 14 acres. The buildings will all be of brick and stone, of fireproof structural steel construction and will be fitted up with the latest mechanical devices.

Blairstown, Ia.—G. W. Pardey is stated to have secured a franchise for an electric light plant.

Monticello, Minn.—See "Water."

Dalton, Ga.—The Mayor writes that the contract for constructing an electric light plant complete has been awarded to the Standard Electric Co., of Charlotte, N. C., for $10,685.

La Grande, Ore.—See "Water."

Pinckneyville, Ill.—City Clk. Peter J. C. Hamm writes that the proposition to grant a franchise for electric lighting was defeated at the election held July 5: also that the City Council has decided to put in an electric light plant at a probable cost of $10,000, and bids for same will be asked in a few weeks.

ELECTRIC RAILWAYS.

Jacksonville, Fla.—The City Council has granted D. W. Eschidge, R. R. Robinson and associates, a franchise to construct a railway beginning at Clay and West Bay Sts. with a terminus at Moncrief Springs.

Oneida, N. Y.—The Oneida St. Ry. Co. is reported to have filed with the Secy. of State a statement of its intention to extend its line from Oneida over the Seneca turnpike to Vernon, Westmoreland, Kirkland, Clinton and over a portion of the Mohawk Valley R. R. tracks to New Hartford and Utica.

Bristol, Va.—The City Council is stated to have granted a franchise to the Bristol Belt Line Ry. Co. S. M. Vance, Supt., Bristol, Tenn.

Canisteo, N. Y.—The Canisteo, Jasper & Woodhull Ry. Co. has been incorporated, with a capital of $250,000, to construct and operate an electric railroad 13 miles long from Canisteo to Jasper. Directors: Leslie D. Whiting, Canisteo; Thos. Shannon, Bath; and D. C. Hunter, of Jasper.

Beaver Falls, Pa.—R. A. Whiteside, of Beaver Falls, is reported interested in the construction of an electric railway from Beaver Falls to Rochester.

Batavia, O.—The Council is stated to have granted a franchise to the Cincinnati, Georgetown & Portsmouth Electric R. R. Co.

Saginaw, Mich.—The Union Traction Co., of Saginaw, is reported incorporated by W. T. Godfrey, F. H. Farnham, Emory E. Perrin and others, of Detroit, with a capital of $50,000, to construct a railway from Saginaw to Flint and Vassar.

Hackettstown, N. J.—The Easton & Washington Traction Co. is reported to have applied for a franchise in Hackettstown. It is stated that the company proposes building a trolley road from Phillipsburg to Hackettstown, 24 miles, and from Belvidere to Clinton, 20 miles.

Elkhart, Ind.—The Winona, Warsaw, Elkhart & South Bend Electric Ry. Co. is reported organized, with a capital of $400,000. It is stated that the first portion of the road to be constructed will be from Elkhart to Nappanee, a distance of 20 miles. Incorporators: Saml. F. George, Dayton, O.; Geo. W. Scott, Troy, O., and others.

Havana, Cuba.—W. H. Park and H. G. Hamilton, of Youngstown, O.; W. McDonald & Co., Chicago, Ill.; H. Whipple, New York, N. Y., and others, are stated to have secured a franchise to construct and operate electric railway lines through Havana. The concessions are estimated to be valued at $25,000,000.

Presque Isle, Me.—The Aroostook Valley R. R. Co. has been incorporated, with a capital of $100,000, to construct a standard gauge line to be operated by electricity or compressed air, between Presque Isle, Washburn and Mapleton, 12 miles. Incorporators: Arthur B. Gould and Jas. L. Wellington, of Presque Isle; Winfield J. Cowse, of Washburn, and others.

Palmyra, N. Y.—The Newark & Marion R. R. Co. is stated to have petitioned the Highway Comrs. for a franchise.

Kansas City, Mo.—The Metropolitan St. Ry. Co. proposes to construct a new electric power plant. Engrs. in Charge, Ford, Bacon & Davis, 1500 Grand Ave., Kansas City.

Ventura, Cal.—The directors of the Ojai Valley Ry. Co. are reported to be considering the question of changing its line to electricity and extending the line to Matilija Hot Springs, a distance of 16 miles. J. H. Chaffee, of Ventura, and J. H. Adams, of Los Angeles, are among the directors.

Riverside, Cal.—The San Bernardino Valley Traction Co. is reported to be preparing to extend its line to Riverside. I. H. Curtis, Mgr., San Bernardino.

Washington, D. C.—The Washington Electric R. R. Co. is reported to be planning a power house addition to cost $100,000. Sunderland Bros., Engrs. & Archts., 12th and G Sts., N. W.

St. Louis, Mo.—The St. Louis & Suburban Electric Ry. Co. is reported reorganized. It is stated that it is proposed to issue $7,500,000 bonds, covering all the indebtedness of the old company and leaving a surplus of over $1,500,000 for improvement and extension purposes, which will be expended at once. Saml. M. Kennard, Pres.

New York, N. Y.—The Rapid Transit Comn. is stated to have passed favorably on the application of the New York & New Jersey R. R. Co. for a franchise to build an underground railroad from a terminal at Christopher St. to the ft. of Morton St., to connect with the trolley tunnel which it is building under the North River.

New Philadelphia, O.—The Councils of New Philadelphia and Strasburg are stated to have granted franchises to the Canton & Akron R. R. Co.

Geneva, O.—The Village Council is stated to have granted the Cleveland, Painesville & Ashtabula Ry. Co. a franchise to construct an electric line on East and West Main Sts.

Springfield, O.—The Bd. of Pub. Affairs has granted a franchise to the Springfield & Washington Traction Co.

Columbus, O.—The Stockholders of the Cincinnati, Georgetown & Portsmouth R. R. Co. are stated to have filed a certificate of the passage of two resolutions for branch lines, one on main line in Hamilton County, from California Junction to Coney Island, and the other in Clermont County, from Olive Branch easterly to Batavia.

New Decatur, Ala.—The City Council is stated to have granted J. T. Cross and associates, of Chattanooga, Tenn., a franchise to construct an electric street railway, light and power plant in the city.

Madrid, Me.—The Madrid St. Ry. Co. is reported incorporated to construct a line between Madrid and Township 5, a distance of about 6½ miles.

Columbus, O.—The Columbus, Newark & Zanesville Electric Ry. Co., of Columbus, has been incorporated, with a capital of $1,500,000, by J. R. Harrigan, A. C. Ralph, C. A. Alderman and others. The company proposes to build an electric railway between Newark and Zanesville, with a branch to Granville.

Zanesville, O.—The Zanesville & Southeastern Ohio Ry. Co. is reported to be taking preliminary steps toward the completion of a system of interurban electric railroads centering at Zanesville. R. K. Paige, of Painesville, and J. W. Marquand, of Zanesville, are among the directors.

Deshler, O.—It is stated that plans are being prepared for the construction of an electric railway to be known as the Deshler, McComb & Findlay Ry.

It is also reported that the branch of the Cincinnati, Hamilton & Dayton R. R. between Findlay and Deshler will probably be converted into an electric line. C. A. Wilson, Ch. Engr., Cincinnati.

Paterson, N. J.—The Jersey City, Hoboken & Paterson St. Ry. Co. was given a franchise by the Bd. of Aldermen on July 6 to construct a railway on B'way., from E. 33d St. to Passaic River. David Young, Pres., Hoboken, N. J.

Birmingham, Ala.—The City Council is stated to have granted the Birmingham Ry. Light & Power Co. permission to lay tracks on 10 blocks.

Rushville, Ind.—The City Council is stated to have granted a franchise for an electric railway to Chas. L. Henry, of Anderson, who proposes constructing a line from Indianapolis to Cincinnati via Rushville.

Portland, Ore.—The Oregon Water Power & Ry. Co. is stated to have purchased the rights and property of the Portland City & Oregon Ry. Co. It is reported that about $5,000,000 will be expended in new work. Jas. H. Morris, W. H. Hurlburt and W. T. Muir are reported interested.

Chambersburg, Pa.—A press report states that the Chambersburg, Greencastle & Waynesboro Electric Ry. is stated to have purchased the turnpike running from McConnellsburg, through Mercersburg to Greencastle, Waynesboro and to Emmitsburg, Md., a distance of 40 miles, and will build its line over that route, running first from Greencastle to Pen-Mar.

Decatur, Ind.—The City Council is stated to have granted a franchise to the Ft. Wayne, Dayton & Cincinnati Traction Co.

Rockville Center, L. I., N. Y.—The Village Trus. are stated to have granted the Mineola, Hempstead & Freeport Traction Co. a franchise to extend its line from Freeport to this village and westerly to the terminus of the Kings County Elevated line below Jamaica.

York, Pa.—The York Traction Co. is stated to have purchased a right of way from North York to York Haven, and in the near future will extend to that borough.

North Hoosick, N. Y.—A certificate is stated to have been filed with the Secy. of State providing for the extension of the Bennington & Hoosick Valley Electric Ry. from North Hoosick to Troy, from Eagle Bridge to Greenwich and from Hoosick Falls to Williamstown.

RAILROADS.

Martinsburg, W. Va.—The Baltimore & Ohio R. R. Co. is stated to have authorized the building of a line from Wilson's crossing, about 5 miles west of this place, to Harper's Ferry, a distance of about 25 miles. J. M. Graham, Ch. Engr., Baltimore, Md.

Brookfield, Mo.—A charter has been granted to the St. Louis & Northwestern R. R. Co. of Brookfield, with a capital of $1,000,000. The road is to run through Linn, Chariton, Randolph, Howard, Boone and Callaway Counties. It will be 10 miles in length. Directors: J. H. P. Parker, H. G. Marquis and others, all of Brookfield.

Philadelphia, Pa.—The Philadelphia & Western R. R. Co. is reported incorporated, with a capital of $450,000, to construct a railroad from Philadelphia to Parkesburg, a distance of about 45 miles, passing through Delaware, Montgomery and Chester Counties. Millard F. Thomson and Paul Withs, of Carlisle, are among the incorporators.

Quanah, Tex.—The Directors of the Woodward & & Quanah R. R. Co. are reported to have voted to at once survey and construct the road to Quanah, a distance of 200 miles, where connection will be made with the Houston & Texas Central.

Thibodaux, La.—A press report states that contracts for building the road and road-bed of the New Orleans & Southwestern R. R., including in its route Thibodaux, Napoleonville, Donaldsonville and intermediate points have been awarded to Garvey, McGhee & Co., of St. Louis, Mo. The contract calls for the construction of 77 miles of road between the points named.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Danville, Ky.—Competitive plans will be received by the Comrs. of the Kentucky Institute for Deaf, Danville, until July 31, for the erection of 2 additional buildings. B. O. Rodes, Pres. Bd. of Comrs.

Woodville, Pa.—Bids will be received by the Dirs. of the Poor of Allegheny County, care F. J. Osterling, Archt., Times Bldg., Pittsburg, until July 19 for the erection of an additional cottage at the Allegheny Co. Hospital for Insane, at Woodville.

Louisville, Ky.—Local press reports state that plans will be received by John H. Cowles, Clk. Fiscal Court, until July 29 for a new county jail. It must have 300 cells and cost not over $125,000.

New York, N. Y.—Bids will be received by the Bd. of Trus. of Bellevue & Allied Hospitals at ft. of E. 26th St. until July 17 for furnishing labor and material required in alterations and repairs to Bellevue Hospital and Bellevue Emergency Hospital, 223 E. 26th St. John W. Brennan, Pres. Bd. of Trus.

Windsor, Conn.—It is stated that B. F. Blood, of Waltham, Mass., will present to this city a brick and granite library, to cost from $15,000 to $20,000.

Gainesville, Fla.—See "Paving and Roadmaking."

Philadelphia, Pa.—The Trus. of Cooper Hospital are stated to have decided to erect a building north of the hospital, to be used as a home for the nurses, to cost about $20,000.

London, O.—The plans of Werner & Adkins, Mitchell Bldg., Cincinnati, are stated to have been accepted for the Carnegie Library, to cost about $15,000.

Washburn, Wis.—It is reported that the Catholic Society will erect a $25,000 church.

Bonham, Tex.—Mrs. S. B. Allen is stated to have decided to erect and present to this city a memorial hospital, to cost about $20,000.

Marysville, O.—The plans of Wilber T. Mills, 73 Wesley Blk., Columbus, are stated to have been accepted for a Presbyterian Church, to cost about $26,-000.

St. John, N. B.—In regard to report that bids were to have been opened July 9 for the erection of a $50,-000 public library, Clk. Herbert E. Wardroper writes that plans have not yet been received and that bids for construction will not be asked until plans have been approved and accepted.

Manchester, N. H.—Chickering & O'Connell, 1037 Elm St., have prepared plans for the French R. C. Church to be built at Harvard, Belmont and Silver Sts.

Kansas City, Mo.—J. O. Hogg, Kansas City, has prepared plans for a $60,000 stone church to be built at Linwood and Woodland Aves.

Camden, N. J.—Competitive plans will be received July 22 for a $10,000 bath house, for which the site 60x100 ft. has been bought.

Brenham, Tex.—The City Council is stated to have adopted plans for a new city hall.

Kingston, N. Y.—It is stated that the Trus. of the Kingston City Library will soon ask for plans for a $30,000 Carnegie Library.

Everett, Mass.—McFarland, Colby & McFarland are reported to have prepared plans for an armory for Co. B, 8th Regt., to be erected on Chelsea St. to cost about $26,000.

Buffalo, N. Y.—A permit has been issued to the Westminster Presbyterian Church Society to build a 2-story brick addition to its edifice on Delaware Ave. near North St., and to remodel the main building. The improvements will cost about $40,000.

Watertown, N. Y.—It is stated that plans have been approved for improvements to the State Armory, to cost about $27,000.

Benton, Ark.—It is reported that bids are wanted July 19 for erecting a court house for Saline Co.; probable cost, $30,000. M. H. Holleman, Comr.

Poughkeepsie, N. Y.—Bids will be received by Wm. J. Beardsley, Archt., 42 Market St., July 15, for the mason and carpenter work for the new court house and jail for Dutchess Co. Jas. H. Kipp, Chmn. Bldg. Com.

Buffalo, N. Y.—Bids for general excavation, including preliminary sewerage, sub-drainage and water connections, for the erection of the armory for the 65th Regt., N. G. N. Y., will be received by Saml. E. Lapp, Clk. Bd. of Superv., at Room No. 36, City and County Hall, Buffalo, until July 15.

Dedham, Mass.—Bids will be received by the Co. Comrs. until July 29 for the erection of a building for the Registries of Deeds and of Probate and for the Probate Court. Thos. Blanchard, Chmn. Co. Comrs. Architects, Peabody & Stearns, 919 State St. Exchange, Boston.

Los Angeles, Cal.—It is stated that bids are wanted July 28 for furnishing a complete system of cells for the county jail. C. W. Bell, Co. Clk.

Morgontown, W. Va.—F. R. Comstock, 20 E. 42d St., New York, N. Y., has completed plans for the M. E. Church, 85x116 ft., and parsonage 2½ stories high, 30x51 ft., both to be built of rock-faced stone. The architect has entire charge of obtaining estimates and the supervision of the building, including seats, glass, organ, decorations and furnishings. Plans can be seen at New York office, also office of Geo. C. Sturgiss, Chmn. of Bldg. Com., Morgantown. From the fact that Morgantown is off the main line of the B. & O. R. R., if sufficient number of contractors give notice, they may have an opportunity of seeing the plans at Connellsville, Pa.

Iowa City, Ia.—The plans of Liebbe, Nourse & Rasmusson, of Des Moines, are stated to have been accepted for the Carnegie Library, to cost about $35,000.

New York, N. Y.—Mayor Low is stated to have approved ordinances providing bond issues as follows: $425,000 for the construction of new buildings under control of the Health Dept.; $75,000 special revenue bonds for repairs for hospitals and Health Dept. buildings; $200,000 for the construction of a borough hall in Richmond; $250,000 for the erection of a court house in the Bronx, and $75,000 for the completion of the Criminal Courts Bldg. in Manhattan.

Neenah, Wis.—Thompson Bros. are stated to have secured the contract for erecting the Carnegie Library for $18,550.

Alma, Mich.—Bids are wanted July 15 for the erection of a village hall. W. W. Kinch, Village Clk.

Vincennes, Ind.—It is reported that bids are wanted July 31 for the erection of the First Christian Church; probable cost, $25,000.

Southampton, Mass.—Bids are wanted July 26 for the erection of a town hall from plans of W. H. Cadwell, of New Britain, Conn Dr. Albert C. Cobb, Chmn. Bldg. Com.

Hopkinton, Mass.—Bids are wanted July 16 for the purchase of $20,000 town hall bonds. Geo. L. Hemenway, Treas.

Orange, N. J.—The City Council is stated to have purchased a site for the erection of a city hall.

Portland, Me.—The lowest bid received by the Com. on Pub. Bldgs. July 7 for the erection of the City Home is stated to have been submitted by F. W. Cunningham for $101,000, not including heating and plumbing. The City Council is reported to have rejected all the bids.

Wilkesbarre, Pa.—Bids are wanted July 23 for erecting a court house for Luzerne Co. Address Geo. R. McLean, Co. Compt.

Houston, Tex.—The City Council is stated to have adopted a resolution providing for the issue of $200,-000 bonds for the erection of a city hall and market house.

Darlington, Wis.—Bids are wanted July 15 for the erection of an addition to the church of the Holy Rosary. H. Kilenbammer, of Platteville, Wis., Archt.

Philadelphia, Pa.—The City Council has passed an ordinance providing for the purchase of a site on Penrose Ferry Road and Eagle Creek, on which a municipal hospital will be erected.

H. C. E. Rahn, 410 Walnut St., is stated to have prepared plans for an edifice for the Bethlehem Evangelical Lutheran Church, to be erected on 30th and Diamond Sts., to cost $30,000.

Munhall, Pa.—See "Water."

Roanoke, Va.—Bishop Van de Vyver, of Richmond, is stated to have awarded to J. J. Gary the contract for erecting a hospital in Roanoke for $25,000.

Rome, N. Y.—Bids will be received by Wm. H. Cloher, Jr., Pres. Bd. Mgrs. Custodial Asylum until July 15 for construction, plumbing and electric wiring, Mortuary Bldg.; constructing a vegetable storehouse, reconstructing old buildings, including new floors, interior woodwork, steel ceilings, etc., and plumbing and electric wiring in old buildings at the Asylum.

Springfield, Ill.—It is stated that bids are wanted July 15 for erecting a 4-story addition, 46x136 ft., to St. John's Hospital. Rev. Louis Hinssen, Dir.

Sparta, Wis.—Bids are wanted July 21 for the erection of a public library from plans of Schick & Roth, of La Crosse. C. M. Masters, Chmn. Bldg. Com.

Ansonia, Conn.—Bids are wanted July 22 for the erection of a city hall. Albert F. Spencer, Chmn. Bldg. Com.

BUSINESS BUILDINGS.

Cynthiana, Ky.—It is stated that bids are wanted July 25 for erecting the Harrison Deposit Bank. Des Jardins & Hayward, Archts., 111 E. 44th St., Cincinnati, O.

Boston, Mass.—A permit has been issued for a 2-story brick and iron building on Central Sq. at Border St., E. Boston, for the Edison Illuminating Co., to contain exhibition and engine rooms, and a residence for the keeper. Builder, Whidden & Co., 43 Milk St. Architects, Winslow & Bigelow, 3 Hamilton Pl.

Dover, N. H.—J. Edw. Richardson, Dover, has prepared plans for a brick block (modern) store and apartments, to be built on Central Ave. Cost, $12,-000.

Mt. Carmel, Pa.—W. U. Jury, of Shamokin, has prepared plans for a 3-story store and office building to be erected by a syndicate of Mt. Carmel capitalists at Oak and 2d Sts. Cost, $30,000.

Muncie, Ind.—Geo. F. McCullough is about to build a 5-story 125x125-ft. business block on Walnut and Charles Sts. Address Clifford Sampson.

Chester, Pa.—A press report states that the Pennsylvania R. R. Co. will erect a station in Chester, to cost about $125,000. W. H. Brown, Ch. Engr., Philadelphia.

Deadwood, S. D.—The lowest bid received for erecting the Deadwood Hotel is stated to have been submitted by Olaf Seim for $57,211.

Omaha, Neb.—It is stated that the Storz Brewing Co. will erect a bottling house on Sherman Ave. It will be of brick, 2 stories high, and cost about $40,-000.

San Francisco, Cal.—Newton J. Thorp is stated to have prepared plans for an 8-story building to be erected on Market and 7th Sts. by Douglas Grant, to cost about $200,000.

New Castle, Pa.—It is reported that E. T. Kurtz will erect a 4-story office building, to be equipped with electric elevators; estimated cost, $60,000. S. W. Foulk, Archt., Pearson Bldg.

Washington, D. C.—Levi P. Morton is stated to have taken out a permit for the improvement of the Shoreham Hotel on 15th and H Sts., estimated to cost $200,000.

Pittsfield, Mass.—It is stated that Siegel, Cooper & Co., of New York, N. Y., will erect a branch store building at Pittsfield.

Savannah, Ga.—G. L. Normer, Equitable Bldg., Atlanta, is stated to have prepared plans for the proposed branch of the Citizens Bank of Savannah, to be erected on Liberty and Montgomery Sts. It will be 5 stories high.

Des Moines, Ia.—The Agar Packing Co. is reported to be figuring on the erection of a building at its plant to be used for warehouse purposes.

Lansing, Mich.—J. B. Edmonds, Secy. & Mgr. Bates & Edmonds Motor Co., writes that it is proposed to erect a factory building 200 ft. long, 50 ft. wide and 1 story high. It has been decided to build with cement entirely.

Denver, Colo.—It is stated that the Natl. Security & Trust Co. will erect an 8-story fireproof building on 17th and Champa Sts., to cost about $300,000. W. O. Temple, of Cripple Creek, and Henry Walker, of Denver, are reported interested.

Pittsburg, Pa.—The Shanahan Transfer Co. is stated to have decided to erect a 6-story warehouse on Forbes St., to cost about $50,000.

It is stated that Jas. C. Thompson will erect a 3-story brick building on Water St. near Wood.

Pasadena, Cal.—John Parkinson, of Los Angeles, has prepared plans for a 3-story and basement brick and frame hotel to be owned by Colin Stewart, Pasadena, and let to Weymouth Crowell, of Los Angeles. Location of building, E. Colorado St. and Los Robles Ave. Cost, $56,970.

New Haven, Conn.—A brick office building is to be erected for the New Haven Water Co. at a cost of $54,600. Carpenter, D. H. Clark, New Haven. Mason, E. H. Sperry, New Haven. Architect, L. W. Robinson, New Haven.

Lancaster, Pa.—M. S. Miller & Co. are about to erect a $20,000 brick and stone warehouse.

Los Angeles, Cal.—A. M. Edelman, Blanchard Music Hall Bldg., has prepared plans for a 4-story and basement business building to be erected on the W. side of Los Angeles St. Owner, Harris Newmark.

John Parkinson, Los Angeles, has prepared plans for a 3-story and basement wholesale building to be located on Los Angeles St. and let to Sylvester Grant. Owner, Susana M. Bernard. Cost, $32,794.

Beloit, Wis.—The American Chronograph Co. will erect a 3-story building here, 22x100 ft.

Paterson, N. J.—The Peerless Plush Mfg. Co. will rebuild at once its main mill, which was recently burned. It will be 156x42 ft. The engine room was not damaged. Otto Jaeger, Secy.

Cincinnati, O.—Jas. McLaughlin & Son., Johnston Bldg., are stated to have prepared plans for an 8-story building to be erected on 4th and Race Sts. for H. & S. Pogue Co., dry goods merchants.

Philadelphia, Pa.—Hales & Ballinger, Archts. and Engrs., have given to A. Raymond Raff the contract for the erection of building for the Oakdale Baking Co., at 10th St. and Susquehanna Ave. The building will be of slow burning construction, 3 stories and basement, about 83 ft. sq., with modern improvements. Contract price, $40,000.

Boston, Mass.—The Boston Tennis & Racquet Club has secured a permit for excavating and piling foundation to a club house to be erected on Boylston St., 152 ft., and on Hereford St., 102 ft., height 75 ft., to be fireproof construction. The Bldg. Com. consists of Saml. H. Hooper, H. D. Burnham, Louis A. Frothingham, and others. The builder is Chas. A. Dodge & Co., 79 Milk St. Carpenter, Frank L. Whitcomb, 166 Devonshire St. Architect, Parker & Thomas, 1 Somerset St.

DWELLINGS.

Boston, Mass.—Permits have been granted to Geo. W. Johnson, 342 Blue Hill Ave., to erect 3 brick 3-story apartment houses at 496-498-500 Blue Hill Ave. near Castle Gate Road; also for a 4-story brick dwelling house for Albert Stone, on Bay State Road. Estimated cost, $40,000. Builder, Connery & Wentworth, 30 Pemberton Sq. Architects, Fehmer & Page.

Rochester, N. Y.—F. A. Brockett, Granite Bldg., has prepared plans for a brick apartment house to be built at 13 & 14 Genesee St. Owner, Margaret Matthews. Cost, $20,000.

Richmond, Ind.—Plans and specifications for the $15,000 flats to be built for Albert Reed, of this city, are now ready for contractors. W. S. Kaufman, 8th and Main Sts., is the architect.

Pittsburg, Pa.—It is stated that Wayland Rupert will erect a 12-room brick residence on Denniston Ave. and Aurelia St.

Wilmington, Del.—Alexis Felix Du Pont is about to build a $20,000 brick and stone dwelling on Kennett Turnpike.

Perrot & Bissell, Bourse Bldg., Philadelphia, Pa., have prepared plans for alterations to the dwelling of Mrs. Eugene Du Pont, located on Pennsylvania Ave. and Clayton Sts. Cost, $30,000.

F. Watson, 1208 Chestnut St., Philadelphia, has prepared plans for a $30,000 brick and stone dwelling, to be erected for Wm. W. Lobdell on Pennsylvania Ave. and Broome St.

Buffalo, N. Y.—Lansing & Beirl, 371 Pearl St., has prepared plans for 3 dwellings, one to be erected on Summer St. and Norwood Ave. for Philip S. Smith to cost $20,000, and 2 to be erected on Lincoln Parkway, one for John W. Bush to cost $40,000 and the other for Myron P. Bush to cost $15,000.

SCHOOLS.

Charleston, W. Va.—Bids are wanted by the Bd. of Educ. until July 15 for furnishing material and erecting a school on Quarries St. Address Geo. Minaker, Pres.

Gainesville, Ga.—It is stated that bids are wanted July 18 for $20,000 school bonds.

Chickasha, Ind. Ter.—The citizens have voted to issue $65,000 school bonds, and bids for same will be received July 15. R. W. Scoffern, Mayor.

Redding, Cal.—It is stated that plans have been completed for a $22,000 school for West Redding.

New Haven, Conn.—Fred. W. Vanderbilt, of New York, is stated to have presented to the Sheffield Scientific School a site and money for the erection of a dormitory.

Spokane, Wash.—J. T. Hunter is stated to have secured the contract for erecting an addition to the Lincoln School, for $28,625.

South Manchester, Conn.—A press report states that Cheney Bros. will erect and present to this town a high school, to cost, with site, about $100,000.

Reading, Pa.—Jas. Matz is stated to have secured the contract for erecting an 8-room school on Douglass and Weiser Sts. for $15,385.

Clinton, Ia.—It is stated that bids are wanted July 15 for erecting a school. C. W. Ball, Mayor.

Violet, O.—It is stated that bids are wanted July 19 for erecting a school. John A. Kramer, Town Clk.

Jacksonville, Ill.—Bids are wanted July 14 for erecting a school, library and studio building for the Institution for the Education of the Deaf and Dumb. J. C. Gordon, Supt. Architect, Robt. B. Watson, Plymouth Bldg., Chicago.

Camden, N. J.—Local press reports state that bids are wanted by the Finance Com. of the Common Council until July 14 for $50,000 bonds, the proceeds to be used to erect a school.

Stockton, Cal.—The plans of Geo. Rushforth, McKee Bldg., are stated to have been accepted for a 3-story high school, to cost about $150,000.

Wilkesbarre, Pa.—Michael Lynch, 139 Moyallen St., is stated to have secured the contract for erecting a school at East End, for $30,343.

Des Moines, Ia.—The West Des Moines school bonds, amounting to $140,000, are stated to have been sold.

Allegheny, Pa.—The Bd. of School Controllers is stated to have authorized the High School Com. to erect an addition to the high school and rewire the building.

Opelika, Ala.—The plans of Ausfeld & Chapman, of Montgomery, are stated to have been accepted for a $20,000 school for Opelika.

Boston, Mass.—A permit has been filed for a 1-story brick power-house and electrical laboratory, on Clarendon St., for the Mass. Institute of Technology; 112 ft. front and 88 ft. deep. Builder, Frank B. Gilbreth, 176 Federal St. Architects, Rand & Skinner, 336 Boylston St.

Quincy, Mass.—City Engr. H. Flood writes that on June 30 the City Council appropriated $55,000 for a 10-room brick school in Ward 2.

New York, N. Y.—The following bids were opened July 1 by the Supt. of School Bldgs., Dept. of Educ., for the general construction of the DeWitt Clinton High School, Boro. of Manhatan: Louis Wechsler, $690,000; Luke A. Burke, $641,750; Wm. & Thos. Lamb, 99 Nassau St., $620,385; P. J. Walsh, $635,000; P. J. Brennan, $636,900.

McKeesport, Pa.—Bids are wanted July 18 for the installation of a flush closet system in the Walnut St. school. W. J. Roseborough, Secy. Bd. of School Controllers.

Somerset, Ky.—Bids are wanted July 21 for the erection of a 10-room brick high school, complete except heating. F. S. Allen, of Joliet, Ill., Archt. Alfred Livingston, Secy. Bd. of Educ.

Baltimore, Md.—Owens & Sisco are stated to have prepared plans for a 14-room school, to be erected at Sparrows Point by the Baltimore Co. Comrs., to cost about $30,000.

Kankakee, Ill.—The lowest bid received for erecting the high school is stated to have been submitted by A. A. Belgard, of Kankakee, for $41,135.

Athens, Ga.—The Daughters of the Confederacy will soon let the contract for erecting the Winnie Davis Memorial Hall, at the Ga. State Normal School, Athens. Approximate cost of building, $15,000.

Canton, O.—Bids are wanted Aug. 4 for the purchase of $70,000 school bonds. S. J. Harmount, Clk. Bd. Educ.

Springfield, Mass.—The plans of Gardner & Gardner, 33 Lyman St., are stated to have been accepted for an 8-room addition to the Tapley School.

Nottingham, O.—Bids are wanted by the Village Bd. of Educ. until July 23 for building a 4-room brick school. Geo. F. Hammond, 166 Euclid Ave., Cleveland, Archt.; M. J. Austin, Clk. Bd. of Educ.

Seymour, Ia.—Bids are wanted July 15 for the erection of a school in sub-district No. 5 in the Dist. Township of Monroe, Wayne Co. E. R. Sager, Secy.

Garden City, S. D.—Bids will be received at the office of Clk. J. R. Evans until July 26 for the erection of a school.

Oswego, N. Y.—Bids are wanted July 16 for ventilating and heating, new floors, electric wiring and fixtures, plumbing, etc., State Normal School. Chas. R. Skinner, State Supt. of Pub. Instruction, Albany, N. Y.

Centerville, Md.—Bids are wanted July 15 for erecting an addition to the school at Queenstown. Louis L. Beatty, Secy. School Bd., Centerville.

Troy, O.—Bids are wanted July 17 for the erection of a school on Peters Road, Concord Twp. Wm. C. Thompson, Clk. Bd. Educ., 120 W. Main St., Troy.

New York, N. Y.—Bids are wanted July 21 for alterations, repairs, etc., to heating apparatus in numerous schools in the Boroughs of Manhattan and the Bronx, and also on the same date for alterations, repairs, etc., to numerous schools in the Boro. of Queens. C. B. J. Snyder, Supt. of School Bldgs.

Kingman, O.—Bids will be received by the Bd. of Educ. of Chester Twp. at Kingman, July 19, for all labor and material for the erection of a brick school. S. P. Buckley, Clk.

Springfield, N. J.—Bids are wanted July 19 for the purchase of $17,000 school bonds. Theo. D. Sickley, Secy. Bd. Educ.

Syracuse, N. Y.—Bids are wanted July 14 for erecting additions to Elmwood and Danforth Schools. Wm. A. Jones, Clk. Bd. Contract and Supply.

Boston, Mass.—Bids are wanted July 15 for the mason, carpenter and other work required in erecting the Emerson School, Poplar St.; also for installing plumbing system in said school. R. Clipston Sturgis, Chmn. Schoolhouse Comrs.

Chicago, Ill.—Bids will be received by the Business Mgr. of the Bd. of Educ., Tribune Bldg., until July 18 for making the necessary repairs to furnaces and also galvanized iron work in connection with the ventilating apparatus in various school buildings.

Monona, Ia.—Bids will be received by Geo. H. Otis, Secy. Independent School Dist., until July 25 for installing a steam heating plant in a school in this district.

Rome, N. Y.—Bids are wanted July 16 for the erection of a school. S. M. Stevens, Clk. Bd. Educ.

Lockport, N. Y.—Bids are wanted July 25 for erecting a school on William St. from plans of W. E. Huston, of Lockport. Emmet Belknap, Clk. Bd. Educ.

Brooklyn, N. Y.—The following bids were opened July 3 by the Supt. of School Bldgs., Dept. of Educ., N. Y. City, for the general construction of School 142, Boro. of Brooklyn: Patk. K. Gray, $146,000; Peter Cleary, $151,525; Luke A. Burke, $165,750; Rutan & Henningham, $154,551; Wm. & Thos. Lamb, $154,152.

Bids opened at the same time for heating apparatus in *a*, School 85; *b*, Girls' High School; and *c*, Erasmus Hall High School annex, Boro. of Brooklyn, were as follows: Frank Dobson, *a* $3,384, *b* $6,670, *c* $2,662; Blake & Williams, *a* $2,583, *b* $6,227, *c* $2,482; Williams & Gerstle, *a* $2,887, *b* $7,954, *c* $2,373; Evans, Almirall & Co., *a* $3,393, *b* $5,165, *c* $2,363; John Hankin & Bro., *a* $2,797, *b* $7,297, *c* $3,177; United Htg. Co., *a* $3,945, *b* $7,260, *c* $2,990; Dowdeswell Bros., *a* $3,599, *b* $7,398, *c* $2,865.

Long Island City, N. Y.—The following bids were opened July 3 by the Supt. of School Bldgs., Dept. of Educ., N. Y. City, for installing alterations in and additions to the heating and ventilating apparatus in School 34, Boro. of Queens: United Heating Co., $8,568; John W. Petry, $11,094; Blake & Williams, $7,634; Williams & Gerstle, $7,997; Frank Dobson, 218 E. 42d St., N. Y. City, $7,525; Evans, Almirall & Co., $9,125; John Anderson & Son, $9,179; John Hankin & Bro., $8,587.

Bids opened at the same time for installing alterations in and additions to heating and ventilating apparatus in School 1, Boro. of Queens: John Hankin & Bro., $6,087; Blake & Williams, $6,135; Frank Dobson, $5,782; John W. Petry, $6,433; Williams & Gerstle, 347 E. 44th St., N. Y. City, $5,679; United Heating Co., $7,432.

STREET CLEANING AND GARBAGE DISPOSAL.

Oakland, Cal.—R. F. Jackson, Secy. Bd. of Pub. Wks., writes that the contract for cleaning the streets by machinery for the year ending June 30, 1903, has been let to J. Martin, 53 Valley St., Oakland, at $6.45 per lin. mile per day.

Massillon, O.—Press reports state that the matter of garbage disposal plant is under consideration.

Lewiston, Me.—This city is said to be considering the question of garbage dispesal.

GOVERNMENT WORK.

Vicksburg, Miss.—The Vicksburg National Park Comrs., Capt. Wm. T. Rigby, Chmn., have asked for bids on the following work: 6 miles of the graduation and drainage of Confederate Ave.; 70,000 cu. yds. excavation and about 40 pipe drains with brick headwall having dressed stone copings; also for 3 steel viaducts, to cross Glass Bayou, the Ala. & Vicksburg R. R. and Stouts Bayou. It is stated that bids will be asked in the near future for furnishing chert, gravel, or macadam, about 15,000 cu. yds., to be delivered on the road to roller.

Freeport, Ill.—Bids are wanted at the Treasury Dept., Washington, D. C., until Aug. 6 for the installation of a conduit and electric wiring system for the U. S. Post Office at Freeport, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted July 15 for repairs to the heating and steam plants in the U. S. Treasury and Winder Bldgs., Washington. Jas. Knox Taylor, Superv. Archt., Treas. Dept.

Plattsburg Barracks, N. Y.—Bids are wanted July 30 for constructing hospital stewards' quarters at this post. Address Quartermaster.

Cumberland, Md.—The contract for constructing the U. S. public building at Cumberland has been awarded to Arthur Cowsill, of Washington, D. C., for $96,936.

Cincinnati, O.—Bids will be received by Maj. Ernest H. Ruffner, U. S. A., at the U. S. Engr. Office, 415 Custom House, Cincinnati, until Aug. 4 for building concrete abutment, with crib, at Dam No. 1, Big Sand River, W. Va., opposite Catlettsburg, Ky.

Ft. D. A. Russell, Wyo.—Bids will be received by Maj. J. W. Pope, Ch. Q. M., Denver, Colo., until Aug. 2 for installing a steam heating plant in commanding officer's quarters at Ft D. A. Russell.

Chilocco, Okla. Ter.—Bids are wanted July 28 for furnishing and delivering at the U. S. Indian School, Chilocco, 2 200-H. P. boilers, 2 pumps for hot water, 2 steam traps, 1 elevator, 2 motors, 45 bbls. cement, etc. S. M. McCowan, Supt.

Fergus Falls, Minn.—Bids are wanted at the Treasury Dept., Washington, D. C., until Aug. 18 for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Court House and Post Office at Fergus Falls, as advertised in The Engineering Record.

Ft. Bayard, N. Mex.—Bids are wanted at office of Capt. H. M. Powell, Q. M., until July 31 for constructing an officers' hospital and installing necessary heating apparatus and plumbing.

Washington, D. C.—Bids are wanted at the office of the 2d Asst. Postmaster Gen., Post Office Dept., until Aug. 14 for the performance of mail service by pneumatic tubes, or other similar devices, at the following cities: Boston, Mass.; Brooklyn, N. Y.; New York, N. Y.; St. Louis, Mo.; Philadelphia, Pa.; Washington, D. C., and Chicago, Ill.

Boston, Mass.—See "Paving and Roadmaking."

Prima Agency, Ariz.—Bids are wanted at the Office of Indian Affairs, Dept. of Interior, Washington, D. C., until July 31 for constructing a brick building for employes' quarters and mess hall at Prima Agency. W. A. Jones, Comr.

Ft. Monroe, Va.—The Special Army Bd. appointed to report a plan for the improvement and development of the military reservation at Ft. Monroe has reported, recommending the following appropriations: Building construction, $936,000; roads, walks and grounds, exterior to the post, $50,000; sea wall and grading along Hygeia Hotel site, $25,000; sea wall and grading west of Sherwood Hotel, $20,000; total, $1,031,000.

Winthrop, Mass.—Bids are wanted Aug. 7 for erecting a brick hospital at Ft. Banks, Winthrop. A. W. Chase, Q. M.

Denver, Colo.—The following bids were opened July 7 at the Treasury Dept., Washington, D. C., for the mechanical equipment (except engines and generators), including plumbing, water supply, steam power plant, etc., heating apparatus, mechanical ventilation, electric wiring and conduits, switchboards, elevators and non-conducting covering for the U. S. Mint at Denver: *a*, atmospheric; *b*, vacuum: Allen Black, St. Paul, *b* $174,000; S. Faith & Co., Philadelphia, *a* $127,300, *b* $126,900; J. F. Buchanen & Co., Philadelphia, *a* $128,850, *b* $128,450; Thomas & Smith, Chicago, *a* $166,053, *b* $168,769; The Chris. Irving Co., Denver, *a* $153,626, *b* $156,883; H. B. Crain, Cincinnati, *a* $164,929, *b* $166,929; C. B. Kruse Htg. Co., Milwaukee, *a* $137,426, *b* $138,200; The Michael Htg. Co., Denver, *a* $197,027, *b* $200,874; Jos. M. Williams Co., Louisville, *a* $147,498, *b* $147,278.

Washington Barracks, D. C.—The Washington "Star" states that Capt. John S. Sewell, Corps of Engrs., has been assigned to the duty of superintending the construction of the Army War College and auxiliary buildings at Washington barracks. About $1,125,000 has been appropriated for the improvement of the military reservation known as Washington barracks, and of this sum about $400,000 is to be utilized in the construction of the War College building.

Chicago, Ill.—The following bids were opened on June 23 by Maj. J. H. Willard, Corps of Engrs., U. S. A., for constructing 2 miles of trunk, western section, Illinois & Mississippi Canal:

Bidders.	Mile 58, 86,337 cu. yds. Cts.	Mile 59, 112,104 cu. yds. Cts.	Total.
Callahan Bros. & Katz, Omaha	9.99	11.61	$21,640
Flynn Bros., Annawan, Ill....	11.4	24	36,747
Cogan & Pound, Chicago.....	14	22	36,750
John J. McCaughey, Chicago..	12.79	16.78	29,854

Amount available for this work, $25,000.

MISCELLANEOUS.

New York, N. Y.—Mayor Low has approved the ordinances providing for a $1,000,000 bond issue for the water grant improvements in charge of the Dock Dept.

Boston, Mass.—The following bids were opened July 3 by the Bd. of Harbor & Land Comrs. for dredging about 61,000 cu. yds. of material from the Commonwealth Flats at South Boston and dumping same at sea; prices are per cu. yd., measured in scows: Eastern Dredging Co., 22½ cts.; Emory R. Seward, N. Y. City, 23 cts.; Bay State Dredging Co., Boston, 20½ cts.; Morris & Cummings Dredging Co., N. Y. City, 17.4 cts.; J. S. Packard Dredging Co., 425 Angell St., Providence, R. I., 14⅞ cts. (awarded).

Buffalo, N. Y.—Bids are wanted July 19 for $100,000 abatement nuisance of Ohio Basin Slip bonds. F. W. M. Heerwagen, Compt.

Portland, Ore.—Bids are wanted July 25 (readvertisement) for a floating wooden drydock in 5 sections, according to plans of Jas. E. Blackwell, Dexter Horton Bldg., Seattle, Wash. E. T. C. Stevens, Clk. Bd. Port of Portland Comn.

Lebanon, Pa.—The City Engr. has made estimates for both a concrete and a rubble masonry channel around the southwestern part of the city, for the purpose of remedying the floods that have from time to time done much damage. The work will involve the expenditure of some $40,000. Abram Hess, Mayor; I. L. Beckley, City Clk.

Port Hawkesbury, N. S.—Bids are wanted at the office of the Dept. of Pub. Wks., Ottawa, Ont., until July 19, for the reconstruction and extension of the "Long Wharf" at Port Hawkesbury. C. E. W. Dodwell, Res. Engr., Halifax, N. S.

Boston, Mass.—Bids are wanted July 31 for building a stone breakwater at entrance to Apponagansett Harbor, Buzzards Bay, as advertised in The Engineering Record.

New York, N. Y.—The following bids were opened July 8 at the office of the Dept. of Docks & Ferries, for furnishing and delivering, Class I, 7,000 bbls. of slow setting, and Class II, 3,000 bbls. of quick setting Portland cement; prices are per bbl. and the same for both classes of cement: John P. Kane Co., 287 4th Ave. (awarded), at $1.72; John E. Sparrow, 15 Whitehall St., at $2.23.

Baltimore, Md.—The Baltimore & Ohio R. R. Co. is stated to have accepted plans for an iron pier at Locust Point to cost $600,000. The new structure will be 800 ft. long, 50 ft. high, 160 ft. wide, and have two decks, upon each of which tracks will be laid.

NEW INDUSTRIAL PLANTS.

P. A. Chum & Co., Rochester, N. Y., have let a contract for a brass foundry and machine shop, to be about 100x329 ft., and will install a 100-H.-P. engine, a boiler and probably a crane.

The North Dakota Mill & Grain Co., Courtenay, N. D., will rebuild its mill, recently burned. The mill will have a capacity of 100 bbls., grain storage of 25,000 bu. and will be of fireproof construction. The steam plant was not damaged, and it is probable that electric motors will be installed.

The Oelwein, Ia., Foundry & Machine Co. will have a 156x92-ft. iron and brass foundry. The power will be partly electric and partly steam. The former will be purchased, and the latter will require a boiler of about 40 H.-P. and an engine of about 25 H.-P.

The American Knit Goods Mfg. Co., Wythe Ave. & Penn St., Brooklyn, N. Y., is erecting an additional mill of 7 stories and 100x125 ft. Electricity will be used for power.

The Farmers' Grain Association, York, Neb., wants bids for a 10,000-bu. elevator, to be run by a 10-H.-P. gasoline engine.

The National Rolling Mill Co., Hartford City, Ind., is putting in a scrap and a puddle furnace, extending its building, which is 70 ft. wide, about 30 ft. The company is figuring on putting in an electric light plant having about 30 arc lights, and may possibly put in a gas producer before winter.

The Meehan & Rounds Lumber Co., Siding, Miss., will erect a planing mill.

The Arcadia, La., Cotton Oil Mill & Mfg. Co. will erect a 2-press cotton-oil mill. The power plant will consist of two 16-ft. horizontal tubular boilers of 60-in. diameter and a 16x36-in. Corliss engine.

The American Fire Brick Co., Empire State Bldg., Spokane, Wash., will erect a 56x120-ft. building, partly 3 stories, for making fire brick, coke ovens, furnace block and sewer pipe. The power plant will consist of two 16-ft. high-pressure boilers of 60-in. diameter and a 100-H.-P. automatic engine.

The Modern Buggy Co., Auburn, Ind., is erecting a 4-story factory building, about 81x193 ft., and a 25x41-ft. engine and boiler room. Electricity will be used for power, and all machines will be run with motors. The capacity of the power plant will be about 65 H.-P.

The Baldwin Locomotive Works, Philadelphia, are building a 400x80-ft. addition to their boiler shop, a 4-story 180x72-ft. addition to the tank and tender shop and a 160x100-ft. power house, to have a capacity of 3,000 H.-P.

The Cleveland Cliffs Iron Co., Negaunee, Mich., is interested in the erection of a manufacturing plant in Munising, Mich.

The Hockensmith Wheel & Mine Car Co., Irwin, Pa., will erect a 225x60-ft. foundry and machine shop, 175x50 ft. blacksmith and wood shop, 2-story, 125x25 ft. pattern and storage building, 50x50-ft. power house and a 30x20-ft. office building.

The foundry and pattern-storage house of the Union Steam Specialty Co., Scranton, Pa., has been burned, and plans are being prepared for a 100x250-ft. brick building, to be equipped with an electric traveling crane. A new cupola, blower, engine, molding machine and foundry appliances will be purchased.

For ice plant at Gueydan, La., see Water.

The W. G. Browne Mfg. Co., Kingston, N. Y., makers of hardware specialties, is erecting a 2-story, 30x80-ft. brick factory with 2 story, 30x50 and 12x15 ft. additions. The company expects to use steam for power.

The Elgin, Ill., National Watch Co. will erect a 4-story and basement fireproof addition consisting of a 46x75-ft. central pavilion, with a 190x30-ft. wing on each side. The machinery to be installed will be driven by induction motors, taking current from the central power plant, which is of ample capacity.

BUSINESS NOTES.

The L. H. Prentice Co., Chicago, contractor for heating and ventilation plants, announces that it has opened a New York office at 114-118 Liberty St., which will be under the management of A. L. Canfield, who will represent the company in the territory east of and including Pittsburg.

The Boston Elevated Railway has executed a contract with the Green Fuel Economizer Co. for installing several economizers at the central power station.

Cass Harkins, Columbus, has been appointed sole agent for Central Ohio for the We-Fu-Go and Scaife water-softening and purifying systems, manufactured by Wm. B. Scaife & Sons Co., of Pittsburg, Pa.

The Ashton Valve Co., Boston, has appointed W. R. Baldwin as special sales agent, with office at the Union Trust Bldg., Baltimore.

The Garden City Fan Co. has finished erecting the buildings of its plant at Niles, Mich., and will soon have it in operation. There is a 50x100-ft. foundry, four wood-working rooms of 40x50-ft. each, a 36x40-ft. pattern vault, a cupola, two 40x140-ft. and two 40x110-ft. machine rooms, a 40x50-ft. fan room, a 26x30-ft. engine room and a 40x18-ft. boiler room. The main offices of the company will remain at 42 South Clinton St., Chicago. The company is owned by W. W. and E. D. Green.

On July 1 the Thomson Meter Co., Brooklyn, stamped its 211,218th meter; the meters are stamped only as they are sold.

The Lead Lined Iron Pipe Co., Wakefield, Mass., has been compelled to enlarge its plant to handle some large orders recently taken as well as to accommodate its increased regular business.

The electric power plant of the new United States Steel Building at Duluth, Minn., will consist of a 75 Kw Westinghouse generator direct-connected to a tandem compound engine built by the Ball Engine Co., Erie, Pa.

An electric plant will soon be installed in the Deaf and Dumb Asylum at Austin, Tex., the unit to consist of a tandem compound engine built by the Ball Engine Co., Erie, Pa., direct connected to a Westinghouse 90 Kw. alternator.

The Delaware, Lackawanna & Western Railroad Co. awarded the contract to the Pittsburgh Filter Mfg. Co. for the construction of two water softening plants of the intermittent type for the Buffalo Division. These plants will each have a daily capacity of 200,000 gals. and will be located on the ground adjacent to the pumping station. The work will be completed in about forty five days.

The Pittsburgh Gage & Supply Co., Pittsburgh, Pa., reports the following recent sales of White Star oil filters: Rockingham Co. Light & Power Co., Portsmouth, N. H.; Nashville, Tenn., Electric Light Co.; Hamburg Railway Co., Blasdell, N. Y.; P. R. Mitchell Co., Cincinnati, O.; Superior, Neb., Electric Light Co.; Kankakee, Ill., Water Supply Co.; Carnegie, Pa., Tube Co.; Silver King Mfg. Co., Park City, Utah; Army & Navy Hospital, Hot Springs, Ark.; Seattle, Wash., Electric Light Co.

PRCPOSALS OPEN.

Bids Close	WATER WORKS	See Eng. Record
July 15	Ronceverte, W. Va.	July 12
July 15	Providence, R. I. Adv., Eng. Record, July 5, 12.	July 5
July 15.	Newcastle, N. B.	July 5
July 15.	Calcutta, India	June 28
July 15.	Independence, Wis	June 28
July 16	Elkland, Pa. Adv. Eng. Record, July 12	July 12
July 16	Paulding, O.	June 28
July 17	Mains Mitchell, S. D.	July 12
July 17	Austin, Pa. Adv. Eng. Record, July 5, 12	July 5
July 18	St. Louis, Mo.	July 5
July 21	Well, Artesian, S. D.	July 12
July 21	Stoneboro, Pa.	July 12
July 23	Mt. Gilead, O. Adv., Eng. Record, July 12	July 12
July 23.	Muskogee, Ind. Ter. Adv., Eng. Record, June 28	June 28
July 24	Pumping plant, Brooklyn, N. Y. Adv., Eng. Record, July 12	July 12
July 24.	Caldwell, Idaho	July 12
July 24	Pipe, etc., Hammonton, N. J. Adv., Eng. Record, July 12.	July 12
July 24.	Standpipe, Hammonton, N. J. Adv., Eng. Record, July 12.	July 12
July 25.	Boston, Mass. Adv., Eng. Record, July 12.	July 12
Aug. 13.	Engines, Chicago, Ill. Adv., Eng. Record, June 21, 28.	June 14
Aug. 15.	Monterey, Nuevo Leon, Mex. Adv., Eng. Record, July 12.	June 21
	Rice Canal, Beaumont, Tex.	July 12

SEWERAGE AND SEWAGE DISPOSAL.

July 14.	Syracuse, N. Y.	July 12
July 15.	Olathe, Kan.	July 12
July 15.	East Liverpool, O.	July 12
July 15.	Cleveland, O.	July 12
July 15.	Kendallville, Ind.	July 12
July 15.	Schenectady, N. Y.	July 12
July 15.	Waterbury, Conn. Adv., Eng. Record, June 28 to July 12.	July 12
July 16.	Buffalo, N. Y.	July 12
July 16.	Kansas City, Mo.	July 12
July 16.	Buffalo, N. Y.	July 5
July 16.	Fairfield, Ia.	June 28
July 17.	St. Paul, Minn.	July 12
July 17.	Cleveland, O.	June 28
July 18.	Mansfield, O.	July 12
July 18.	New York, N. Y.	July 12
July 18.	San Juan, P. R. Adv., Eng. Record, July 5.	July 5
July 19.	Youngstown, O.	July 12
July 19.	Zanesville, O.	July 12
July 19.	South Brooklyn, O.	July 5
July 20.	Westfield, Mass.	July 12
July 21.	Bronxville, N. Y.	June 28
July 21.	Canton, O.	July 12
July 21.	Redfield, S. D.	July 12
July 21.	Fayette, O.	July 12
July 21.	Cincinnati, O.	July 12
July 21.	Carbondale, Ill.	July 12
July 21.	Des Moines, Ia.	July 5
July 22.	Cleveland, O.	July 12
July 22.	Columbia, Mo.	July 12
July 22.	White Plains, N. Y.	July 12
July 22.	Binghamton, N. Y.	July 5
July 22.	Des Moines, Ia.	July 5
July 23.	Lockhart, Tex.	July 12
July 23.	Des Moines, Ia.	July 12
July 23.	Muskogee, Ind. Ter. Adv., Eng. Record, June 28.	June 28
July 24.	Des Moines, Ia.	July 12
July 24.	Long Island City, L. I., N. Y.	July 12
July 25.	Monticello, Ind.	July 12
July 26.	De Pere, Wis.	July 12
July 26.	Grafton, N. D.	July 12
July 31.	Williamsport, Pa. Adv., Eng. Record, June 28, July 5.	June 28
Aug. 2.	Culverts, Cincinnati, O.	July 12
Aug. 4.	Canton, O.	July 12
Aug. 4.	Cincinnati, O.	July 12
Aug. 4.	Ardmore, Pa.	July 12
Aug. 6.	Abilene, Kan. Adv., Eng. Record, July 12.	July 12
Aug. 12.	Machinery, New Orleans, La. Adv., Eng. Record, June 7 to July 12.	June 7
Aug. 12.	Construction, New Orleans, La. Adv., Eng. Record, June 7 to July 12.	June 7
Aug. 15.	Monterey, Nuevo Leon, Mex. Adv., Eng. Record, July 12.	June 21

BRIDGES.

July 17.	Boston, Mass.	July 12
July 17.	Danville, Ill.	July 12
July 18.	Mansfield, O.	July 12
July 18.	Indianapolis, Ind.	June 28
July 19.	Craig, Mont.	July 5
July 21.	Chillicothe, O.	July 12
July 21.	Ft. Benton, Mont.	June 28
July 22.	Monticello, Ill.	July 12
July 22.	S. Michigan St., Buffalo, N. Y. Adv., Eng. Record, July 12.	July 12
July 22.	So. Park Ave. Supers., Buffalo, N. Y.	July 12
July 24.	St. Clairsville, O.	July 5
July 26.	Wilkesbarre, Pa.	July 12
July 26.	Tipton, Ind.	July 12
July 26.	Tupperville, Ont.	July 12
July 26.	Akron, O.	July 5
July 28.	Chicago, Ill. Adv., Eng. Record, June 28, July 5.	June 28
July 29.	St. Louis, Mo.	July 12
Aug. 1.	Manston, Wis.	July 12
Aug. —	Columbus, O.	June 28
Sept. 3.	Chicago, Ill.	July 12
Sept. 9.	Caldwell, Idaho	July 12
Sept. —	Bridge plans, St. Petersburg, Russia	Sept. 21
——	Vicksburg, Miss.	July 12

PAVING AND ROADMAKING.

July 14.	Syracuse, N. Y.	July 12
July 14.	Norristown, Pa.	July 12
July 15.	Schenectady, N. Y.	July 12
July 15.	Jersey City, N. J.	July 12
July 15.	Independence, Mo.	July 12
July 15.	Davenport, Ia.	July 12
July 16.	Baltimore, Md.	July 12
July 16.	Buffalo, N. Y.	July 12
July 16.	Kansas City, Mo.	July 12
July 18.	New York, N. Y.	July 12
July 18.	Mansfield, O.	July 12
July 18.	Cedar Falls, Ia.	July 12
July 18.	St. Louis, Mo.	July 5
July 18.	Springfield, O.	June 28
July 19.	Boston, Mass.	July 12
July 19.	Greenville, O.	July 12
July 19.	Pembroke, Ont.	July 12
July 19.	Sheboygan, Wis.	July 12
July 21.	Curbing, Kansas City, Mo.	July 12
July 21.	Jellico, Tenn. Adv., Eng. Record, July 12.	July 12
July 21.	Union, N. J.	July 12
July 21.	Des Moines, Ia.	July 5
July 21.	Michigan City, Ind.	July 5
July 22.	Cincinnati, O.	July 12
July 22.	Buffalo, N. Y.	July 12
July 22.	Philadelphia, Pa.	July 12
July 22.	Steubenville, O.	July 5
July 22.	Napoleon, O.	July 5
July 23.	North Adams, Mass. Adv., Eng. Record, July 12.	July 12
July 23.	Brooklyn, N. Y.	July 12
July 23.	Mt. Pleasant, O.	July 5
July 23.	Dayton, O.	July 5
July 24.	Upper Sandusky, O.	July 12
July 24.	Long Island City, L. I., N. Y.	July 12
July 24.	Centerville, Ind.	July 12
July 26.	Sheet asphalt, Washington, D. C. Adv., Eng. Record, July 12.	July 12
July 26.	Block asphalt, Washington, D. C. Adv., Eng. Record, July 12.	July 12
July 26.	Washington, D. C. Adv., Eng. Record, July 12.	July 12
July 28.	Springfield, O.	July 12
July 28.	Cincinnati, O.	July 5
July 29.	Portsmouth, O.	July 12
July 29.	St. Louis, Mo.	July 12
July 30.	Peoria, Ill.	July 12
July 31.	Marinette, Wis.	July 12
Aug. 1.	Lancaster, O.	July 12
Aug. 5.	Jeffersonville, Ind.	July 12
Aug. 5.	Cincinnati, O.	July 12
Aug. 11.	Toledo, O.	July 12
——	Vicksburg, Miss.	July 12
—	Schenectady, N. Y.	July 12

POWER, GAS AND ELECTRICITY.

July 16.	Gallipolis, O.	July 5
July 16.	Norristown, Pa.	June 14
July 21.	Cedar Falls, Ia.	June 28
July 22.	Newcastle, N. B.	July 5

GOVERNMENT WORK.

July 14.	Dam, Wheeling, W. Va. Adv., Eng. Record, June 21 to July 12.	June 21
July 15.	Washington, D. C.	July 12
July 15.	Cribs, Wheeling, W. Va. Adv., Eng. Record, June 21 to July 12.	June 21
July 17.	Tampa, Fla.	May 31
July 18.	Ft. Hunt, Va.	June 28
July 18.	Ft. Washington, Md.	June 28
July 19.	Paving, Boston, Mass.	July 12
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July 28.	Chicago, Ill. Adv., Eng. Record, June 28 to July 12.	June 28
July 28.	Boilers, etc., Chilocco, Okla. Ter.	July 12
July 28.	Butte, Mont. Adv., Eng. Record, June 14, 21.	June 14
July 29.	Heating, Joliet, Ill. Adv., Eng. Record, July 5, 12.	July 5
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July 30.	Aberdeen, S. D. Adv., Eng. Record, June 21, 28.	June 21
July 31.	Hospital, Ft. Bayard, N. Mex.	July 12
July 31.	Prima Agency, Ariz.	July 12
July 31.	Wiring, etc., Joliet, Ill. Adv., Eng. Record, July 5, 12.	July 5
Aug. 1.	Ft. Totten, N. Y. Adv., Eng. Record, July 5, 12.	July 5
Aug. 2.	Htg. bldg., Ft. D. A. Russell, Wyo.	July 12
Aug. 4.	Crib work, Cincinnati, O.	July 12
Aug. 5.	Brunswick, Ga. Adv., Eng. Record, June 21, 28.	June 21
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Aug. 7.	Hospital, Winthrop, Mass.	July 12
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Aug. 12.	Denver, Colo. Adv., Eng. Record, June 28, July 5.	June 28
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July 15.	School, Clinton, Ia.	July 12
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July 15.	Aslyum improv., Rome, N. Y.	July 12
July 15.	Village hall, Alma, Mich.	July 12
July 15.	School, Centreville, Md.	July 12
July 15.	Hospital, Springfield, Ill.	July 12
July 15.	School, Boston, Mass.	July 12
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July 16.	School, Rome, N. Y.	July 12
July 16.	Pub. bldg., Paterson, N. J.	July 5
July 16.	Schools, St. Paul, Minn.	July 5
July 16.	Htg. Court House, Norristown, Pa.	June 21
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July 17.	School, Valley Crossing, O.	June 28
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July 18.	Htg. school, Chicago, Ill.	July 12
July 19.	Hospital, Woodville, Pa.	July 12
July 19.	School, Violet, O.	July 12
July 19.	Court house, Benton, Ark.	July 12
July 19.	School, Kingman, O.	July 12
July 21.	School, Somerset, Ky.	July 12
July 21.	Library, Sparta, Wis.	July 12
July 21.	School work, New York, N. Y.	July 12
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July 22.	City hall, Ansonia, Conn.	July 12
July 23.	Court house, Wilkesbarre, Pa.	July 12
July 23.	School, Nottingham, O.	July 12
July 23.	School, Cleveland, O.	July 5
July 23.	City Hall, Sheldon, Ia.	July 5
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July 25.	School, Lockport, N. Y.	July 12
July 25.	Htg. school, Monona, Ia.	July 12
July 25.	School, Sandusky, O.	July 5
July 25.	Pub. bldg. plans, Milwaukee, Wis.	June 28
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July 26.	Pub. bldg., Columbus, O.	July 5
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A Single Grade of Steel for Bridges and Other Structures.

Among other subjects discussed at the fifth annual meeting of the American Section of the International Association for Testing Materials, held at Atlantic City last month, that relating to the use of a single grade of structural steel for all ordinary construction in that metal has attracted much attention. The purpose of that discussion was to discover if possible whether it is desirable or feasible to secure the adoption of a single grade of structural steel in bridges and buildings, and to extend the use of that single grade of metal possibly to at least a large portion of ships' frames and hulls. One prominent feature which characterized at first the partial use and then the exclusive use of steel in structural work was the great range in the grade of metal employed. In the early days of steel construction metal possessing as much as 90,000 to 100,000 pounds per square inch ultimate tensile resistance was at times specified. The great difficulties attending the satisfactory shop manipulation of such a metal soon excluded it from use. A high grade of steel, however, has been used, at least in some cases, for the compression members of bridges until quite recently and possibly this is true even at the present time. The erratic developments which at first followed the shop treatment of steel in bridge members in some cases, prompted the great majority of engineers to avoid those classes or grades of metal in which the amount of carbon ran comparatively high, for all those members subjected to the operation of forging. High steel under such circumstances was exclusively employed for those members subjected only to operations in which heating for forging was avoided. A lower grade of metal whose behavior under forging was more like wrought iron was reserved for eye bars or other forged members.

As experience with steel structures and the manufacture of steel structural members expanded it was found that in a great majority of cases low steel with an ultimate tensile resistance running perhaps not higher than about 65,000 pounds per square inch could be punched and riveted, under suitable conditions with nearly the same immunity from erratic results as wrought iron. It was also found that a soft or low grade of steel possessing an ultimate tensile resistance of 52,000 to 60,000 pounds per square inch made an almost ideal rivet material. Out of all those various results and others of a similar nature there have been evolved by different engineers correspondingly diversified specifications for various grades of steel supposed to be specially adapted each to its own particular class of members. The simplest resulting classification has been that in which all grades of steel are divided into "soft or low," "medium" and "high." There have not been lacking specifications in which intermediate qualities have been recognized or prescribed, but generally the three principal grades named have during the past few years covered all the steel usually employed in bridges and buildings, although a separate and higher grade of steel has been generally preferred for steel castings.

These results have naturally caused the mill managers considerable trouble and annoyance, which have indeed been shared to some extent by civil engineers. The situation has therefore led naturally, if not inevitably, to the discussion at the Atlantic City meeting of the American Section of the International Association, to which reference has already been made. The predominant tone of this discussion, as well as that of other discussions in some local organizations of civil engineers, appears to be in favor of a single grade of steel for all ordinary structural purposes as existing either in bridges or buildings, although it is not quite clear whether a considerable portion of those in favor of nominally a single grade would not except either rivet or pin steel or both from that main single grade. The tendency in these discussions has been to advocate for this standard an ultimate resistance generally varying between about 55,000 and 65,000 pounds per square inch, although there has not been unanimity in regard to these limits. It seems furthermore to be the opinion that such metal need not be drilled or reamed, and that the principal advantage to be gained from its use arises from the fact that it may be punched and riveted like wrought iron.

Undoubtedly convenience and simplicity would be enhanced both in specifications and in construction by the adoption of such a standard metal, but there are some serious considerations connected with such a step. There are many experienced engineers who probably would object most strongly to the omission of reaming of punched holes even in that mild grade of steel. Again, there are others who are by no means satisfied with simple punching and riveting to produce as high a grade of results of manufacture as is desirable. They even go so far as to believe that reaming and in many cases drilling are to be desired in the interests of improved shop results. Nor is it certain that it is yet advisable to use generally for rivets metal that may run as high in ultimate resistance as 65,000 pounds per square inch. It is also practically certain that some prominent engineers desire to secure the advantage of a high working unit stress in compression members and believe that such results can be more rationally attained with steel of ultimate resistance running from perhaps 62,000 to 70,000 pounds per square inch or, possibly higher, than from the lower grade which would constitute the single standard grade of metal. Simplicity and uniformity are certainly most desirable and valuable characteristics in either specifications, design or construction, but it may be a matter of reasonable doubt whether the effort to secure simplicity and uniformity may not be pursued too far when it excludes from use particular grades of steel that are specially adapted to certain structural conditions or to the attainment of certain necessary results. It is quite possible that the nicer and more accurate shop processes may be both judicious and economical when the design of members for long spans, for instance, is in question, and in any case the adoption of a low or soft grade of steel for rivets, and another but higher grade for the main truss members, both tension and compression, and possibly also for pins, may be too judicious to be abandoned. A steel having an ultimate tensile resistance between 58,000 and 66,000 pounds per square inch is a most admirable material for both tension and compression members in all ordinary structural work either of bridges or buildings, and it would probably give neither engineers nor manufacturers any sensible inconvenience to use it in such a field in connection with a special grade for rivets, and even another but higher grade for pins, although in all ordinary cases the higher grade would not be needed. It does not seem probable that the radical measure of resorting exclusively to a single grade of steel will find favor with a sufficient number of experienced engineers to secure uniform adoption, although it would be quite reasonable to adopt a single grade for tension and compression members in all ordinary bridge or building work.

Malaria and Mill-ponds are so closely associated, according to the Alabama Supreme Court in Richards v. Daugherty, 31 S. Rep. 934, that such a pond, although in use about ten years, has been declared a nuisance and ordered to be abated. The complainant in the case agreed to the construction of the pond originally, and advised the defendant concerning the plans, but these acts were held to be no bar to his subsequently procuring the abatement of the pond, when it was found that his family suffered severely from malaria after it was formed.

The Louisiana Purchase Exposition has such exceptional resources at its command that it will be marked by features of management that have never before been possible. The appropriation of $5,000,000 by Congress was only made after satisfactory proof had been furnished that the exposition company had raised $10,000,000, so that financially the enterprise has about double the resources at the command of the managers of the Columbian exposition at Chicago. One of the results of this condition will be the absence of all charges for floor space to machinery exhibitors, and the abolition of charges for power, light and such facilities may seem reasonably necessary for the best presentation and operation of a desirable display. With such a generous programme, however, it is necessary for the management to have full information at an early date of the extent and character of the exhibits, in order to plan the necessary facilities, and Mr. Thomas M. Moore, chief of the Department of Machinery, urges all who intend to take part or wish further information to communicate with him at once. The Manufacturing Department will be housed in three large structures. The Varied Industries Building, 1,200x525 feet in size, will contain those manufactured products in which an attempt is made to please the eye, such as silverware, furniture and pottery; the special machinery used in producing these articles will also be exhibited here. The Manufactures Building is a 1,200x525-ft. structure for displaying purely utilitarian products, such as rubber goods, plumbing materials and apparatus for heating and ventilation. The Textile Building is 758x525 feet in plan and will be devoted to materials used for clothing and allied purposes and to the special machinery for making them.

The Plant of the Pike's Peak Power Co.

By R. M. Jones, Engineer and General Superintendent.

The Pike's Peak Power Company, whose general offices are at Victor, Colo., was organized in 1899, under the laws of Colorado. The company during that year purchased ranch property, placer claims and reservoir sites on West and East Beaver Creeks, in Teller and Fremont Counties; located, developed and patented placer claims along these streams, and at this date owns by patent all of the lands on and along these streams, including reservoir sites, and all water power privileges, over a distance of 1½ miles on Beaver, 7 miles on West Beaver and 3½ miles on East Beaver. These streams are noted for excessive difference in elevation in short distances, and produce sufficient water to make of them valuable water power properties.

One of the power stations contemplated by the company, completed and in operation during the past year, is known as Station A. It is located on West Beaver, in Fremont County, 2¼ miles up the stream from the junction of East and West Beaver. The completion of this station has also accomplished much of the development and actual construction for Stations B and C, in the way of reservoir capacity and pipe line delivery of water, which is especially serviceable to the two lower stations after having been used through Station A. A description of the completed work follows:

Dam and Reservoir.—The dam and reservoir are 5½ miles east of Victor. Here is located the largest steel-faced, granite backfilled dam on record to date. The structure is 405 feet in length along the cap, 220 feet in length of base, 148 feet in cross section at base and 20 feet in cross-section at cap. The upper slope or steel face is 30 degrees from the vertical, and the lower slope 50 degrees. The height of the dam from the bed rock to the top of the sixteenth plate, at the level of the spillway, is 70 feet. The spillway is 40 feet wide, cut in granite formation and passes around the northwest end of the dam. The granite backfill against which the steel plate rests, is carefully laid as a dry wall of heavy granite boulders, usually of 20 to 80 cubic feet each, as they are broken from heavy blasting, with loose, fine granite filling the intervening spaces.

The steel face is built of sheets measuring 5x15 feet and ½ inch in thickness for the bottom, which is eight plates in height. Continuing, the plate is reduced in thickness to ⅜ inch and finally at the cap it is ¼ inch in thickness. The entire facing is riveted up with horizontal butt straps, and 4x5x½-inch angle bars placed vertically the entire length of the dam. The 5-inch leg of each pair of angle bars projects into the reservoir and constitutes a standing joint seam, with a 2x⅜-inch iron liner, riveted between the extreme outer points of these angle bars, thus making a thorough expansion joint for each section of 15 feet. The bottom and end connections of the entire sheet are concreted into a deep channel quarried out of the bed rock, and the bottom terminates in two pairs of 5x8-inch angle bars, which are riveted through the plates. The end connections are prepared in exactly the same manner, but are applied vertically. The entire facing is riveted up and calked in the same thorough manner as in boiler practice. A space of 6 inches was left between the steel plates and smooth surface of the granite backfill. This narrow space is taken up by sand, gravel and sedimentary deposit, the filling being applied with ample water and permitted to dry before water pressure was allowed to enter the reservoir.

The reservoir has a surface area of 130 acres and holds 102,000,000 cubic feet of water.

Wood and Steel Pipe Line.—Water is taken into the wood stave pipe through a "Griglay" 240 feet long, perforated, giving 30 times greater area than the pipe. The connections between the Griglay and also those between the main pipe line and the steel facing of the dam are made by steel angles.

The wood pipe is 23,200 feet long, 30 inches in inside diameter and is of 1½-inch redwood stave, banded with ½-inch steel bands and cast-iron lugs. The bands are spaced along the pipe at all distances between 2¼ and 8 inches on centers, as is necessary for resisting the internal pressure, variations being caused by various inverted syphons along the line, two of which have to withstand a head of 215 feet. This pipe line extends over fearfully rough country, about half of the grade being through original granite formation; many curves are on less than 100 feet radius, and there is one compound curve of 35 feet. The wood pipe passes through the Skaguay tunnel, which is 1,535 feet in length, located 21,000 feet from the dam.

From a point 200 feet below the Skaguay tunnel, where the static pressure reaches 220 feet, the line consists of steel pipe 29 inches in diameter in various thicknesses of plates, ranging from ¼ to ¾ inch, as required to meet the internal pressure with an ample factor of safety. The total length of steel pipe, including the receiver, is 2,900 feet, and it is on an incline averaging 38 per cent. It passes over grades constructed through a tougher granite formation in respect to roughness than ever was encountered in railroad construction in Colorado. At one point it passes through an inclined tunnel 335 feet in length, just above which is a bridge 70 feet in height, both being on 40 per cent. gradient, and at various points there are extremely deep open cuts. From the south end of the Skaguay tunnel the pipe line is entrenched in the grade on which is constructed a three-foot railway leading from the Skaguay tunnel to the power house, its grade being 1,163 feet vertical in 3,100 feet horizontal. This road is the only means of access to the power house. The cars are operated by a double-hoisting engine.

JOINT BETWEEN STEEL FACE AND CONCRETE.

VIEW OF THE DAM OF THE PIKE'S PEAK POWER COMPANY DURING CONSTRUCTION.

The upper terminus of the railroad lies under a vertical ledge 70 feet in height, and all machinery, apparatus and materials of all kinds, were lowered by boom and derrick, taking loads from the wagons at the upper landing and lowering them 70 feet over the ledge to the cars. The loaded cars were lowered by means of the friction brake on a hoist, which was equipped with a ¾-inch steel cable; 1,400 tons of building materials passed down this peculiar railroad.

Station A.—The power house is 38x98 feet in size, with two side wings of 16x48 feet each, and is located on the summit of a granite projection surfaced off true to grade. The building is constructed of brick, with a corrugated steel arch roof covered with concrete, tar and gravel; it has a concrete floor and is absolutely fireproof. It is provided with a 10-ton traveling crane..

The hydraulic apparatus was manfactured by the Pelton Water Wheel Company, of San Francisco. Each unit consists of two steel disk wheels 66 inches in diameter keyed to the same shaft and working in the same wheel house.

The base frames are built up in a box pattern of the same type and general design as the generators, to which they are connected. The frames of the water wheels and generators are faced for accurate, rigid connection to each other by bolts and dowels. The connection of the water wheel and generator shafts is effected by the hub of a 7,000-pound steel cast balance wheel banded with a rolled steel tire band 4 inches in thickness. The wheel is 7 feet in diameter.

The nozzles used to develop the required power under the 1,160 feet of effective head obtained at the station require to have a diameter of only one inch to furnish 236 horsepower, including losses. The nozzles for each unit vary in diameter, one having the capacity of the generator, and the nozzles for the other wheel in the same unit being somewhat reduced. Each wheel in each unit will furnish power for the full capacity of the generator connected to it. In operation, however, it is customary to install nozzles of such varied diameter or capacity as to enable the load requirements to be met by the use of nozzles under full pressure, and thus avoid more than a slight loss in water due to regulation for low loads. The nozzles are of the deflecting type and work under full pressure at all times, which is the cause of the variation in their diameters. The regulation is of the Armstrong type, owing to the fact that automatic regulation under the existing conditions could be only a failure. Due care has been taken to extend the apparatus for the actual control and regulation of each unit to a point directly in front of the switchboard panel belonging to that unit.

The receiver runs longitudinally through the building under the steel-concrete floor. The discharge or tail-race water returns directly under the receiver to the south or lower end of the building, at which point it will later unite with water conducted from a point 800 feet above Station A, where a catcher-dam is to be constructed, and the water diverted from the Beaver Stream channel. There is a considerable accumulation of water between the dam and Station A, and it is the purpose of the company to unite the waters through the station with the accumulation in the stream and conduct the combined waters through a pipe line to a point 200 feet above the forks of the East and West Beaver Creek, at which point there will be constructed Station B. There will be built a small pipe line up the East Beaver to the same static level as the tail-race water of Station A. The waters of both pipe lines will be united before entering the receiver. The pressure of Station B will be 1,257 feet or 544 pounds pressure per square inch. With the added accumulation of water in the West Beaver branch, 3,500 horse-power will be obtained, and from the East Beaver branch, about 2,000 horse-power, all of which may be developed at Station B.

POWER STATION A, PIKE'S PEAK POWER COMPANY.

THIRTY-INCH WOOD STAVE PIPE, 23,000 FEET LONG.

The electrical generators now in operation at Station A are four 400-kilowatt General Electric machines, three phase, thirty cycles, 600 volts, with stationary armatures and rotary fields, making 450 revolutions per minute. Two four-pole exciters have a capacity of 30 kilowatts each while running at 675 revolutions per minute, and furnish current at 70 volts, each giving sufficient exciting current for all four generators while working at full load.

With reference to the efficiency of the water wheels, it may be stated that they were guaranteed to develop 83 per cent. of power on their shafts at full load when the nozzles are in normal position. In considering the efficiency of the water wheels, the General Electric Company's generators were assumed to have a commercial efficiency of 94 per cent. at full non-conductive load, therefore with every 33,000 foot-pounds of water the water wheels will produce in current one indicated horse-power less 17 per cent. loss in the wheels and 6 per cent. loss in the generators, delivering 78/100 horse-power or 582 watts from the brush-holder terminals of the generators. These efficiencies have been fulfilled by tests. All water connections are tested to 800 pounds pressure to the square inch. In making the efficiency tests, measurements are made through the standard wier commonly used in the United States, which measurements are verified by spouting tests by working water through nozzles of known diameters.

The switchboard apparatus is especially liberal in design, and is made up of one exciting current panel, four generator panels, two distributing panels, two high tension panels and one paralleling or synchronizing panel. Each panel is made of Vermont marble, 62x36 inches in size, with a 28x36-inch sub-base, and is 2 inches in thickness; it has a complete equipment of indicating and recording instruments, switches and regulating apparatus. The main line switches from each machine are operated independently either for power or light. The circuits are arranged so that any or all of the machines may be applied on either circuit. The transformers are six 250-kilowatt air blast, of the General Electric make, having 600 volts on the primaries and 12,600 on the secondaries. The twelve complete sets of lightning arresters are of the General Electric make. The cable connections between the generators and switchboard and from the switchboard to the transformers are all highly insulated and laid in conduits in the concrete floor. Since the early operation of this station, it was found necessary to install some thorough system for combined arc and incandescent lighting, which has been fully accomplished by the introduction of two 200-kilowatt compensated three-phase generators, 60 cycles, with their full equipment. These generators have 12 poles and operate at 600 revolutions per minute. Each generator contains its own independent 12-pole exciter, built directly on the revolving field-shaft. These machines are also directly connected to impulse type water wheels.

Transmission and Distribution.—The line transmission from Station A to the center of distribution at the Gold Coin Mine at Victor includes a distance of eight miles by pole line. The circuits consist of three No. 4 B. & S. power wires, and the lighting circuits of three No. 6 B. & S. wires, which are ample to deliver 1,600 kilowatts at less than a 5 per cent. energy loss. These lines are transposed at intervals of ½ mile along the line. The poles also carry for telephone purposes two No. 10 galvanized iron weather-proof wires, transposed each 120 feet. The insulators were furnished by R. Thomas & Sons Company, of East Liverpool, Ohio. They are 5½ inches in diameter, of porcelain, and each is same up of three independent cups. In manufacture they are subjected to a 40,000 volt salt test. The line voltage is 12,600, both on 30 and 60 cycle lines.

The sub-station is a brick, steel and concrete structure, adjoining the Gold Coin ore house in Victor. All transmission circuits enter this building where the current is transformed through nine 50-kilowatt General Electric oil transformers to 115 and 460 volts secondary, for local lighting distribution connected in the Y four-wire system and also for local power work. There is also a set of three 50-kilowatt oil transformers with 350-volt secondaries, which operate a 120-kilowatt rotary converter, furnishing current for a locomotive in the United Mines transportation tunnel for ore hauling, and also for Bull Hill tunnel haulage. High-pressure distributing lines leave the sub-station in various directions after first passing through 20,000-volt oil switches, making each line independent. These branches run to Economic Mill, where about 300 horse-power is delivered, to Beacon Hill for hoists, power and lights, to the Deadwood mine where a 100 horse-power air compressor is operated and a secondary 460-volt power circuit reaches Independence, Altman and the Wild Horse districts. Another primary line reaches Cameron and Gillett, after first passing through Goldfield, all for lighting services and distributed in each of these towns through their local transformers connected in delta. Two additional primary distributing lines reach Anaconda, where independent lighting and power is distributed to the town of Anaconda and the various mines in that vicinity. These lines also reach Elkton on their way to Anaconda, where lighting is also distributed.

Extensions.—It is the purpose of the company to construct an independent transmission line from Station B to Station A and possibly an independent line to the distributing stations in Victor, including the connections through Station A, thus permitting the use of the entire energy of both stations to work in parallel over either station's lines or to work each station independently, as desired. It is also proposed that transmission lines will be extended from these stations to other localities within reach. Thus, with two complete pipe lines, pole lines and generating station systems, the most unquestioned reliability may be counted upon. It is also the intention of the company to install a third station on the combined Beaver streams at a point near the mouth of the canyon and approximately 2 miles below Station B, to be known as Station C. Here the difference in elevation is but 373 feet, but as the volume of water will probably reach 50 second feet, this could develop 2,100 horse-power less losses. The company owns also an excellent reservoir site on East Beaver at 1,700 feet elevation above Station B and but 2½ miles distant, which reservoir may be developed to excellent advantage in the near future.

The securities of the company are all owned by the Woods Investment Company, of Colorado Springs and Victor, of which Warren Woods is president, H. E. Woods vice-president and treasurer and F. M. Woods, secretary and general manager. The power company was organized and the property developed originally by the Woods Investment Company for the purpose of supplying power and light to the milling and mining interests owned and controlled by them in the Cripple Creek mining district, but the work of construction was carried out to much larger magnitude than at first intended, and therefore the company is now supplying current to other properties and doing a large proportion of the lighting in the various towns in the district.

INTERIOR VIEW OF STATION A.

The Second Division of the New York Rapid Transit Railroad.

The Second Division of the New York Rapid Transit Railroad includes sub-sections 5A, 5B, 6A, and 6B, and extends about 20,125 feet from 41st to 104th Street. It is nearly all of the standard four-track construction illustrated in The Engineering Record of January 12, 1901. The regular structure has concrete walls, roof and floor, steel columns and roof beams, and is 13 feet high from base of rail and 50 feet wide in the clear. The bents of the riveted steel framework are 5 feet apart on centers and each has a 15, 18 or 20-inch I-beam roof girder in four sections, knee-braced to the tops of five vertical columns, the two end ones being enclosed in the concrete side walls. The roof, sides and bottom of the structure are waterproofed by a continuous sheet of asphalted felt which encloses it completely and is built into the thickness of the concrete far enough from the outer surface to be protected from injury. Inside the waterproofing there is a set of sixteen four-way terra cotta electric conduits built into each side wall, and outside there are tile cross-drains under the floor which connect with longitudinal tile pipes to the sewers for the drainage of the ground-water around the structure.

There are three underground stations on this division where there are special arrangements of tracks, cross-overs and switches. At the south end of the division connection is made with the east one of the two Park Avenue tunnels by a tunnel which has a cross-section with a maximum inside width and height of about 29 feet and 18 feet respectively. This tunnel is curved in horizontal plan, is built in rock and earth, and is lined entirely with concrete without steel reinforcement. The floor is horizontal and the side walls are vertical for a height of about 7½ feet where they are tangent to the three-centered curve of the arch roof. Connection is made with the west tunnel in Park Avenue at 41st Street by the ordinary steel and concrete structure.

This division is entirely in subway and, except on 42nd Street where various tunneling methods are used, most of the excavation is done in open cuts and by drifting under the surface tracks of the electric railways. The maximum depth of excavation is about 50 feet, the minimum 20 feet, and the average about 25 feet. The total estimated quantities include about 540,000 yards of rock and 550,000 yards of earth excavation, 160,000 yards of concrete and 32,500,000 pounds of steel. The total amount of the contracts let is about $10,000,000, and the work is required to be completed by September 1, 1904. It is hardly necessary to add that Mr. William Barclay Parsons is chief engineer of the Rapid Transit Commission; Mr. G. S. Rice is deputy chief engineer; Mr. Alfred Craven division engineer, and Mr. Robert Ridgway assistant engineer.

Special pains are taken for the systematization of data and records in the division engineer's office, and no preliminary work is done in the field that can be prepared in the office. Notes, maps, profiles, tables of figures, distances and values, cross-sections and various reference data are made to uniform scale on tracing cloth and blueprinted on 5x7½-inch pages which are bound in flexible leather coyers like field books and are supplied to the assistant engineers on the different sections. These notes are very comprehensive and are carefully arranged and checked in the office so that scarcely any figuring is necessary in the field and reference marks can be found and angles and levels given without requiring more than an interpolation.

One page has a map and profile of about 800 feet of the line with survey stations, column centers, line and grade, tangent points, curb, street centers, crossings and references to the large scale drawings marked on it. The opposite page is headed "alignment and grades," dated and ruled in four vertical columns for station number, grade of base of rail, deflection and curve data, the last column giving the angular deflection for 50-foot tangents and the versed sines for 50-foot chords. Diagrams of standard and special cross-sections, plans and elevations are given and special small-scale drawings showing the essential dimensions of different portions of the work isolated from the rest, as of the foundations which show the base of rail and details of floor construction and of location and grade of side sewers and sub-drains. Standard cross-sections of steel and concrete work show the important dimensions and limiting values.

The concrete tunnel has a varying cross-section, the variable dimensions being indicated by letters on the diagram, tables are given of the successive values of the letters and of the deflections to be laid off by the instrument at successive points, so that the engineers can give any point or distance without calculation and still not be burdened with a mass of elaborate drawings or confused data. Another table is ruled in double columns, one of which, marked D, is the distance in feet from the end of the vertical curve to the point at which grade is wanted, and the other column, K is the correction to be added to or subtracted from the given tangent grade to obtain grade on vertical curve. There are many other diagrams, tables and specific data but these serve to illustrate their character and the convenience, expedition and accuracy which they secure.

The condition and progress of the work at the present and at any past time, together with the actual and comparative amounts of different classes of work done and its total cost and relation to the progress required for the timely completion of the contract are clearly shown on diagrams appended to the monthly reports of the division engineer. In one diagram the different classes of work like earth and rock excavation, concreting, waterproofing, steel delivered, steel erected, etc., are represented by their costs, which are of course proportional to their total quantities. The totals for all the items have the same ordinate but different abscissas, so that the values are rectangles of uniform height and differing widths, the latter corresponding to their varying amounts. The ordinates are divided into 100 for percentages, and every tenth point is marked by a horizontal line across the diagram. As the different classes of work are executed the percentages finished are laid off from the bottom up in successive increments, and the areas shaded for each monthly report so that the total amount of each class of work finished is evident by inspection and the amounts which have been shown on previous reports are indicated by reversed shading; as the areas are numbered it is easy to trace the progress to date. The total sums are recorded beyond the end of the diagram and, being cross added, give the total amount of work completed.

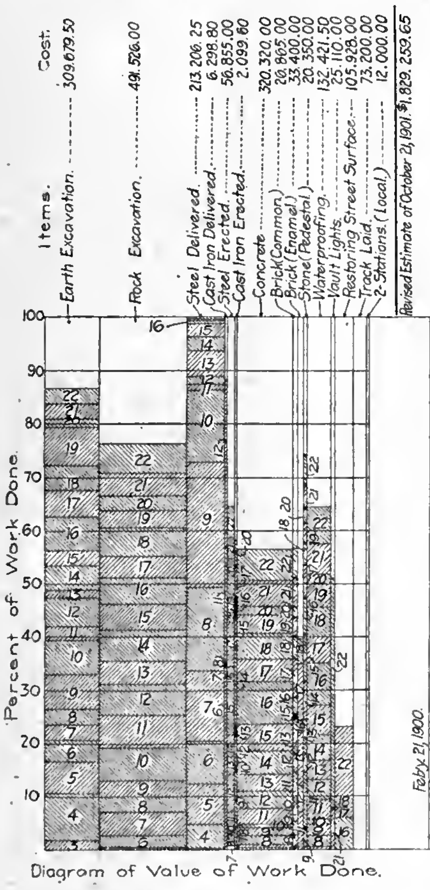


Diagram of Value of Work Done.

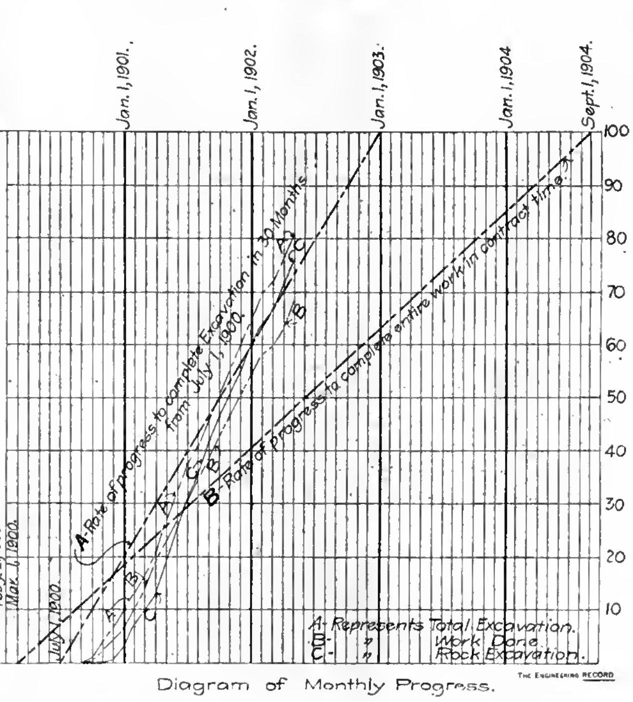


Diagram of Monthly Progress.

Diagrams Accompanying Monthly Reports of Mr. Alfred Craven, Division Engineer.

In the other progress diagram the horizontal lines are percentages of work finished and the vertical ones are the months from the beginning of the work to the required time of completion. Straight diagonal lines drawn from the origin to the 100 per cent. line indicate the regular progress which should be made to complete the contract as required. The successive percentages of work completed in different months are platted and give irregular lines which deviate from the theoretical diagonals and show at a glance whether the work is in excess or default of that required and whether the speed is being maintained, diminished or increased. This diagram shows only "total work" and "earth" and "rock excavation," the most important items which control the remainder.

In this division a large amount of preliminary work was required to move and relay gas and water mains, sewers, conduits and telephone and telegraph ducts. Such of them as cleared the finished structure were merely supported during excavation and construction and left in their original positions; others were moved enough longitudinally to clear without being disconnected; others were replaced by new lines built parallel to the old ones and connected to them to allow the original lines to be completely removed, and parts of the sewer system were remodeled.

Along the line north of 42nd Street to 73rd Street, most of the main sewers running north and south were replaced by new ones. House drains were intercepted by lines on each side of the subway which generally were run close to its outer walls and pitched both ways to outfall sewers at 45th, 65th and 72nd Streets, which had drop shafts on the east side of the subway, crossed under it in cast-iron pipes and discharged to the river through deep cuts in the cross streets. The intercepting sewers vary from 15-inch pipes at their upper ends to 32x48-inch brick sewers at their lower ends and are accessible through manholes just outside the subway walls. Generally they are carried on a rubble wall from 12 to 48 inches thick which is built from the stone excavated from the trench and serves instead of brick or concrete to protect the vertical waterproofing layer in the side walls.

Where the clearance over the subway was too small to give the proper depth for the cleaning and electric vaults for the surface car tracks and for the drains from the same, the ordinary concrete roof was replaced by horizontal 3-inch transverse I-beams 12 inches apart on centers resting on the bottom flanges of the roof beams and filled in solid with concrete between their webs to make a thin slab. By this construction, which was also used in similar places for the crossing of the gas and water mains, from 10 to 18 inches of headroom was gained. This method was used where a 30-inch water main passes over the subway at 59th Street. A few inches additional space was gained where the clearance for the vaults and their drains was very small by the use of steel plates or drip pans which rest on the lower flanges of the roof beams.

At 71st Street a 48-inch water main was branched into two 36-inch pipes to cross over the subway roof below the surface tracks, and on the other side the two pipes were again united in one 48-inch pipe. Similarly, at 66th Street, a 30-inch and a 36-inch gas main will be respectively divided into two and three 24-inch short pipes above the subway roof, and a 36-inch water main at 96th Street will be treated in the same way.

A 20-inch high pressure water main was moved about 40 feet transversely for a distance of 46 blocks. The new line was laid in sections from three to eight blocks long, temporary connections being made with the old main at the ends of a section. These connections were usually made at night to avoid the public inconvenience which would have been caused by shutting off the main in the day time. When a section was connected and put in service, the corresponding section of old pipe was removed. The sewer work was in charge of Mr. C. W. Hendrick, but the pipe and conduit work was executed by the regular staff of this division. That part of Division 2 which extends from 104th to 82nd Street is called 6 B, Mr. A. A. Sproul being the assistant engineer. From 82nd to 60th Street it is called 6 A, Mr. Bayly

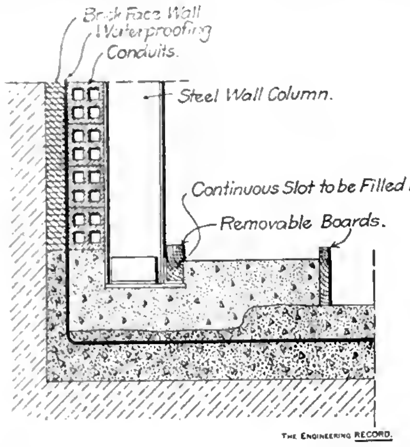
Hipkins being assistant engineer. Mr. William Bradley is the contractor for both sections and Mr. R. G. Collins is his engineer. Between 96th Street and 60th Street most of the structure is of the standard four-track subway construction.

North of 96th Street, the center tracks descend on a grade of 0.45 per cent., while the outer tracks rise on a grade of 1.40 per cent. This continues about to 100th Street, where a third track is added to each pair. The difference of levels is sufficient there to permit the upper tracks to converge, and this six-track structure continues north, with the upper three tracks immediately over the lower ones, nearly, to 103rd Street, where the lower tracks curve to the east, forming the beginning of the "East Side line" which runs under 104th Street, Central Park, Lenox Avenue and the Harlem River into the Bronx Borough. The upper tracks continue north under Broadway as the "West Side line."

Broadway north of 60th Street is much wider than most other streets in the line of the subway, and has a parkway 22 feet wide in the center over the subway, which affords space for the open ventilating wells in the subway roof. These are 7 feet wide and 14½ feet long, reaching across three panels of the steelwork and are enclosed with brick walls having pressed brick facing, granite coping and ornamental iron railings. There is one well at each end of each station and one midway between every two stations.

The excavation in these sections is made in open trench, and the two surface tracks above the subway are supported temporarily on needlebeams suspended under pairs of movable longitudinal trusses as described in The Engineering Record of March 30, 1901. Much of the excavation was through a rock fill in which it was difficult to drive the sheeting for the sides of the trench. The maximmu depth of trench was 50 feet at 103rd Street. About 50 per cent. of the excavation was in earth and fill and the remainder in hard rock. Excavation has been in progress simultaneously in twenty-six places on these two sections, and is now more than half completed and nearly one-third of the steel and concrete structure is finished. The longest completed length of steelwork is 1,130 feet between 81st and 86th Streets. The concrete for the floor is generally mixed by portable gravity concrete mixers, manufactured by the Contractors Plant Company, of Boston, which receive the aggregate at the surface of the ground and deliver the mixed concrete at the bottom of the trench. The concrete for the walls and roof is mixed partly by the same mixers and partly by hand. The principal items of the contractor's plant were enumerated in the description of the excavation already published, all the machinery below 82nd Street being operated by air pressure from the compressors installed near the foot of 76th Street. Steam plants are used north of 82nd Street.

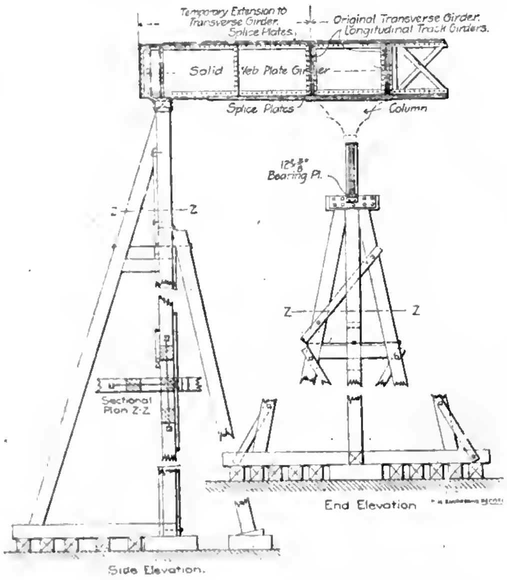
The three-track line of the Ninth Avenue elevated railroad crosses diagonally over the subway near 65th Street and four of the columns of that structure are located over the subway so that they were within the limits of the excavation and had to be relieved of their loads while the subway was constructed under them. This is being accomplished by extending the ends of the main transverse girders beyond the ends of the columns and supporting their extremities on wooden trestle bents carried down to rock in or adjacent to the excavation, as shown in the accompanying sketches. The elevated structure at this point consists of six lines of longitudinal lattice girders of spans of about 46 to 80 feet supported on transverse lattice girders of about 22 feet span and 4 feet depth. The track rails are in the planes of the longitudinal girders and the columns, about 18 feet high, are in the center lines of the outside tracks. The end panels of the transverse girders have solid plate webs and terminate at the connections with the outside longitudinal girders, where the temporary solid-web extension about 13 feet long was spliced with double web cover-plates like fillers under the web connection angles to the longitudinal girder and



Detail at Lower Corners, Standard Section.

with three thicknesses of flange cover plates of different lengths on the top and bottom chords, all thoroughly field-riveted and painted. About 18 inches from the end the girder extension was seated on a 12-inch bearing plate on the longitudinal cap of a wooden tower or trestle bent which had one vertical post and three batter posts converging to a solid cross-section at the top and extending to a triangular base about 16 feet long and 12 feet wide with sills supported on short transverse grillage beams. A fourth batter post was set at the bottom of the bent making it a rectangular pyramid there, with 12x12-inch main timbers braced with diagonal planks, horizontal struts and tie bolts.

As the side walls of the subway also act as retaining walls special care was taken to provide for resisting the lateral thrust at the bottom, and provision was made for it in laying the concrete floor. The first layer, about 7 inches thick, was laid over the full width of the excavation. The 4-inch outside protection wall was commenced on the edge of the footing and a fillet turned in the angle to provide a rounded seat for the waterproofing. The waterproofing was placed on the bottom and flashed up on the side of the wall. A second layer of concrete, about 7 inches thick, was laid on top of the waterproofing, finishing the floor to about 4 feet from the outside of the wall where a vertical shoulder was left and the waterproofing was covered only about 4 inches deep, as shown in the diagram. After this concrete was well set a concrete bench 12 inches deep was laid with a continuous trench in its surface to receive the column bases. Then the 12-inch I-beam vertical wall columns were erected and bolted down, and finally the spaces on both sides of them were filled with concrete above their base plates, enclosing the feet of the columns up to the level of the top of the bench.



Support for Ninth Ave. Elevated Ry.

After the erection of the steelwork the panels between the wall columns were filled with vertical arches made of concrete rammed in between the electric conduits and short vertical sections of wooden centers hook-bolted to the inner flanges of the column I-beams. Each centering section was made of vertical lagging strips 3 feet long nailed across three horizontal scarf pieces 1½ inches thick. The sections were successively set from the bottom up and were so smoothly made and fitted that they left a neat and satisfactory finish on the surface of the concrete. The roof arches were laid on similar centers suspended from the roof beams. Wherever a horizontal point in the concrete was formed by the meeting of different days' concreting a 2x4-inch horizontal strip of wood was bedded in the edge of the part finished first and after it had set was removed, leaving a groove into which a tongue of the concrete of the next part bonded itself and made a strong connection between the two parts.

That part of Division 2 which extends from 60th Street to 47th Street is called 5 B; Mr. John H. Myers is assistant engineer; Naughton & Company the contractors, and Mr. C. W. S. Wilson is the contractors' engineer.

Here there are two surface tracks close together, symmetrical with the center line of the subway on tangents. During construction they were supported on needlebeams shored up by vertical timbers from the bottom of the excavation, which was made in open trenches generally on one side of the surface tracks. As a rule one-half of the structure was completed and the backfilling done before the opposite side of the street was opened, this method being followed to avoid interference with public traffic any more than was absolutely necessary. The first operation was to excavate to rock between the surface tracks and the east or west curb as shown at the north end of the plan. The water mains, gas pipes, electric conduits, etc., were carried on horizontal timbers having their outer ends let in flush with the top of the asphalt paving, the inner ends resting on the concrete covering of the ducts for the surface tracks. Drifts were run under both tracks about 10 feet apart, and 12x12-inch needlebeams about 25 feet long were laid in them ready to support the tracks when the earth was excavated underneath; their outer ends were supported on vertical shores set at first, on the surface of the rock as shown in section Y Y. The excavation was then continued through the rock to the sub-grade with a face diagonal to the axis of the subway. After reaching rock in the side trench the excavation was continued under both tracks by lateral extensions and when a sufficient width and length was completed the concrete floor was laid and the steelwork was erected for one-half of the subway. The masonry piers were built on the finished roof of the subway, one surface track was supported on them and the street surface restored to the curb. Then a trench was excavated to rock on the opposite side of the surface tracks and vertical shores set in it to support the ends of the needlebeams. Finally the rock was excavated in the bottom of this trench and the subway structure completed and the second surface track supported on it. The rock and earth excavation was made with oblique faces in the side trenches and with longitudinal faces under the tracks, and all shores were successively replaced by longer ones as the excavation was deepened around them.

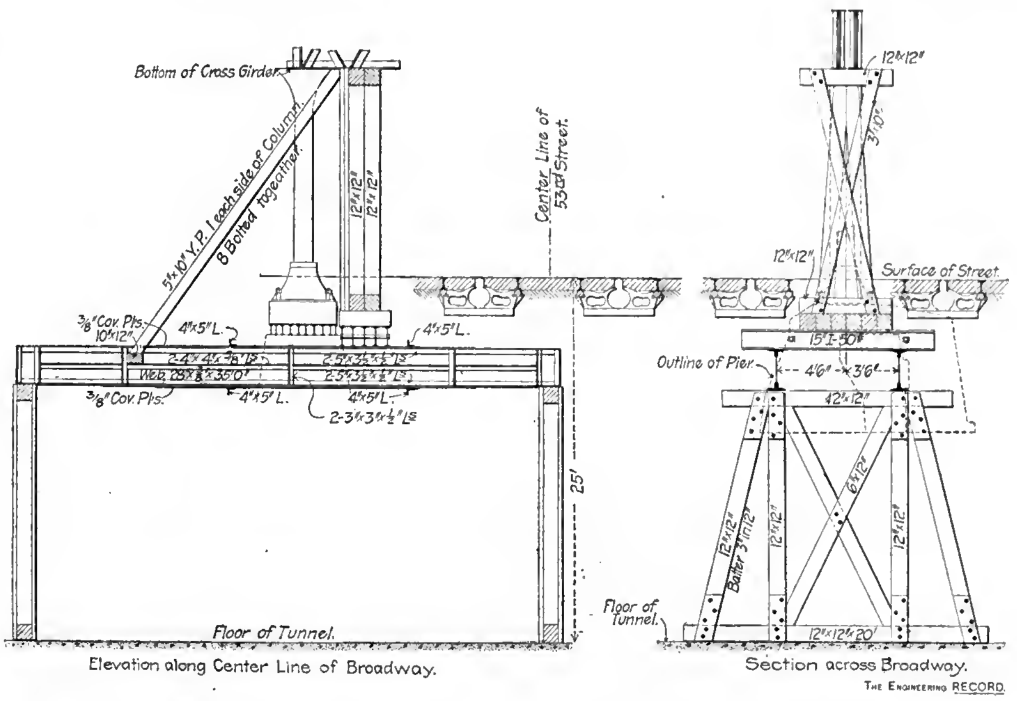
The elevated railroad crosses the subway at 53rd Street and two of its columns are located between the surface tracks of the Broadway lines above the subway roof. To support this part of the structure temporarily while the subway was being constructed and piers built on its roof for the columns bases, the main elevated girders were carried on wooden columns or towers and the foundations of the columns removed preparatory to replacing them on the new piers. The temporary columns were meanwhile carried on pairs of girders just below the street level which were set each side of the old column and pier, and were supported on trestle bents seated on the subway floor, as shown in the sketches. Open trenches about 6 feet wide, were excavated across the line of the subway about 17 feet each side of the column which was to be removed, the finished subway concrete floor was built in the bottoms of them and on it were set the trestle bents each composed of two vertical and two batter posts with caps and sills, all of 12x12-inch timber bolted together with scabs and braced by 6x12-inch diagonals. Two 28-inch steel plate girders, 35 feet long, which had previously been used by the same contractor for the underpinning of the Columbus Monument, as described in The Engineering Record of July 27, 1901, were set across their caps, 8 feet apart. One side of the column pier had to be cut a little to clear one of the girders and the other girder was put through a hole in the pier which had originally been made to receive 12 and 20-inch water pipes recently removed. Each side of the pier the girders were connected transversely by sway brace frames made of horizontal angles riveted across their flanges and X-brace angles riveted to the horizontal angles. A grillage of five 15-inch I-beams, bolted together with separators, was set across the top flanges of the girders close to the old column pier and on it was placed the temporary column consisting of two vertical and two inclined 12x12-inch timbers with horizontal caps, sills and footing timbers and diagonal braces securely bolted together. The top of the column was braced by an inclined post to the plate girders and the transverse girder of the elevated railroad structure was jacked up 1 inch. Wedges were driven between it and the cap of the new column, the jacks were removed, and the pier of the old iron column taken out.

The excavation was then completed between the two trestle bents, the subway structure built there and on its roof a new concrete masonry pier built to carry the old iron column and its estimated loads of 40,000 pounds dead and 100,000 pounds live weights.

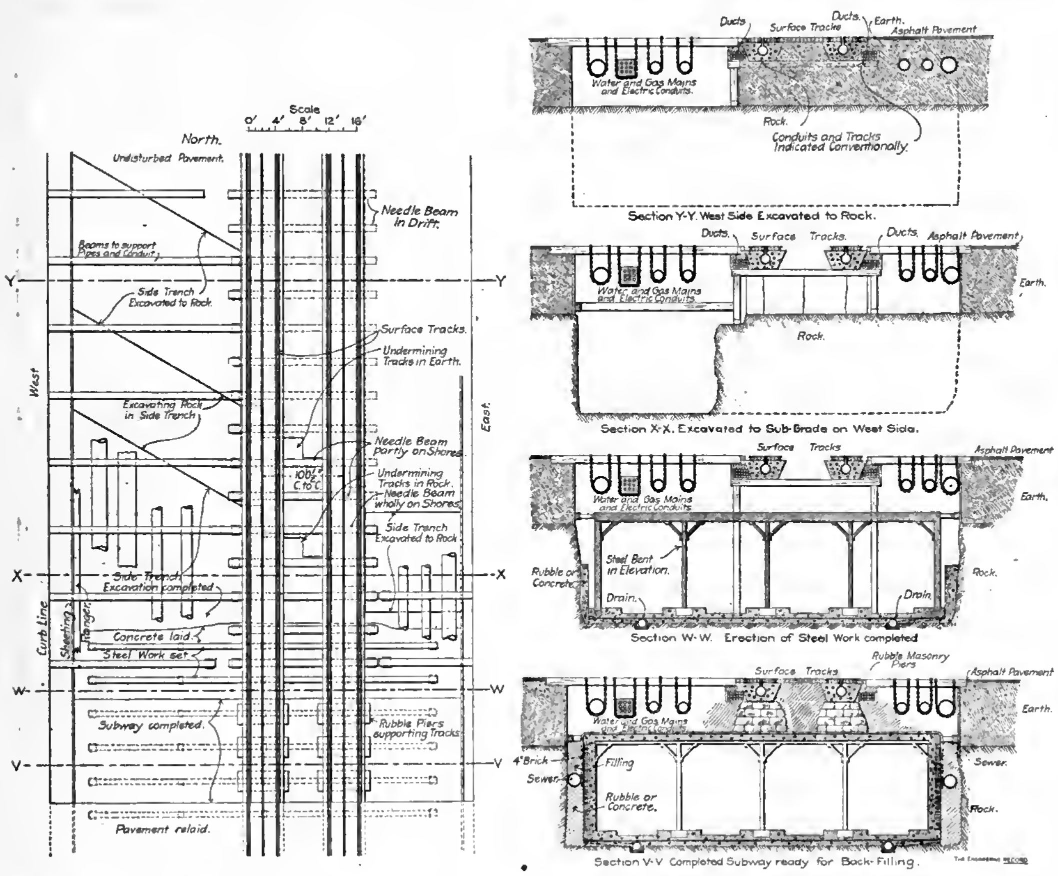
After the south column had been thus underpinned a transverse trench was dug 17 feet north of the north column, the south trestle placed in it, the girders moved north across the other trestle to rest on it, and the north column was underpinned as has been described for the south one. The temporary columns were braced transversely as the excavation was extended below them, and they showed a settlement of only 1/8 inch and no serious vibrations under the constant train service which was maintained above them with little reduction of ordinary speed.

On this section of the subway the excavation is now 90 per cent. completed and about three-fourths of the steel work is set and concrete walls and roof finished to correspond. The 50th Street station is half finished and the 60th Street station is nearly completed. The passenger platforms where under the sidewalks are roofed with the Tucker & Vinton patent vault lights set in concrete reinforced with Ransome twisted steel.

(To be continued.)



METHOD OF SUPPORTING ELEVATED RAILWAY AT FIFTY-THIRD STREET.



SEQUENCE OF OPERATIONS ON DIVISION 2, NORTH OF FORTY-SEVENTH STREET.

The Partial Failure of some concrete piers of a bridge crossing the Sanitary District Canal at Joliet on the line of the Chicago, Rock Island & Pacific Railway occurred during a severe flood on June 2 and 3. The bridge is about 600 feet long and crosses the canal on a 30-degree skew. In 1899 the Sanitary District Trustees built a pier and an abutment for the bridge, and these were not injured. Last year the railway company replaced the superstructure with plate girder spans and rebuilt the old cylinder piers. Cofferdams were constructed about these cylinders, which rested on rock bottom, and after placing forms about the old piers concrete was rammed around them so as to make much larger piers oblong in plan and without any cutwater. When the forms were taken off it was found that the concrete at the base was partly gone and the defect was repaired by replacing the forms and slushing concrete into the voids. During the storm one of these piers was pushed downstream 18 inches and tipped so that the lower edge was 12 inches below that on the upstream face. This tipping continued steadily until it amounted to about 5 feet in the course of a week. The other reconstructed piers suffered in a similar but less pronounced manner. The failure was evidently due to the defective bond of the old and new concrete.

The Hoboken Station of the United Electric Company.

The Hoboken station of the United Electric Company of New Jersey is of interest chiefly because of its being a remodeled plant, the changes in equipment having been made while the usual service was continued without interruption.

The old plant embraced two vertical Corliss engines, one horizontal Corliss and two small McIntosh & Seymour high speed cross-compounds. The high-speed engines were direct-connected to generators, but the greater part of the power was transmitted by belts from the large engines to dynamos of various kinds, in many cases passing via countershafts. None of the generators was very large, and the amount of leather belting used was enormous. The present service comprises 550-volt railway circuits, 2,200-volt two-phase alternating power and lighting circuits, and constant-current arc lighting. The power losses were so great with the old equipment that it was found necessary to change over the entire plant.

The building was extended, the part marked A B C D on the plan being the new portion, and additions to the plant were made in this extension.

There are five Babcock & Wilcox water-tube boilers of 520 horse-power each, normal rating, set in a continuous battery. They are all equipped with Roney mechanical stokers. Three sets of stokers are operated by an 8-horse-power Westinghouse engine, and the remaining two sets by another.

The feed-water heating arrangements consist of a primary heater made by the American Pipe Bending Company, of 1,000 horse-power rated capacity, and a 2,200-tube Green economizer. The feed water is taken from the city mains and passed through the Crown meters. From these it goes into the boiler feed pumps, of which there are two. One only is needed to supply the boilers, the other being a reserve. They are Worthington duplex compounds, 8, 10 and 7x12-inch, with a 4-inch discharge to the heater.

The exhaust from the condenser and feed pumps is carried to the heater and there used to raise the temperature of the feed water to about 175 degrees Fahrenheit. The water then passes to the economizer, which is built up above the top of the boiler settings and through which the hot gases of combustion pass, heating the water up to about 250 degrees.

A main distributing feed pipe runs along above the front of the boilers from which 2½-inch pipes are tapped and pass into the front ends of the boilers.

Two Buffalo Forge Company fans for draft are set above the boilers on a level with the economizer. The impeller wheels are 14 feet in diameter by 6 feet wide. Each is driven by a 12x16-inch horizontal engine, the speed varying from 30 to 110 revolutions per minute, according to the demand on the boilers. Their speed is hand controlled from the boiler-room floor. One fan only is required to produce the necessary draft, the other being a spare.

The smoke breeching is provided with a sliding door by means of which the gases may be passed through either fan. From the fan the smoke and gases go into the stack, which extends only 30 feet above the boiler room roof. Its diameter is 18 feet.

Of the old engine equipment only one unit has been retained. The 26 and 48x54-inch horizontal cross-compound Corliss engine is still kept belted to two General Electric railway generators of 500 kilowatts capacity each, which are held in reserve for emergencies.

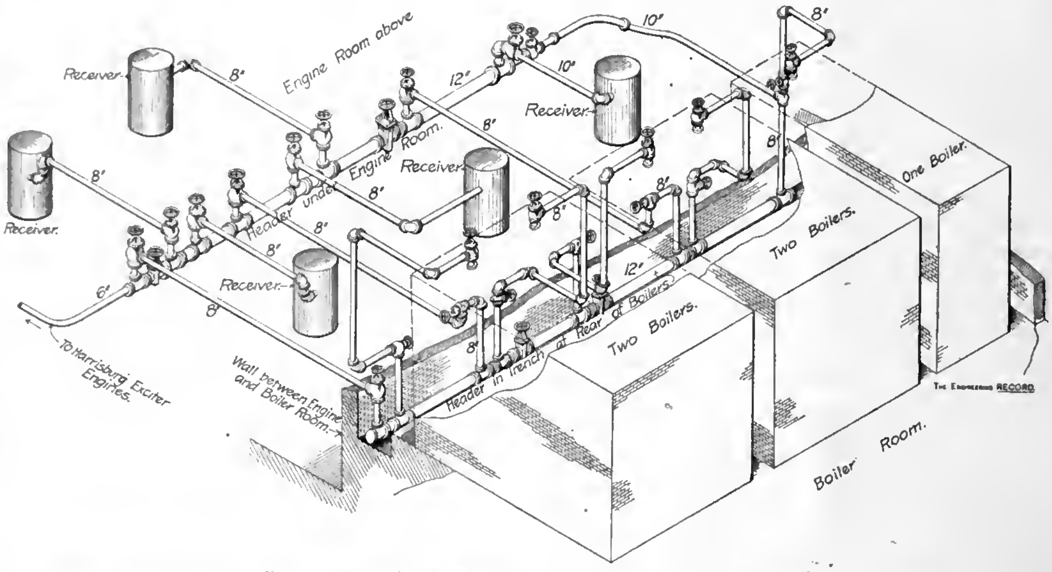
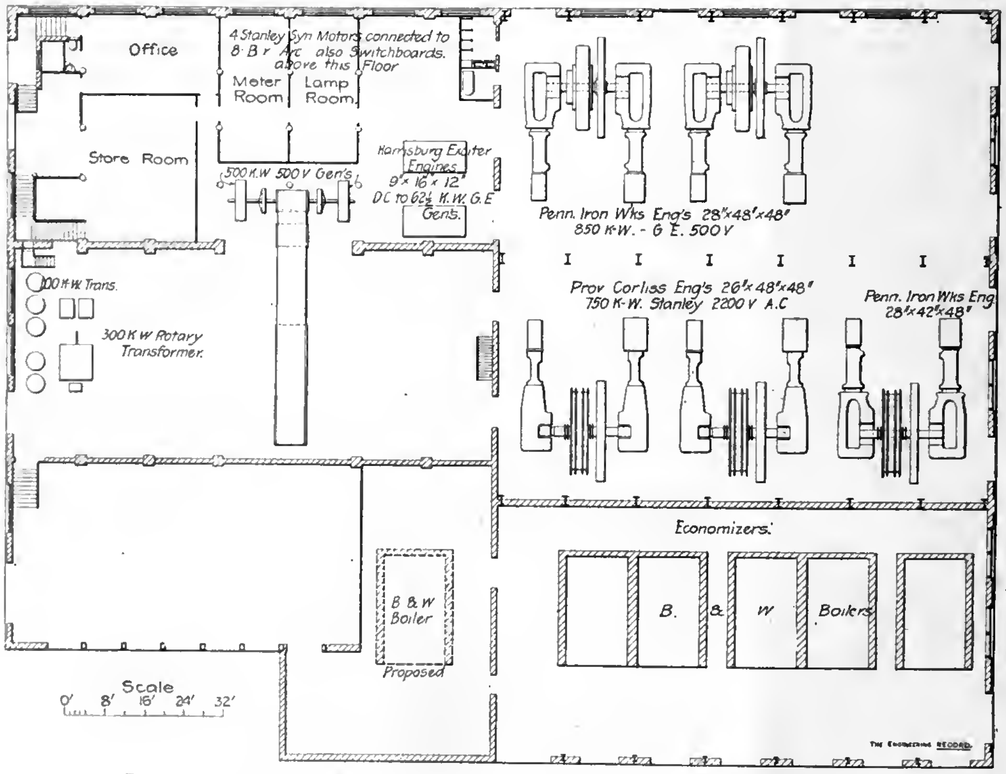


DIAGRAM OF STEAM PIPING IN THE HOBOKEN STATION.



PLAN OF THE RECONSTRUCTED HOBOKEN STATION, UNITED ELECTRIC CO.

The engines in the new plant are all of the horizontal cross-compound Corliss type. There are two 26 and 48x48-inch Providence engines direct-connected to 750-kilowatt two-phase Stanley alternators, and three 28 and 48x48-inch engines built by the Pennsylvania Iron Works Company; of these last, two drive General Electric 850-kilowatt railway generators and one drives a 750-kilowatt two-phase Stanley alternator. These last machines are excited by two General Electric 60-kilowatt 6-pole engine-type generators, each driven by a Harrisburg 10 and 18x12-inch tandem compound rocking-valve engine running at 280 revolutions per minute. The large engines all have a speed of 90 revolutions.

There are five independent jet condensers located beneath the engine room floor, which is 10 feet above the condenser pit floor. Four of these are 8, 16 and 24x24-inch Deane tandem compounds and one a Worthington 9, 14 and 19x15-inch duplex tandem compound. Condensing water is brought from the river in a 20-inch cast iron main, and the 10-inch condenser injection pipes are tapped into it at proper intervals. The discharge from the condensers is carried by means of individual 12-inch discharge pipes to a common discharge main, 20 inches in diameter, which empties into the river. The exhaust steam from the engine ends of the condenser pumps goes to the heater, as before mentioned.

The steam-piping layout is somewhat unusual, as may be seen by referring to the diagram of the layout of the system. From the steam drum of each boiler an 8-inch pipe starting from the nozzle—which is connected to a dry pipe inside the boiler—passes through an angle valve to the side of the boiler wall and then downwards, tapping into a 12-inch main header which lies in a trench below the level of the boiler room floor. These supply pipes pass through angle valves near the header, so that both ends of these pipes may be closed. The header is divided into three sections by two gate valves as shown. Two boilers deliver steam to each of the end sections and one to the middle section. A second steam header runs underneath the boiler room floor parallel to the first header. It is a 12-inch pipe, divided into two sections by a gate valve. It is connected to the first header by four pipes, of which three are 8 inches in diameter and one 10 inches. These lateral connecting pipes are provided with angle valves at both ends, and consequently may be shut off from either header or from both. From the second header branch pipes are carried to each engine receiver. These receivers are merely large shells with baffle plates inside and act both as separators and storage reservoirs. Each is placed directly beneath its engine, and consequently there is always a supply of dry steam available for sudden overloads.

The two Harrisburg exciter engines are also connected to the second header, the pipes to these engines being 4 inches in diameter. Owing to their location the connection is not shown in the drawing.

All the piping and fittings are extra heavy and all joints and connections flanged. The valves are of various makes, Chapman predominating. They are all controlled from the engine room floor above by means of hand wheels and rods supported by handsome floor stands.

The system was installed in part by Westinghouse, Church, Keer & Company and partly by W. K. Mitchell & Company of Philadelphia, and the covering was furnished by the W. H. Johns-Manville Company. In addition to the steam and condenser piping mentioned there is a main free exhaust pipe leading out into the air, into which the exhaust from any engine may be turned at will. The valves making this connection are also controlled from the engine room floor.

Of the five large separators four are 4 feet in diameter and 6 feet in length and one is 3½ feet in diameter and 6 feet long. All drips from the steam pipes and separators are trapped and returned to the boiler by the Holly system.

There is no provision for coal storage at present, but bins and a system of coal handling machinery are to be shortly installed. This will include a trestle and conveyor from the river, so that coal may be unloaded direct from boats. Conveyors will also elevate the coal to the bins, whence it will be fed directly to the automatic stokers, passing through automatic registering scales.

The engine room is traversed by two 25-ton hand-operated overhead traveling cranes, each being one-half the span of the room. These were made by Alfred Box & Company of Philadelphia.

The station switchboard is so located that the engine driver cannot see or communicate with the switchboard attendant, and in order to properly control the plant a system of signalling has been devised by Mr. H. D. King, the superintendent. High up at one end of the engine room, and plainly visible from any point, is a large glass sign with illuminating lamps behind it. On this sign are engraved the directions, such as "stand by," "slow down," "stop," "start," and in the lower right hand corner are the numbers 1, 2, 3, 4 and 5, referring to the correspondingly numbered units. At the switchboard is a small box with levers projecting through the top which are properly labelled. The switchboard attendant throws the small lever corresponding to the number of the unit he wishes controlled, and that number is illuminated on the sign in the engine room. Levers also light up such directions on the sign as he may wish to give, all directions referring to the unit of the same number as that illuminated on the sign. This system is rapid, effective and seems to be in many respects better than the usual method of motioning to the engineer from a visible switchboard gallery.

The Coating of a Riveted Steel Main 48 inches in diameter, laid in New Bedford in 1896, was found to be almost as good in 1901 as when new, only an occasional blister in the asphalt in the bottom being detected.

Method of Building a Long Bridge in India.

The East Coast Railway from Madras to Calcutta crosses the Godavari River at Rajahmundry, 40 miles from the sea, on a single-track steel bridge 9,000 feet long between abutments. There are fifty-six 150-foot deck lattice-girder spans and one 40-foot span supported on six caisson piers and 50 brick well piers. Two of the caisson piers were sunk 28 feet into the sandstone by the pneumatic process. These caissons were built on shore, launched from ways supported at the river end on sand bags built up several feet to just below water level. They were lowered between pontoons from transverse beams across the tops of towers built on their decks. The other caissons were sunk by dredging through pairs of 10-foot circular openings. The brick well piers were all sunk by steam dredges suspended from gallows frames on top. The dredge buckets were toothed and the clay was broken up in advance by heavy rail-chisels. Most of the wells were sunk 20 feet into stiff black clay which was generally so impervious that the water could be bailed out and the work executed dry. When the excavation had been carried 20 feet below the cutting edge dynamite was used to loosen the clay and bring the brick shell down. The piers were filled with concrete lowered in automatic buckets with bottom flap doors.

Each span has two riveted girders 14¼ feet deep and 8 feet apart on centers which weigh 46 tons each. The top chords have semi-cylindrical bearings on fixed and roller shoes on top of the masonry, and the solid floor consists of heavy corrugated decking 14½ feet wide.

The girders for the water span were assembled on shore and moved along falsework ways to pontoons by which they were floated to the piers. There they were lifted about 30 feet vertically, moved about 11 feet transversely and lowered to bearing on the pier tops. Temporary horizontal brick platforms were built on the offset courses just above water level at the ends of the oval piers, and cantilever rails, built into the sides of the permanent upper part of the brick pier for anchorage, were supported on them and projected beyond their outer edges to support the vertical posts of a transverse gallows frame for the hoisting apparatus.

The posts of this frame were 45 feet long and 36½ feet apart, and were connected by a pair of 16-inch I-beams seated across their tops 7 feet clear of the pier coping. Each post was built of two 12x12-inch timbers clamped together and was trussed on the wide sides with 1½-inch rods in vertical planes parallel to the bridge axis and guyed on the other side by wire ropes from the tops to anchorages in the vertical plane of the longitudinal axis of the pier. The I-beam caps were 16 inches apart on centers and had clearance between their flanges for the vertical suspenders for the ends of the girders. The upper ends of these were supported on a horizontal yoke-beam 3½ feet long, in the plane of the gallows frame, and about 2½ feet above it in the clear. This yoke-beam was seated in the middle on top of a hydraulic jack which had a special base with bearings for four transverse rollers traveling on the top flanges of the I-beams. There was one suspender 16½ inches each side of the center line of each jack. The two 6x½-inch bars forming each suspender were riveted together flatways, with spacers 11½ inches apart and were made in 5¼-foot pin-connected lengths. They passed between the ends of two 12-inch channels 6 inches apart in the clear, which formed the yoke-beam on top of the jack, and were supported by flat steel keys which were slipped through them edgeways between the spacers and rested across the top flanges of the yoke. The lower ends of the suspenders had nuts bearing on lugs bolted to the lower flanges and webs of the top chords at the ends of the girders.

There was about 5 feet clearance between the posts of the gallows frame and the ends of the pier masonry, and in these spaces the end girders were raised to the tops of the piers, close up to the I-beams, by successively pumping up the jacks, inserting keys in the chains above the beams to support the girder while the jacks were released, and then lowering the plunger and yoke for another stroke, and so on. The suspenders were thus successively supported from the yoke while the girders were lifted and from the cap-beams between lifts. As the girders were raised the upper sections of the suspenders were removed. About 21 hours were required to raise the girders to the tops of the gallows frames. Then their jacks were rolled towards the center of the pier where the I-beam caps were spliced and supported from the masonry on a pony trestle bent, and the girders were lowered to the required position on their permanent seats.

The land span girders were assembled in a vertical plane on the ground between the piers and were hoisted into position in about 1 hour each, with wire rope tackles suspended from gallows frames seated on top of the piers. The gallows frames were 20 feet high with double posts and caps, the latter 33 feet long. The caps were 5 feet apart, supported on top of posts 13 feet apart in vertical planes parallel to the longitudinal axis of the pier. The posts had transverse sills 14 feet long with diagonal braces from their ends to the cap-beams. The cap-beams overhung the post centers 10 feet at each end and were braced by diagonal struts from their extremities to the feet of the posts. The ends of the cap-beams were anchored to the ground by ¾-inch adjustable guy chains. The hoisting tackles were operated by sweeps set on the ground near the piers. Each end of each truss was hoisted by two tackles suspended between the ends of the cap beams from rollers which rolled back on short lengths of track rails to traverse the girder to its seats after it was raised above the pier-top. Fifty-four spans, weighing 7,668 tons, were erected and completed in 8½ months. The bridge was designed and constructed by Mr. E. T. G. Walton, engineer-in-chief under the Government of India, and was illustrated in recent issues of London "Engineering."

Surveying in Central America.

There has always been a sort of fascination about surveying operations in the tropics which lends interest to even the dry official reports on such work. This is particularly true of the surveys in Central America to furnish information concerning the practicability of various ship-canal routes, articles concerning which have appeared in this journal on November 19, 1898, and September 29, 1900. One of the engineers most actively engaged on this work since 1888 is Mr. Boyd Ehle, who has a paper on the problems and methods of the Isthmian canal surveys in the "Transactions" of the Association of Civil Engineers of Cornell University for 1901-02. In a general way the operations were similar to those preparatory to railway location in the United States, but various modifications were necessary owing to the special local conditions. The organization of the engineering department had a chief engineer at the head, under whom were division and assistant engineers. The latter were in charge of a party in field work, or a section of construction. A survey party had two instrument men, a level rodman, two chainmen, a cook, helper, and about eight machetemen, as a minimum. In new country the assistant engineer was supposed to scout the work ahead of the instrumental survey, using hand instruments and perhaps pacing distances. To get the best results a clinometer was used and a chart giving the pacing reduction for various slopes. With a small protractor it was possible to make a map and sketch on the topography. A machete was, of course, the most essential part of the outfit, without which progress was well nigh impossible.

Much valuable information could be easily and quickly secured by these preliminary examinations, and if results justified a detail survey, a compass or transit lines with levels would be run through paths cut by the machetemen and the line cross-sectioned for a considerable distance on each side, so that in case of a probable canal location, this could be projected on the map. Usually the field work was mapped out on a scale 400 feet to an inch and 10 feet contours, but in the more important work at the lock and dam sites, 100 feet or 50 feet to an inch was used. The topography of large tracts was thus developed in order to cover thoroughly the area of comparative feasibility. No comprehensive idea of the whole problem could be secured except from maps, for the field work was somewhat like surveying in the dark, as far as the physical characteristics adjacent to the line were concerned.

There was, however, a great difference in the amount and character of the work of the various assistant engineers, due, Mr. Ehle says, both to method and energy displayed. A certain man seeking out a ridge or canal location would try to make a checker-board survey of the whole country in question and pick out his results on a map, while another would carefully scout out the work on the ground and direct the survey at once to the desired results. The latter was the more valuable man, but it required greater physical energy on his part. Often an assistant engineer simply kept his men at work while he remained in camp, ran the party and submitted results.

In the surveys of the impounding ridges for the basins it was considered best to determine the general direction and follow that compass course until it ran off the heights into a water course, and then offset back up a branch to the divide again and start over.

In a canal survey it is important to get the shortest distance with the least elevations, and this usually led into valleys and swamps where the work was disagreeable, difficult and unhealthy, not to mention the attention of the myriads of mosquitoes and other insect pests. Transit location surveys never averaged one-half mile a day, while compass and cross-section work usually averaged less than 5,000 feet per day, with a maximum of about 8,000 feet per day.

In a river survey, stadia methods were used for fixing the points along the bank, and the soundings located from these by the stadia or sextant. With the sextant the boat was usually run on a range and the soundings taken at time intervals. The line was assumed straight between the sextant observations, which is only possible in still water. With the stadia it is possible to locate each point more quickly and accurately. Stadia or gradient methods were of little use in the forests, and the chain was usually depended on for distances. Triangulation surveys were used on Lake Nicaragua, but were not effective on the San Juan or other rivers on account of the great difficulty of clearing out the overhanging trees along the banks.

In a reconnaissance along the coast of Darien, two sextants were used to establish the position and elevation of points on the distant mountain range and the contour sketched. The distance between the observers was determined by observation on the mast of a ship. The results, although somewhat crude, answered the purpose, and were secured very quickly and cheaply.

In the investigation for foundations and classification of material various methods were used. The earth auger was the most simple and least satisfactory, as it was difficult to manage at any great depths, and when stone was reached it was the limit of the boring and in no wise conclusive that this indicated rock in place.

The Pierce machine, with its facilities for driving, casing and washing up light material, succeeded the common earth auger. With this when stone was reached it was customary to lower sticks of dynamite and explode them by an electric battery, which usually was sufficient to displace ordinary boulders. If this was not effective the diamond drill was used to get deeper and obtain a core of the material. On the Panama canal deep test pits were used, and even a tunnel to determine the substrata.

The various classifications of material were obtained from samples preserved by the boring foreman in small bottles, if earth or of rock by taking a section of the core. These were labeled with the location of the hole and depth in feet at which they were taken, and shipped to headquarters for use in classifying the material on the cross-sections for estimates or determining questions of foundations.

Gauging stations were established at important points on the various canal routes and around the watershed of the water supply for the summit level. The observers were required to keep a careful record of the rain gauge, river gauge, and thermometer, also to make gaugings of streams with the current meters. Sediment observations were also conducted on the more important streams by lowering a sediment box and ascertaining the quantity of material moved in a certain period. Current meters were rated by moving them at uniform velocity in still water and plotting the results as a curve. The meter was then used with a boat that was anchored at points along the cross-section of a stream, if this was possible. It was sometimes necessary in large rivers in flood, to rig a cable over the stream. On this was hung a car from which the observer used his meter. The results of the rain gauge observations were plotted to give zones of rainfall, which were variously colored. These data and the river gauging observations were necessary in the very extended computations to ascertain the sufficiency of water for the lockage, and also the proper measures to be taken to regulate the floods.

The camps were usually sheds with a roof of palm leaves which were lapped similar to shingling; side walls were not necessary. Canvas tents were not a success, as they were soon ruined by the mildew of the damp climate of the rainy season. The beds were of a piece of canvas with poles through the side loops, and raised on crotched sticks. The kitchen arrangements were very simple: crotched sticks with a cross-bar were used to hang the kettle over the fire, or sometimes a rough fire place of large stones took the place of this.

In the rainy season it was first the custom to attempt to dry wet clothes with Sibley stoves, but after several dry houses were burnt with their contents, this was not in favor; it was found that no ill effects were experienced from wet clothes, although it was not unalloyed pleasure to get out of warm blankets into cold wet clothes. In the evening, on returning from work, it was customary to take off wet clothes, have a bath and get into pajamas. In mosquito infested camps, this was followed by getting under the mosquito bars as soon as possible after supper. It was sometimes necessary to do office work under mosquito bars.

The office work in the field was usually somewhat crudely done, merely to verify the accuracy of the work and its completeness. Duplicate copies of notes were made and sent to the division or chief engineer's office. At headquarters the field work of the various parties were combined into large contour maps somewhat elaborately drawn. On these large contour maps the various projects were laid out and studied. A paper location would often be sent to an assistant engineer to be run out and verified. When all the data were in, estimates were made by taking cross-section notes from the map, plotting these with the classification of material obtained from the boring notes, and obtaining the yardage by the planimeter measurement. Maps were plotted and surveys adjusted by the method of latitudes and departures. Courses were generally referred to the true meridian in transit work, checking this by the needle course. From star observations it was possible to get latitude co-ordinates for the maps. Longitude was obtained by carrying chronometers from Panama, which had been very accurately located by direct observation as a primary point by a French astronomical expedition.

By means of these map co-ordinates it was possible to combine the new work on small scale maps with those of the coast survey and other expeditions. For this work the large maps were pantographed down; usually each set of maps was reduced one-fourth, although this was not strictly adhered to. In the Darien survey the field maps were 1/12000, the general map of a route 1/60000, and the general map of all the routes 1/300000. The general map of the Panama route was made 1/100000, the profile had a similar horizontal scale with a vertical scale 1/1000. The general map of the Nicaragua route had a scale of 1/506880, the sheets of general topography 1/57600, and the detail topography 1/19200; on these latter sheets were placed the boring records. Plans of structures were made 1/480, 1/960 or 1/100 as was necessary to show details.

The Macadam Pavements of Winnipeg, Man., were repaired during 1901 at an average cost of 4.18 cents per square yard, as stated in the report for that year of City Engineer H. N. Ruttan. Formerly the macadam consisted of broken stone 10 inches thick at center and 8 inches at the sides, the first course being limestone and the top 3 inches of trap. Now, however, limestone only is being used. During the year nearly 33,000 square yards were laid at a cost of about 74 cents per yard.

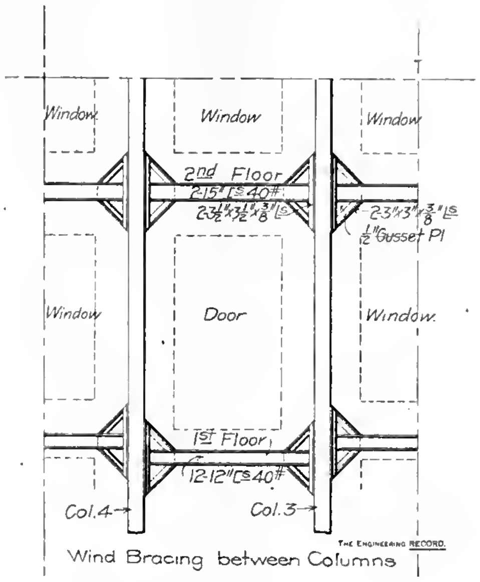
The Description of the North German Lloyd Piersheds recently printed in this journal contained a few errors. The weight of the roof in the cut on page 579 is stated per square yard but should be per square foot. The theoretical range of expansion of the sliding joints mentioned on the same page is 1½, not 1¼, inches. The flooring of the second-story is a 3-inch first layer and a 1¼-inch second layer of pine, instead of 2 inches all told, as stated on page 579. On the next page the height of the upper section of the doors should be 10 feet instead of 12 feet for piers 1 and 2 and 11 feet for pier 3. The leader mentioned on page 611 is 4 inches, not 4½ inches.

The Battery Place Building, New York.

The Battery Place Building is a twenty-story steel-cage office building, 255 feet high from basement floor to roof, which has a frontage of 181 feet on Battery Park and 63 feet on West Street. The principal contracts have been let, the work on the caissons and substructure is well advanced and it is expected that the building will be ready for occupancy next May. There are in the framework 53 riveted steel columns with rectangular closed cross-sections built of two channels and two or more cover plates. They are seated on 48 concrete piers carried to bed rock in steel pneumatic caissons, as described in The Engineering Record on June 21. Most of the piers are cylindrical with steel shells or cofferdams extending to about 2 feet below the basement floor and having circular granite cap-stones 20 inches thick and 6 inches less in diameter than the pier, bedded in the concrete and projecting 2 inches above the top of the shell. A second granite cap-stone 2 feet narrower than the first, is bedded on it and receives the cast-iron column base which nearly covers its surface and has its lower flange bedded in the concrete of the basement floor.

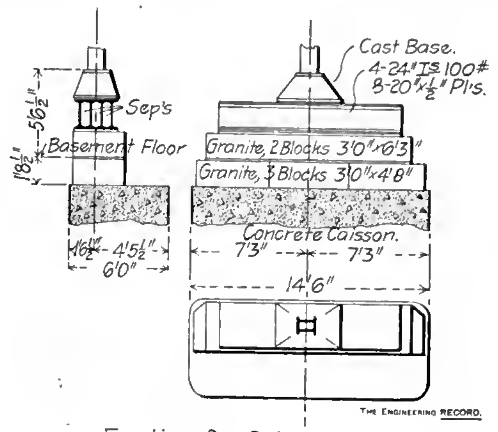
There are sixteen rectangular piers with rounded corners, four in the center of the building and two in the front wall-column line which are symmetrically loaded with two columns each; two more in the front wall-column line which have a single center column each, and eight in the rear wall-column line which are eccentrically loaded with one column each. The twin columns on the front wall piers are 31 inches apart on centers and are seated on the upper course of granite cap-stones. The rear wall-column piers are filled with concrete to the tops of the steel shells and have two courses of thick, large, rectangular granite capstones close to the outer edges, surmounted by steel grillage beams, as shown in the diagram of the footing of column 44.

Excepting four columns which are arranged on the arc of a circle around the elevator shafts adjacent to the 66x18-foot light court, all the columns are at the intersections of longitudinal and transverse lines from about 12 to 15 feet apart, but in some cases columns are omitted making maximum spans of nearly 30 feet for the floor girders. The upper sections of the columns are only one story high, all others are two stories, generally 23½ feet high, and all are spliced with horizontal cap plates and standard splice plates, shop-riveted to the lower and field-riveted to the upper sections. The smallest column load is 25,300 pounds, in the twentieth story, where the column is made with two 10-inch channels, latticed. The heaviest loads are, of course, in the basement where one column has a load of 1,194,200 pounds and is built with two 13-inch 50-pound channels, four 16x13/16-inch flange plates and two 12x½-inch web reinforcement plates. Another column has a load of 1,361,400 pounds, which is the maximum, and is built with two 13-inch 50-pound channels, six 16x¾-inch flange cover plates and two 12x¾-inch web reinforcement plates.



Wind Bracing between Columns

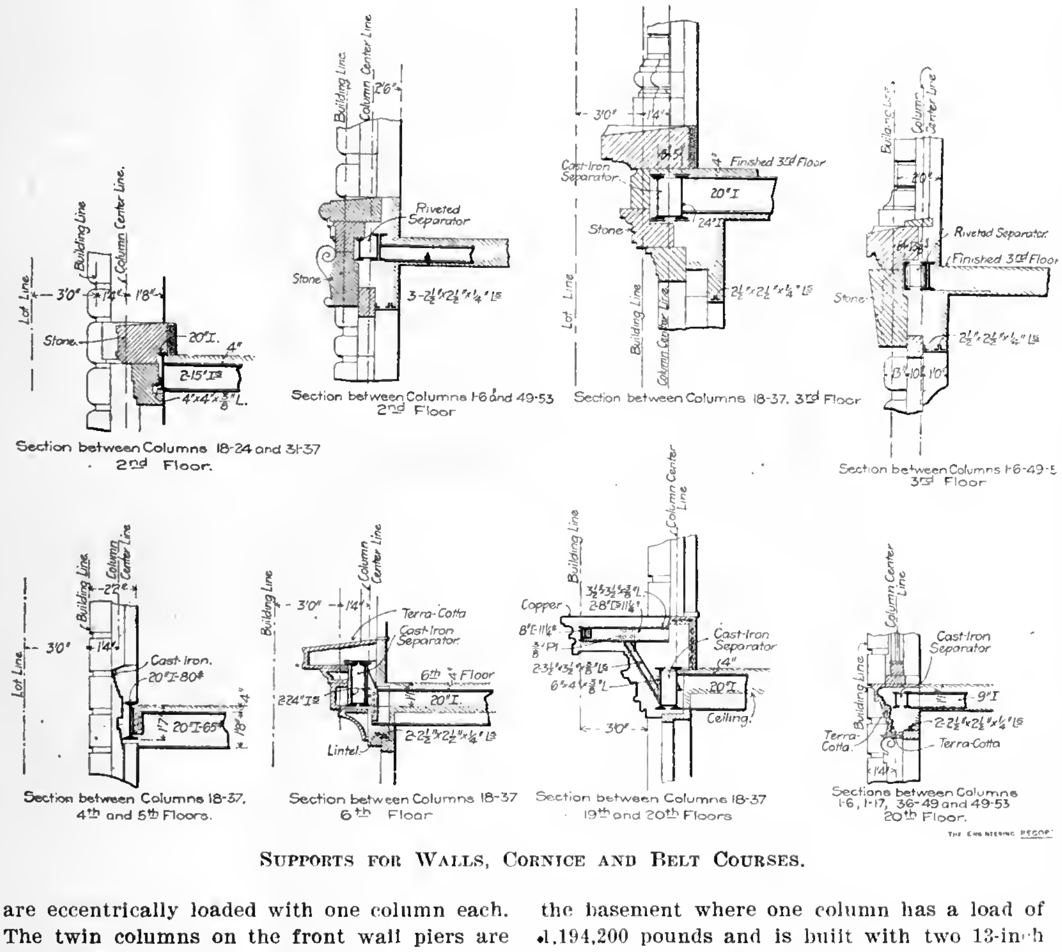
The floors are end-construction hard tile flat arches, calculated for a total load of 160 pounds per square foot and supported on 8, 9 and 10-inch I-beam joists from 4½ to 5½ feet apart and 12 to 15 feet long. They are web-connected to 10 and 12-inch floorbeams of about the same length, or to 20-inch I-beam girders of twice that length. The wall-columns are connected by floorbeams on their center lines; these beams have others of the same size bracketed out from them beyond the faces of the columns, to which they are also riveted, to carry the wall masonry. These beams are 20 inches deep in the long panels and from 9 to 15 inches deep in the shorter panels. The location of columns is shown in the half plan of the building, which gives the arrangement and principal sizes of beams in the tenth to the fourteenth floors inclusive, and is typical of all the floors above the basement. Below the eighth floor the wall girders in the end walls are composed of pairs of 12 and 15-inch channels riveted together, back to back. The framing of the roof



Footing for Column 44.

beams is similar to that of the floors except that some of the beams are lighter and closer together and there are double lines of 20-inch I-beam girders under the walls of a T-shaped steel-frame janitor's house, one story high.

In the lower stories of the Battery Park front the wall stones are notched to rest directly on the top flanges of the wall beams, as shown in the details of the second-floor connections. In the middle panel of the Battery Park front the sixth-floor beams are about 15 inches below the top flanges of the wall columns and their outer ends are connected to the webs of the latter with drop-plates as shown in the detail. In the third-floor tier the wall girders support a very heavy projecting belt course of granite blocks and in the 29 1/3-foot spans of the center panel the wall masonry is supported on a 24-inch 80-pound I-beam which is riveted at the ends to the columns and is connected intermediately to the corresponding floorbeam girder by riveted web diaphragms or separators. The flanges of these 24-inch I-beams are all reinforced by full length 9x¾-inch plates riveted to them, and a continuous horizontal 2½x2½x5/16-inch angle, not shown in the detail, is riveted to the inside of the web of the floor girder to carry the skewbacks of the floor arches. The heaviest projecting course of granite stones is supported directly from the tops of both the wall and floor girders, and two lower courses are secured to them with suspension bars and anchors. In the West Street end of the building the corresponding granite courses are notched over 15-inch channel girders about 15 feet long, which are connected intermediately by vertical transverse diaphragms with a pair of 15-inch channels riveted together, back to back, for the floor girders, and are connected to the columns symmetrically with the wall girders. In the fourth and fifth floors there is a cast-iron moulded fascia plate between the window openings above and below and as no masonry is carried at this level in the middle panel of the building, the wall girder is omitted and the fascia plate is attached to the floor girder as shown in the



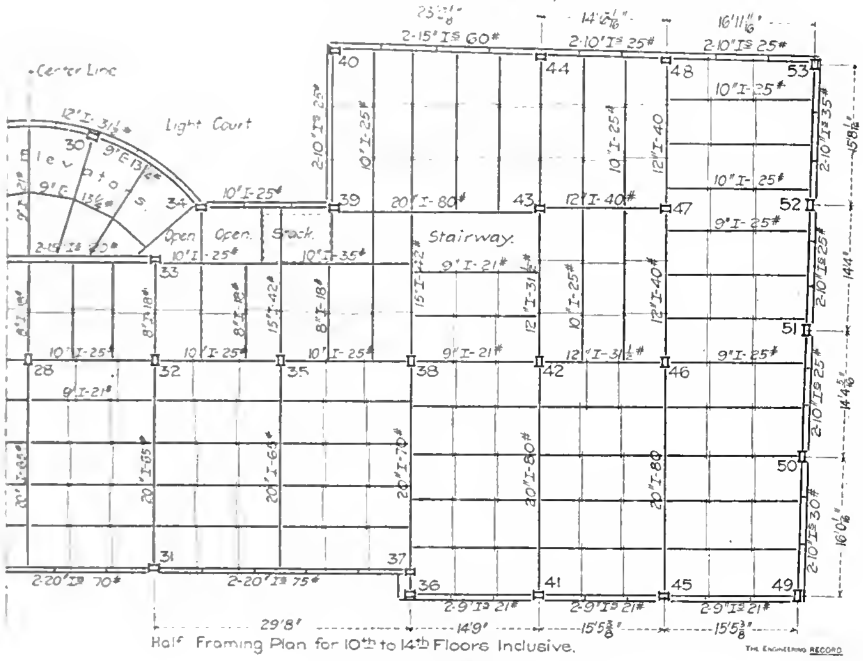
SUPPORTS FOR WALLS, CORNICE AND BELT COURSES.

detail section, which also illustrates the drop end connection for the floorbeams of nearly 21-foot span.

At the nineteenth floor a copper cornice about 4 feet deep projects nearly 4 feet beyond the face of the wall and has light metal cross frames carried by an 8-inch horizontal channel bracketed out from the wall girders and columns, as seen in the cross-section through the middle panel of the Battery Park front. A bracket projects from the face of each column, but as the center columns are nearly 20 feet apart the span is reduced by an intermediate bracket which is similar to the one shown and has the inner end of its two 8-inch horizontal channels built into the wall instead of being riveted to the column web. In the side panels in the front and in the ends of the building, the wall girders are pairs of 8, 9 and 10-inch I-beams, and the knee-brace angles of the cornice brackets are not connected to them at all, but are riveted to the column webs. At the twentieth floor there is no projecting cornice, but there is a course of moulded terra cotta blocks at the height of the wall girders and connected directly to them in the position shown in the section of the floor at the West Street end of the building. In the middle panel of the Battery Park front the arrangement is similar, except that the wall girders are 20 inches deep and are, with the terra cotta course, set back about 28 inches from the building line. The flat roof pitches down towards the Battery Park front and is surmounted by a massive balustrade which, with the outer ends of the roof beams, is carried by wall girders at the upper ends of the columns. On the ends of the building these girders are 12-inch I-beams; in the middle panel of the front they are long-span 20-inch I-beams. In both cases they support the upper edge of the deep copper cornice which projects about 20 inches from the building line and is carried at the lower edge by a pair of I-beams similar to those shown for the lower tiers.

At the two narrow ends of the building transverse wind bracing is provided by a system of knee-braces on all the wall columns up to and including the seventh floor. The wall girders consist in every case of a pair of 12-inch or 15-inch channels riveted together, back to back, on the center line of the row of columns. Between the webs of the channels at each end of each girder there is a vertical ½-inch plate about 2 feet wide which projects 2 feet beyond the upper and lower flanges of the girder as shown in the elevation of one panel of the south wall of the building. Pairs of 3x3-inch flange angles are riveted to all the edges of these plates and serve both to stiffen the diagonal sides and as connections to the columns. These knee-braces only occupy a small space in the panels between the columns and girders and give clearance for large rectangular windows which occupy about one-half the area of the walls. In each end of the building there is a door in the center panel of the first story and to clear it the wall girder is depressed about a foot below the adjacent wall girders, making an irregularity in the braces as shown in the elevation of one panel of the end wall. In all other cases the bracing corresponds to that which is shown for the second floor wall girders.

Mr. H. J. Hardenbergh is the architect of the building and the George A. Fuller Company is the general contractor. The Carnegie Steel Company is the sub-contractor for the 3,000 tons of structural steel in the superstructure, and Messrs. Purdy & Henderson are the consulting engineers.



TYPICAL BEAM PLAN.

The Stability of Chimneys is the subject of regulations issued on April 30 by the Prussian Ministers of Public Works and of Commerce and Manufactures. The stacks must hereafter be designed for a wind pressure of 25½ pounds per square foot, no attention being paid to suction on the lee side and no allowance made for the protection afforded by neighboring structures as a rule. The center of pressure will be taken at the center of gravity of the center vertical cross-section. The pressure on a round stack is to be taken at 67 per cent. of that on a square stack with a face of the same width as the diameter, and at 71 per cent. for an octagonal stack. The same proportions hold for a wind blowing against an angle rather than a face, and this direction is to be assumed in computing the maximum stresses. The horizontal cross-sections must be so planned that in no case will there be a tendency for the joints to open on the windward side farther than an axis through the center of gravity. The allowable pressures are as follows: Ordinary brick laid in a 1:3 lime mortar, 100 pounds per square inch; hard brick in lime and cement mortar, 170 to 210 pounds; concrete simply deposited, 85 to 115 pounds; rammed concrete, 125 to 210 pounds; good earth foundations, 6,000 pounds per square foot, and, in exceptional cases, 8,000 pounds.

Ventilating and Heating the Rochester Athenaeum and Mechanics Institute.

An interesting system of ventilating and heating has been installed in the Rochester Athenaeum and Mechanics Institute, Rochester, New York, embracing hot blast apparatus, indirect steam heating and a considerable amount of direct. There are two large supply fans installed in the basement, the air for which is taken through screened windows, passed through tempering coils and then through a large coke filter. The latter is one of the features of the installation, the economical working of which is enhanced by using for the moistening of the coke the surplus water taken from a Johnson hydraulic air compressor operating in connection with automatic thermostats for temperature regulation throughout the building. From the fans the air is delivered into a plenum chamber, which it leaves through a number of ducts each individually serving a particular part of the structure. Vent ducts are provided for exhaust ventilation and special provision for such is made in the chemical laboratory by having a system of hoods and piping over the tables and using an electric fan to draw the air upward through a flue to the roof. Another interesting feature of the work is a tile duct system under the floor of the basement for the passage of air from the fans to the latter for ventilating purposes. The power house is in an adjoining building and is separated from the Institute by an alley 16 feet wide; the steam piping and electric conduits are carried accross the latter in an underground conduit.

The main structure is three stories high inclusive of the basement, and occupies approximately 44,640 square feet of ground between Plymouth Avenue and Spring Street. The entrance is near the center of the building on Plymouth Avenue and leads into the first floor. There is also an entrance on the Spring Street side as one means of access to the basement from the street. On this floor, as on the floors above, the space is divided into six sections by a main corridor, the smaller halls and a court shown on the basement plan. One of the largest rooms here is the physical culture room, 42x80 feet in size, a fan room, 44x60 feet in plan and 13 feet high, and several others, the dimensions of which may be taken from the accompanying sketch. The first floor contains a library, a public office, three kitchens for cooking classes, four recitation rooms, two laboratories and other rooms for various purposes. The second floor is composed of six rooms for dressmaking classes on the left, biological laboratory, chemical lecture room, rooms for the mechanical department and those for painting, design, etc.

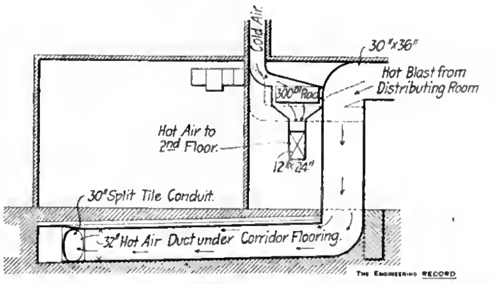
The boiler plant is contained in the narrow building adjacent to the main building. There are three boilers installed, two new ones and one old one. The former are each of 150 horsepower apiece and are of the Cahall vertical water-tube type, 28 feet high and 10 feet 8 inches in diameter. They are fitted with Jones under-feed stokers. The steam pressure usual carried is 60 pounds per square inch. The third boiler is 40 horse-power in capacity, and is of the standard horizontal tubular type made by the Stearns Manufacturing Company, of Erie, Pa. It is set to the side of the others for convenience in piping, a 4-inch pipe being taken from the steam dome in front and carried over to a 5-inch connection from the vertical boilers. From the 5-inch connection, a 7-inch main is led to the other building through the 30-inch conduit running under the alley, and a 5-inch reducing valve introduced in a branch line at a convenient point, so as to obtain a suitable pressure of the steam for heating purposes. A 2½-inch high pressure main is also brought over to the main structure for the fan engine for summer use. A blow-off tank, boiler feed pump, etc., are contained in the old power house, while the location of the auxiliary apparatus for the heating plant of the new building is shown on the basement plan.

Ventilation is accomplished, as mentioned, by the forced blast system. Air is taken into the building through two windows, each 5 feet wide by 10 feet high, covered with ⅜-inch mesh bronzed wire screen and passes on to two tempering coils, one to each window located in the fresh-air room. The tempering coils consist in each case of four sections of 1-inch pipe, one of them with four rows and the other with two rows. The coils were furnished by the B. F. Sturtevant Company, of Boston, and are 7 feet high. In the tempered air chamber there is installed a Johnson humidostat operating automatically, which is controlled from the main office.

The air next comes in contact with the filter, which is constructed of an angle iron frame extending across the room, a distance of 32 feet, supported by standards from the floor and ceiling spaced 2 feet apart and having heavy wire screening of ⅜-inch mesh stretched on either side. Between the screening is a space 9 inches wide which is filled in with broken coke. A horizontal bounding strip on top is a closed water trough, triangular in section, the apex pointing downward and perforated so as to allow such water as is supplied to it for the moistening of the coke to escape slowly and percolate through the latter. At the bottom there is a cement trough constructed to carry off the waste water.

Passing from the filter, the air is drawn into two Sturtevant horizontal steel plate blowers, each with a 9-foot diameter wheel, 4½ feet wide at the periphery, which, when revolving at 150 revolutions per minute, is counted on to deliver 94,000 cubic feet of air per minute against a back-pressure of ⅝ ounce. The fans are rotated on 3 15/16-inch shafting, coupled at the center, with inside bearings and driven by horizontal engines of the same manufacture. The illustration shows the fans and engines. The latter are both 9x12-inch machines. The blowers deliver their air supply to an enclosure in which are placed two heaters having twenty sections of 1-inch pipe, 6 to 14 feet long by 7 feet high, sixteen sections of which have four rows of pipe and four of them two rows. The air thus heated is forced into the plenum chamber shown on the plan.

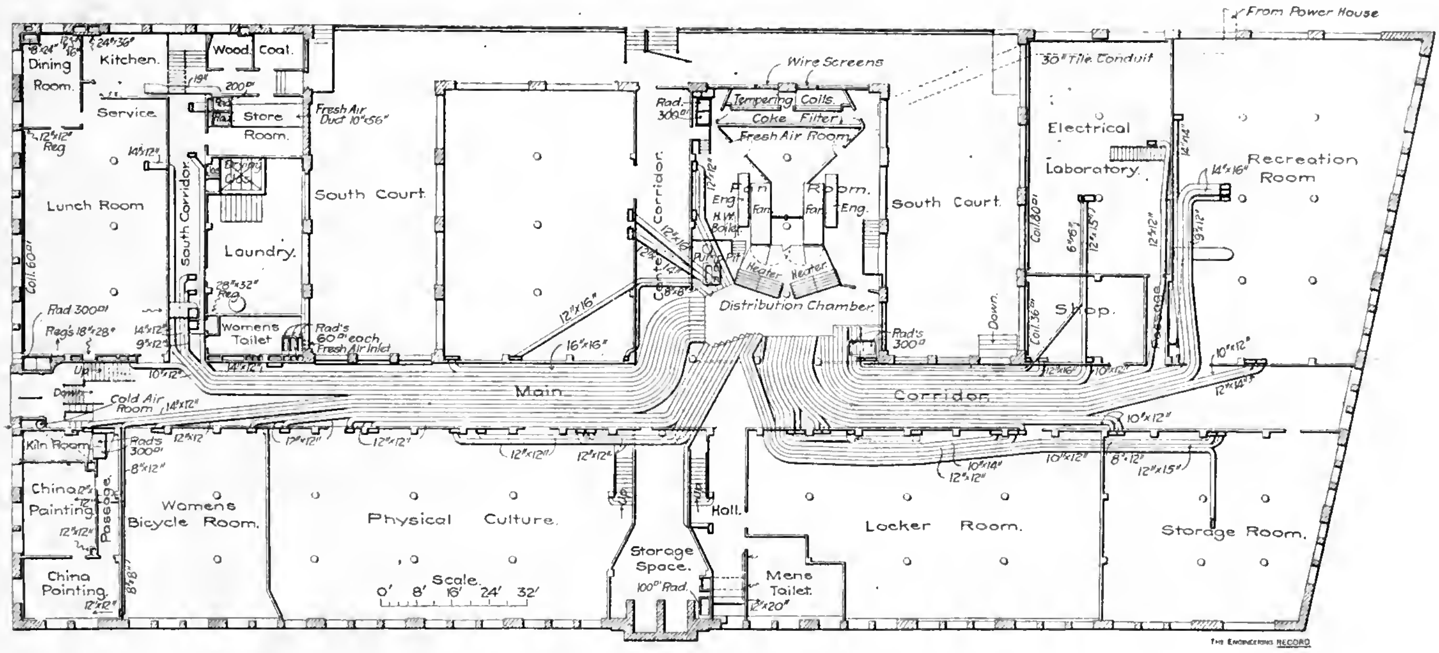
The distribution of warm air is effected as previously mentioned by separate ducts which lead from the distributing chamber to flues individually serving particular portions of the building. In all there are about 50 ducts radiating from this enclosure, the air supply through each being governed by dampers at the mouths, operating automatically under the Johnson system. The accompanying drawings indicate the direction of the ducts and the localities of the flues, the system being so proportioned as to supply a uniform amount of air per minute to each room in proportion to its cubical contents. The tile heat ducts in the basement, extended beneath the floor, consist



ENTRANCE OF BASEMENT DUCT.

of a system of vitrified sewer pipe receiving a supply of warm air through a 30x36-inch vertical brick flue brought from the chamber to a distributing duct, "this duct to be laid in Portland cement mortar and tile drain laid in Portland cement with a water-tight joint." There is also a tile fresh-air duct under the kiln-room floor, taking air from a small room to the left and discharging it over the two indirect radiators shown, the vitiated air passing out through louvres to vent flues. Vent flues throughout the structure have been proportioned about the same as the heat flues, louvres have been set in where necessary, and special provision has been made for the ventilation of the qualitative laboratory by the installment of the system of hoods and piping before mentioned. A small vent duct is also shown in the locker room on the basement floor, and a 10x8-foot stack near the ceiling in the laboratory on the second floor which has a coil of 25 feet of steam pipe with automatic air valves. Wire screening has been used throughout for heat and vent registers. Valves in the vent stacks are closed at night and allow a circulation of the warm air contained in the building.

The auxiliary indirect heating apparatus is set up in various places, the most prominent point being at the basement entrance. In this case there are installed two pin radiators, one above the other and of a total area of 300 square feet on one side of the hall. The fresh air is admitted at a point outside the building wall and allowed to pass under the radiators, thence into the lunch room and to kitchen B, on the floor above. Another example of indirect heating by natural means is that near the center of the main corridor on the basement floor. Here two radiators with a total surface of 300 square feet are set underneath the floor and air is introduced at the court wall, passing out through the registers indicated in the drawings. Another instance is the apparatus under the store room floor taking air from the left-hand court, which, after passing over a pair of radiators set as shown and containing 200 square feet of heating surface, is led to kitchen C above and the store room, etc., below. In a toilet room opening from the south corridor there are three indirect heating stacks installed, of 60 square feet each, which have an air supply through an opening in the court wall. The flues supplied from this heating surface, three in number, are run to the corridors on the two floors above.



BASEMENT, SHOWING HEATING APPARATUS.

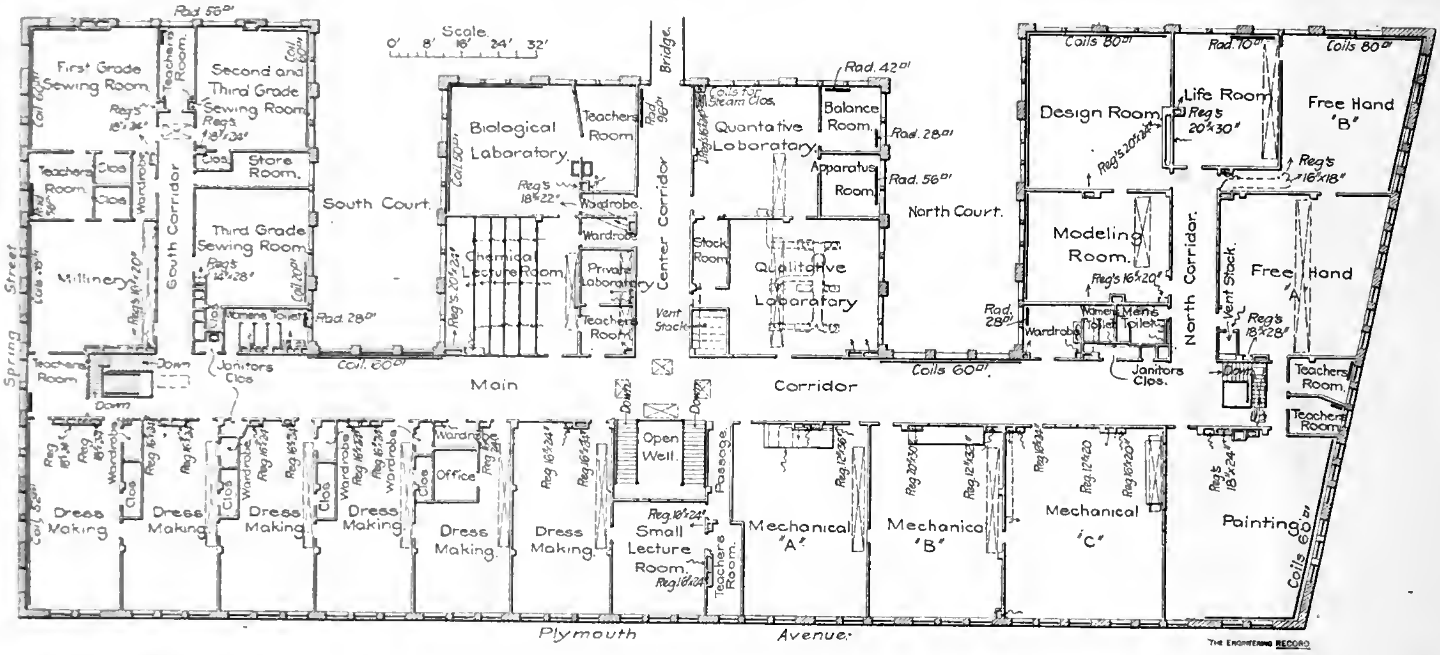
The direct heating of the building is mainly in the offices, teachers' room and kitchen of the first floor. The radiators are of Fowler & Wolfe manufacture. The small offices have each 21 square feet of direct radiation, the board room 84 square feet, and the teacher's room, pantry and kitchen A, 56 square feet apiece. The large lecture room on this floor is heated partly by a coil of 1-inch pipe extending around the room beneath the court windows, and the architectural room and physical laboratory for the study of light, by 60 feet of the same size pipe in each case. Other rooms thus heated on this floor are shown. Several of the rooms on the floor above, which are on the western side, have a similar installation, including the sewing rooms, the biological laboratory, and the fine arts rooms. The window surface of the smaller rooms on the opposite side being small, no heating coils have been necessary to offset the cooling effect.

Steam cooking apparatus is installed in the kitchens and in the drying room steam outlets have been provided, the pressure of the steam being about 60 pounds per square inch for these purposes. In the laundry a complete 9-section metallic drying closet, fitted with large coils for quick drying, was supplied by A. T. Hagan & Company, of Rochester, N. Y.

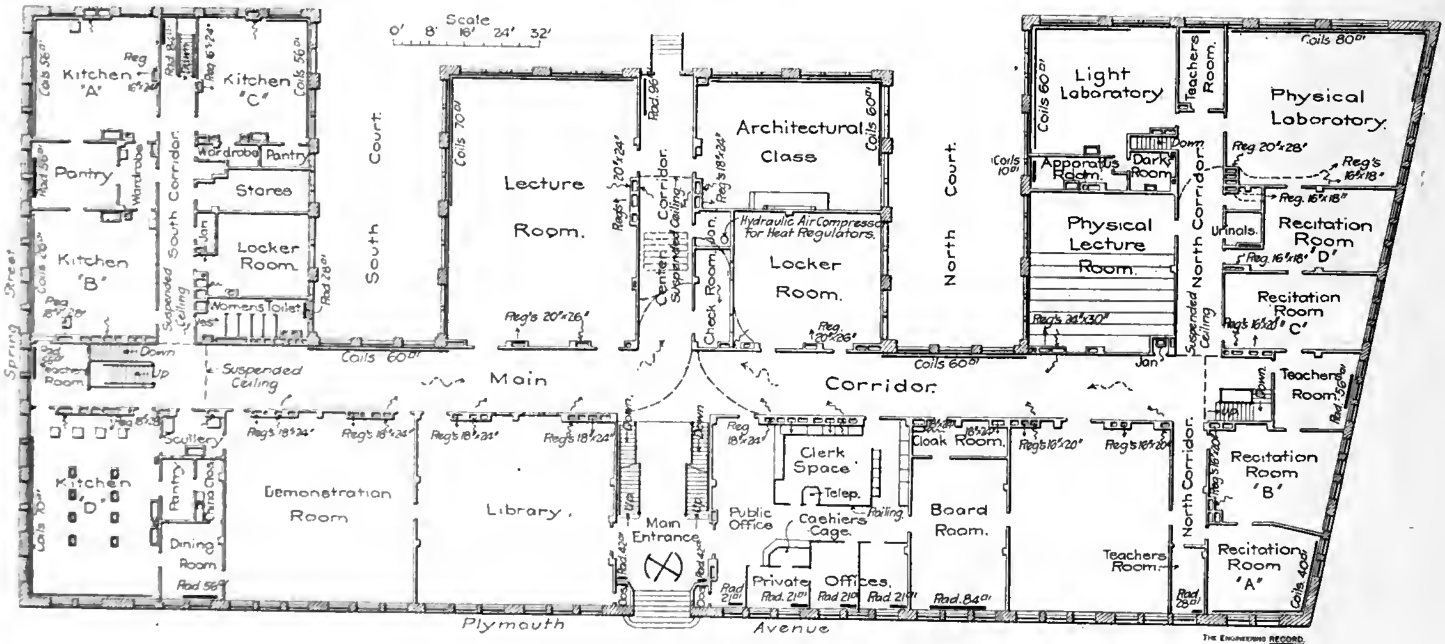
The contract for the heating work required that "the contractor shall guarantee to warm all rooms provided with heat throughout the first and second stories, also the lunch room, dining, kiln and two china painting rooms in the basement to 70 degrees Fahrenheit, and all corridors and the balance of the basement to 60 degrees in zero weather, all at the same time, the temperature to be taken 2 feet above the floor line, with the building constructed with unfurred outside walls and single sash." Regarding the heat ducts and flues, the velocity of warm air in the former has been figured to be about 1,400 feet per minute while that in the latter is probably 600 feet per minute. The Johnson system of temperature regulation is in use on all coils and radiators throughout, as well as the automatic dampers in the air ducts. Valves on all lines are of the Jenkins Brothers manufacture and a 4-inch grease separator of the Baldwin horizontal type is set in the exhaust line from the engines and pumps. Rod and clip hangers are used for supporting all piping, and suitable provision has been made for contraction and expansion of steam lines.

The architect for the building was Mr. J. Foster Warner, of Rochester, New York, who also designed the entire heating apparatus. The contractor having charge of the installation of the warming equipment was Mr. R. T. Ford, also of Rochester. The cost of the entire building and land was $225,000, and was the gift of Mr. George Eastman, of the Eastman Kodak Company, of the same city. The cost of the heating plant including the Cahall boilers was about $30,000.

Pipe Subways at the University of Nebraska, Lincoln, Neb., are described by Mr. G. H. Ellsworth, assistant superintendent of Grounds and Buildings, in the "Blue Print," the annual publication of the Engineering Society of that university. In order to keep the steam mains at a safe distance above water level in the boilers, they had to be carried close to the surface of the ground, requiring a tunnel having a comparatively flat roof. This was built of 3-inch 5½-pound I-beams, bent to a 3-inch camber and spaced 18 inches apart, with the ends resting on the side walls, which are 8 inches thick of hard-burned brick laid in Louisville cement mortar. The roof beams carry 12x18x3-inch porous terra-cotta book tiling having ends notched to slip between the flanges of the beams. On the tile is placed 1:2:4 Louisville cement concrete, 3 inches thick, and a finish coat of 1 inch of Atlas Portland cement mortar, in the proportion of one part cement to two parts sand. The tunnel floor is a brick invert with the bricks laid on edge and grouted with thin cement mortar. With the sandy subsoil underlying the campus, drain tiles were considered unnecessary and were omitted. At each junction box the roof of the tunnel is brought to the surface of the ground and double trap doors, made from ¼-inch steel plate, give access for handling full length pipe to and from the tunnel. Some of the branch lines are carried in smaller tunnels, the roofs of which are of 4-inch flagstones jointed with cement mortar. The return mains are suspended from the steam main hangers by No. 10 galvanized-iron wire cable and were brought to grade by inserting a wooden twister between the wires. Winter temperatures reach 175 degrees Fahrenheit in the main tunnel and little evidence has been found of radiation at the ground surfaces, even where the earth covering is thinnest. During the summer of 1900, 120 feet of concrete tunnel were constructed, with side walls of 1:2:4 Louisville cement concrete, the roof of 1:3:5 Nazareth Portland cement concrete, finishing with 1 inch of 1:2 Portland cement mortar. The walls and roof are 8 inches thick. For supporting the steam mains 1¾x1¾-inch tees are bent to conform to the tunnel roof spaced 12 feet apart with the webs extending slightly inside the arch. Holes in the webs furnish the means for supporting pipe hangers, which consist of pipe rollers suspended from chains.



SECOND FLOOR PLAN.



PLAN OF FIRST FLOOR.

The Drafting System of a British Engine Shop.

So much discussion has taken place of late concerning drafting office methods that considerable interest will doubtless be aroused in a description in "Engineering" of the system of shop drawings adopted by David Rowan & Company, a British engine-building firm. In the drafting office of the company, the drawings are made, with few exceptions, on 40x27-inch sheets. Standard drawings, marked "S. D.," show such arrangements and details as have been adopted as standard articles and which never vary, and may be used for any job without alteration. Contract drawings, or "C.D.," are drawings which have to be made specially for any particular job or contract, and which are peculiar to that job. Alterations or deviations from standard drawings fall under this heading.

Each series of standard and contract drawings has a running number. In order to distinguish between standard and contract drawings a special method of numbering is followed. The standard drawings begin at 1 and run up to 1999, then begin again at 3000 and run up to 3999, and then from 5000 to 5999, and in like manner for higher numbers. The contract drawings begin at 2000 and run up to 2999, then from 4000 to 4999, then from 6000 to 6999, and also in like manner for higher numbers. The drawings are known as "S.D. No. 1890," "C.D. No. 2890," etc., according as they are standard or contract.

The objects of the arrangement are (1) to allow the standard and contract drawings to be kept separately, and (2) yet allow each class to have a continuous series of running numbers, thus avoiding blanks, and showing when a drawing is not in its place in the drawer, and (3) to avoid having two simultaneous series of running numbers.

Each sheet is divided into ten equal rectangles or blocks, measuring 13½ by 8 inches, by dividing its breadth, horizontally, in halves, and its length, vertically, into five parts. Each block or section has a border line drawn ¼ inch from each side, making the space in which the drawing must be contained 13 by 7½ inches. Each block is numbered A, B, C, D, E, F, G, H, and I, and the lower right-hand block is reserved for the drawing number and title.

Each block is known by its symbol, which consists of two letters and a fraction, thus, S.D. 1890/H, the numbers indicating the numbers in the class, and the final letters the particular blocks or sections of the drawings themselves.

In the C. D. series the block devoted to the arrangement occupies section A at the top of the left-hand corner of the sheet, and the details fill the following blocks, each block having one piece, and one only, drawn on it. Should the necessary views of the arrangement or any of its details require more than one block for its proper representation, two adjacent blocks may be taken. Should the drawing require to show the method or attachment of the piece or its relation to another piece, this other piece is to be shown in dotted lines, and will, of course, be drawn in full on another block.

In the S.D. series the same principle is followed; there being but one piece to each block, with the arrangement on block A, and the details following in succeeding blocks.

Immediately a standard or contract drawing is started, the draughtsman goes to the drawing records and books the number, and at the same time he enters the proposed title and his name. On the completion of the drawing he enters particulars of the date finished and full title. The draughtsman immediately fills up a C.D. or S.D. register card for the card cabinet. The standard drawing cards are white and the contract drawing cards are buff colored. These cards give the drawing number, general title, and the sub-title of each block. On the back appears the draughtsman's name, and the date when finished. If the drawing is a contract drawing, the contract number first used is given.

The object of booking a number before the drawing is started is (1) to give the draughtsman a drawing number against which he may charge his time, and (2) to prevent half-finished or delayed drawings from going astray. The drawing after completion is examined by the chief draughtsman, who initials it, and it is passed into the tracing-room for tracing, and the tracing is entered in the drawing record. The tracing being made and having been checked by the chief draughtsman, it is handed back to the draughtsman for him to make his drawing correspond with it. Both are stamped and initialed by the chief draughtsman. The tracing is then passed out for photographing, and the drawing filed away into its drawer in the drawing cabinet, while the register card is filed away in the card cabinet under its section or class of subject in the C.D. or S.D. drawing-register drawer.

Four blue-prints are taken of standard drawings, and are divided as follows: (*a*) Two for works; (*b*) one, of arrangement block only, for rate-fixing department; (*c*) one, of arrangement block only, for drawing office.

The works prints are cut up into the blocks, and each block is pasted on a steel sheet, and is called a "shop card." On the back of each steel sheet is pasted a form, giving the contract numbers which use this particular standard drawing. The shop cards are then varnished over front and back, marked up with the first contract number they are to be used for, dated, and are ready for issuing to the shop. There are thus two sets of shop-cards for shop use, and they are divided as follows:

One complete set, including the "arrangement," is sent to, and is for the exclusive use of, the machine and erecting shops, the machinemen and surface tablemen using the blocks of the details, and the erectors the arrangements. By thus having one piece on one card no two men can require the use of the same card at the same time.

The remaining set is divided between the patternshop and smithy, the sheets containing the cast-iron, cast-brass, or cast-steel details going to the pattern-shop, while those containing forge work go to the smithy, and are for the sole use of these departments. The "arrangements" are sent to either the pattern-shop or smithy as circumstances warrant. To ensure this each card has either "Machine Shop," "Pattern Shop," or "Smithy" stamped on it, so that there can be no doubt subsequently as to the ownership of any shop-card which goes astray. Once these standard shop-cards are issued, they are never returned to the drawing-office unless for alteration or to be cancelled; but always remain in the works, and are stored there in a manner described later on.

The rate-fixing and drawing office sheets (blue-prints *b* and *c*) are next pasted on cardboard sheets. The cards of one set are sent down to the rate-fixing department, and are called "time-office cards." The cards of the other set are filed away in the drawing-office for use there. These are called "drawing-office cards." The drawing-office set of cards is used for registering (on their backs) the contract or engine numbers which have used these particular blocks in their construction, and thus avoid stamping the drawings themselves. The time-office cards also have on their backs the contract numbers, although this is not essential. They were principally used as a guide for determining the time allowances for each operation under the premium system of payment followed at these works, when this system was started and before sufficient data had been accumulated. The cards are now only used for reference.

When contract drawings have to be issued, only three blue prints are taken—one on cloth and two on paper—and are distributed as follows: (*a*) One, cloth, for machine shop; (*b*) one, paper, for pattern shop and smithy; (*c*) one, paper, of arrangement only, for rate-fixing department.

These are cut up, and each set for each department is clipped together with a title-page on the outside. The machine-shop gets a complete cloth set. The second set is divided between the smithy and pattern-shop. The photoprint of the arrangement is sent to the rate-fixing department. As each of these contract drawing blocks has the contract or engine number stamped on its face, as well as its own C.D. number, it may become detached from the rest, and yet not be lost or separated from its contract number. Unlike the standard drawings, these contract drawings are returned to the drawing-office on completion of the job, and are either destroyed or kept for the re-issue of a duplicate job.

The machine-shop set of standard drawings is stored and kept in the machine-shop toolroom in trays, the drawings being in their proper numerical order. The storeman, who has charge of them, hands them out to whoever requires them, at the same time marking on the slip provided for the purpose the man's number and date. As they are returned this entry is scored off. The contract drawings are treated in the same manner. The pattern-shop and smithy sets of drawings are kept in their respective department in trays, as in the machine-shop.

Each department has thus a complete set of drawings for its own exclusive use, and does not require to borrow.

As the drawings themselves are not regarded as shop orders to proceed with the work, but merely as guides to show how the work is to be done; and especially as the standard shop-cards always remain in the works, never returning to the drawing-office, some sort of order to the shops is required to indicate which shop-cards are to be used for a particular contract. Cards, 6 by 4 inches, called "factory orders," are therefore issued, and for uniformity as well as for indexing purposes, these are issued with the contract drawings. One card is issued for each block or section to be used; in other words, there is one card for each piece and arrangement of pieces. One set of these factory orders is written out, and after being entered in the drawing register, is issued to the works. These factory orders are subdivided into two classes as under: 1, factory orders for material ordered from inside; 2, factory orders for material ordered from outside.

The factory orders are still further subdivided in the drawing-office into:

(*a*) Those referring to general arrangements which are sent down to the works manager's office direct.

(*b*) Those referring to cast details are sent direct into the pattern-shop.

(*c*) Those referring to malleable iron details, which are sent direct into the smithy.

Those factory orders (*a*) dealing with arrangements of details are sent down to the engine-works manager's office in order to keep him advised that the material called for on the arrangement factory order has been ordered from the various departments. These factory orders remain in his office until the termination of the contract.

Factory orders (*b*) and (*c*) are sent to the pattern-shop or the smithy; the foreman, or his clerk, of each department files these orders in the special drawer in the compartment, or division, set apart for the contract number. After the foreman of each department has executed the work called for on the factory order, he takes the order from its place, and, having initialed and dated it on the back, in a space set apart for the purpose, he sends it into the machine-shop, where it is placed in a cabinet, which has drawers divided into compartments set apart for particular contract numbers. Thus the foreman pattern-maker and foreman smith, by looking over the factory orders, see only the work which is ahead of them, and which has yet to be done for each particular contract number. As each factory order represents only one kind of article, it follows that so long as there are any lying in the compartment for any particular contract number, the pieces called for on these factory orders have yet to be made. Thus the risk of forgetting small details is avoided, or, at least, very much minimized.

The factory orders for the material which is not made in the works, but is to be ordered from outside contractors, are sent direct from the drawing-office to the counting-house with photo-prints, or sketches, of the material which they represent. If only a sketch is supplied, this is made on the ordinary foolscap sheet, and sent with the factory order. This sketch is copied into the drawing-office copy-book, set apart for this purpose, and it, as well as the factory order-card, has the copy-book number and page marked on its top right-hand corner. These factory orders for outside material are placed by themselves in the counting-house in a receptacle under the charge of the order clerk, who initials and dates them as each order is sent to the outside contractors. He will send them down to the works, distributing them as follows: Those factory orders calling for material or goods of the nature of finished material (such as asbestos, cocks, rubber valves and safety valves), which should be delivered into store, are sent down to the storemen, and are filed by them in a suitable cabinet drawer under their contract numbers. The storemen will thus be kept advised of the ordering of this material and by referring to the factory orders in the store the manager and foremen know what has been ordered, and when it was ordered. By suitable filing they are able to say what is delivered and what has still to be delivered.

Those factory orders dealing with raw material ordered direct from outside people, and upon which machine work has to be done (such as forgings of shafting, connecting-rods, etc.) are sent down to the machine-shop, and there filed in the cabinet drawer amongst the other factory orders from the smithy and pattern-shop.

As the factory orders from the pattern-shop, smithy, and some from the counting house all converge in the machine-shop, they have to be available for the inspection of the various foremen who have to deal with them. It is obvious from the foregoing arrangement that only the smithy factory orders represent pieces actually made and delivered to the machine-shop, and that when these factory orders reach the machine-shop the pieces called for are actually in existence and awaiting the machine work. This, however, is not the case with the factory orders which are sent in from the pattern-shop and counting-house. When these cards reach the machine-shop they only inform that department that these pieces have been ordered and when they have been ordered; but as to whether the pieces are delivered, or are to be delivered, no definite information is given. This want has to be submitted to for the present, although it might be remedied in one or other of the following methods: (1) By making the man who receives the castings and heavy forgings retain possession of the factory orders until the actual pieces are delivered, when he could then place them in the machine-shop cabinet; or (2) by retaining the factory orders in the pattern-shop and counting-house until the pieces were delivered, and then sending them down to the machine-shop.

The factory order cards for valve chests and cocks made at the works are white. They are used for ordering out all valves, chests, and cocks, etc., and other material in connection with the pipe arrangements. One valve or article only is sketched on each card, with all other necessary information in copying ink. These factory orders are reproduced in the mimeograph machine, and the copy is sent to the pattern-shop and smithy as required, and filed under the proper contract number until the valve or piece has been ordered. The foreman then initials and dates the card, and sends it down to the machine-shop, where it is filed until that department's machine work has been done on it. It is then initialed and dated by the foreman, sent up to the erecting-shop foreman, and filed by him in such a manner as to show what has been finished and is ready, and what yet remains to be done. The original set is retained in the drawing-office.

In addition to the above mimeograph copy, and at the same time as it is being taken, four copies on a foolscap sheet are taken for the use of the outside foreman and erecting-shop foreman. There is also one spare and one for the engine-works manager.

The factory orders from smithy, pattern-shop, and counting-house, duly initialed and dated, showing that they have had the attention of these departments, are then sent down to the machine-shop, to be placed in the cabinet which is in the tool-room, being deposited in the drawer for factory orders and in the compartment for the contract number. Each of the compartments is still further subdivided by means of guide-cards into sections for A shop; B shop; D and E shops, and finishing shop. It is the duty of the engine-works manager to allocate these factory cards to the proper sections by placing them in each of their compartments. Thus by inspection of the cabinet at any time will be seen how much work for each department is waiting to be done. Those factory orders remain in the cabinet drawer until all machine work is completed, when they will be removed and placed in the compartment for finished work.

A Break in a 36-inch Water Main is described in the annual report of Superintendent R. C. P. Coggeshall, of the New Bedford, Mass., Water Board, from which the following account is taken: The break was caused by the blowing out of a large piece in the middle of the pipe, which was of cast iron. It approached an oval in shape, 3 feet wide and 5 feet long, and the piece came out very much as a cover is lifted off of a stove, there being no cracks in the remainder of the pipe. The break extended from the bottom of the pipe upward upon the side, and as far as could be seen the iron was of full thickness and of good quality. No satisfactory explanation of the break could be offered on the ground of water hammer or defects.

Trade Publications.

The Fort Wayne Electric Works, Fort Wayne, Ind., have issued a bulletin describing the leading features of their direct-connected type of direct-current generators, which are made with capacities of 20 to 800 kilowatts at 125, 250 and 575 volts.

The Richmond Stove Co., 2 Square de l'Opera, Paris, has issued a well-illustrated catalogue in French describing its line of low-pressure steam and hot-water heaters. The cuts are evidently the work of American engravers, but all dimensions and other technical data are in the metric system.

The Pierce, Butler & Pierce Mfg. Co., Syracuse, has issued a well-illustrated book of tables of the sizes, capacities and prices of its heating apparatus, which embraces seven types of steam boilers, nine types of hot water boilers, three types of tank heaters and numerous styles of direct and indirect radiators.

The lighting of the underground stations of the Rapid Transit Railway in New York will be largely done by means of steel-concrete vault lights of a type described in this journal on Sept. 7, 1901. A description of the system and an account of some tests made with it by Mr. William Barclay Parsons are given in a circular from the makers, Tucker & Vinton, 156 Fifth Ave., New York.

Makers of concrete in sufficient quantities to warrant the use of power mixers will find some interesting comments on such plant in Circular A of the Ransome Concrete Machinery Co., 11 Broadway, New York. For many years Mr. E. L. Ransome has been building concrete work in all parts of the country, and has devised various appliances for his work. The mixer described in Circular A was used by him for many years before being manufactured for general sale, and its record covers work from the Atlantic to the Pacific.

The American Steel & Wire Co., Chicago, has prepared a series of tables on wire for electric purposes giving (a) dimensions and weights of pure copper wire, (b) comparative sizes of various gauges, (c) comparative weights of copper wire of the same numbers of different gauges, (d) weights per mile of copper wire by different gauges, (e) resistance of pure annealed copper wire, (f) standard copper conductors, (g) weights of standard copper cables, bare and weatherproof. There are also a number of other tables on iron and steel wire, cables and other wire products.

A 208-page book concerning carts, pumps, chains, concrete plant, derricks and their fittings, cars, hoisting and other engines, hand and horse powers, plows, cranes, dredges and other plant useful to the general contractor has been prepared by the Dobbie Foundry and Machine Co., Niagara Falls, N. Y. It is fully illustrated and is particularly explicit in the section relating to derricks.

A small catalogue of air compressors, both steam-actuated and belt-driven, and vertical and horizontal receivers, has been issued by the Herron & Bury Mfg. Co., Erie, Pa. Illustrations and tables of sizes are given; but as the company believes it can best explain the details of construction by correspondence, nothing of the sort is attempted.

A well-printed description of the Acme type of fire-box boilers for heating purposes has been prepared by the American Radiator Co., Chicago. It shows the construction, explains the setting, and gives useful hints on the construction of chimneys. The same company has also brought out a twelfth edition of "The Homes Successful," a gospel of good heating, published in a form that is the acme of tasteful typography.

A 140-page general catalogue of pumping machinery, which has been issued by the Stilwell-Bierce & Smith-Valle Co., Dayton, is a sort of encyclopædia of the subject. It gives a great number of engravings of various types of pumps, from the diaphragm pattern to the high-duty engine for water-works, with brief notes on the service for which each type is best suited. There are also many useful hydraulic tables and several pages of suggestions for setting and connecting pumps.

Personal and Obituary Notes.

Capt. Robert McGregor, Corps of Engineers, U. S. A., has been ordered to report to the acting civil governor of the Philippine Islands for assignment as engineer for the city of Manila.

Mr. Arthur M. Greene, Jr., instructor in mechanical engineering at the University of Pennsylvania, has accepted the chair of mechanical engineering at the University of Missouri, Columbia, Mo.

Mr. Charles M. Mills, M. Am. Soc. C. E., has resigned his position as assistant engineer in the Bureau of Surveys of Philadelphia to accept a post as principal assistant engineer in charge of subway and elevated road work for the Philadelphia Rapid Transit Company.

Col. Alexander Mackenzie, Major Harry F. Hodges and Captains Edward Burr, Charles H. McKinstrey and William V. Judson, Corps of Engineers, have been appointed a board to review all new projects for improvements under the provisions of the river and harbor bill recently passed by Congress.

Charles C. Gilman, of Marshalltown, Ia., died in Chicago July 10. He was at one time chief engineer of the Iowa Central Railway and later of the Wisconsin, Iowa & Nebraska railroad, now the Chicago Great Western. During the past 25 years he has been engaged largely in railway contracting and at the time of his death was completing work for the Baltimore & Ohio Railroad. He built two sections of the Chicago drainage canal.

Although in his article elsewhere in this issue on the power plant of the Pike's Peak Power Co., Capt. R. M. Jones does not mention that he was responsible for all the engineering work involved, such was nevertheless the fact. The construction of the plant presented obstacles which would appear practically insurmountable to many engineers without his experience in difficult work in the Rocky Mountain region. He was the engineer of the Big Cottonwood and Jordan Narrows plants in the Great Salt Lake valley and prior to that was engaged on both lighting and street railway systems in numerous cities in the region named.

The resignation of Adin Mann as city engineer of Elgin, Ill., again calls attention to the fact that the Nestor of steam engineering is still in active practice. Mr. Mann is 86 years of age, but Charles H. Haswell, who is in charge of New York City work on Riker Island, will be 94 years old in a few months. In 1837 he was chief engineer of the only steam vessel in the U. S. navy, in 1843 he was engineer-in-chief of that department, in 1844 he published the first edition of his famous "Pocket-Book," and in 1847-48 designed the boilers and engines of the U. S. steam frigate "Powhatan," one of the most successful vessels of the time. His book entitled "Reminiscences of an Octogenarian of the City of New York" is replete with information of interest to all who care to study municipal conditions and phases of life before the Civil War.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 72, xv, xviii and xxvii.

WATER.

Whatcom, Wash.—City Clk. W. H. Hildebrand writes that the City Council will receive bids on Aug. 18 for approximately 565 tons of cast-iron water main, 16-in. in diameter; also bids for laying same, either in one contract or separate contracts. E. C. Lyle, Engr. in Charge. Estimated cost of improvement, $30,000.

Manning, Ia.—Prof. A. Marston, Ames, Ia., is designing a 60,000-gal. steel water tower 100 ft. high.

Sacramento, Cal.—C. M. Phinney, City Engr's Office, writes that on June 16 a contract was awarded to Henry R. Worthington for a 2,000,000-gal. pump, to be installed at the water works, to be considered an emergency pump until such time as a new water supply can be secured.

Gloucester, Mass.—H. W. Spooner, Engr. Bd. of Water Comrs., writes that bids, opened July 7, for the construction of a dam and all appurtenances thereto, will not be made public, according to a vote of the Comrs.; the contract was awarded June 10 to Coleman Bros., of Everett, Mass.

Pickens, Miss.—Water works bonds to the amount of $6,000 will be sold Aug. 1. J. F. Wilburn, Town Clk. Plans for the water works system are being prepared by Kirkpatrick & Johnson, of Jackson, Miss.

Biloxi, Miss.—Kirkpatrick & Johnson, of Jackson, Miss., have been engaged to prepare plans for a water works system, supply to be from artesian wells, with elevated tank, pumping to be done by the head for the wells.

Dunn, N. C.—Engr. in Charge John W. Hays, of Petersburg, Va., writes that water works and an electric light plant are to be built by day labor; cost, $35,000.

South Omaha, Neb.—The City Council has granted the Omaha Water Co. an extension of its franchise from Oct., 1904, to Oct., 1914.

Greeley, Colo.—The Poudre Valley Reservoir Co. is of Greeley, is reported to have been incorporated by A. H. Myers, Thos. Smith, W. R. Clark and others; capital, $250,000.

Brandon, Manitoba.—A recommendation has been passed by the City Council for the removal of the pumping station to higher ground and for the increase of the present pumping plant by the addition of 2 pumps of 1,000,000 imperial gal. each, to be operated by electric power; a standpipe or water tower; new intake and filtering galleries, and the construction of new pumping station. The power will be supplied by the Brandon Electric Light Co. from the company's water power plant on Saskatchewan River. W. H. Shillinglaw, City Engr.

Ivanhoe, Minn.—Engrs. Loweth & Wolff, St. Paul, write that the contract for constructing water works has been awarded to the Des Moines Bridge & Iron Co., Des Moines, Ia., at $8,780.

Baton Rouge, La.—Local press reports state that the City Council Com. on Water has determined to secure the services of Freeman C. Coffin, of Boston, Mass., to examine the plant, mains and all property of the local water company, with a view to fixing its value and establishing a basis for negotiations for its purchase, or for the erection of a water works system by the city.

Wheeling, W. Va.—The Council Com. on Water & Fire, the Fire Underwriter and the Water Bd. have recommended to the Council an additional storage reservoir having a capacity of 20,000,000 gal.; also additional fire hydrants.

Clinton, Ia.—Press reports state that a company is being organized to construct a canal down the east side of the Mississippi River, from Clinton, Ia., to near Lyndon, Ill.

Meridian, Miss.—This city has purchased 15 acres of land on Mount Barton, 1 mile south of the city on which to construct a reservoir for the proposed independent gravity water works system; deep well pumps to supply the water for the reservoir. An election will probably soon be held to vote on the issue of $200,000 bonds for said system.

Great Falls, Mont.—Bids are wanted July 28 for $45,000 water bonds. W. H. Smith, City Clk.

Bird Island, Minn.—Bids are wanted July 22 for constructing an 8-in. tubular well; also at the same time for constructing a complete system of water works. Frank Murray, Village Recorder.

Gibbon, Minn.—Bids are wanted July 25 for constructing a system of water works from plans by Oscar Claussen, Engr., St. Paul.

Eden Valley, Minn.—W. R. Salisbury, Village Recorder, will receive bids July 26 for the construction of a water works plant.

Milwaukee, Wis.—Bids are wanted Sept. 5 for furnishing and erecting at High Service Pumping Station, North Ave. and 10th St., one 8,000,000-gal. pumping engine and one horizontal tubular boiler. Bids are also wanted July 21 for furnishing such corporation stop-cocks as may be required by the Water Dept. during 1902. Chas. J. Poetsch, Comr. of Pub. Wks.

Summit, N. J.—A Com. of the Council is investigating the question of municipal ownership of water and light franchises.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Lorain, O.—City Engr. Chas. S. Ferguson writes that it is proposed to improve the water works at a probable cost of $32,000. C. L. Penney, Supt.

Rockville, Md.—The Town Council has decided to drill an additional artesian well.

Grinnell, Ia.—D. W. Morris, of the Grinnell Water Co. writes that said company, recently incorporated with a capital of $25,000, proposes to construct a dam with a watershed of 1,000 acres, lay mains, erect standpipe and pumping station. Plans have not yet been made. H. W. Spaulding, Pres. of Co.

Loveland, Colo.—Local press reports state that Lowell C. Lloyd is interested in the Boyd Lake Irrigation Co., which has been organized with a capital of $250,000.

Milford, Ind.—Bids will be received by the Milford Water Co., at Miles & Higbee's Bank, Milford, until July 24 for the construction of water works.

Staunton, Va.—S. M. Gray, Providence, R. I., has been retained to advise this city in regard to obtaining a new water supply; the water to be brought by gravity from the mountains, some 15 miles distant.

Avon, N. J.—Mayor John Thomson writes that proposed water works and sewerage systems will probably cost about $65,000. Halsey & Logan, 163 Market St., Newark, Engrs. in Charge. Francis Collingwood, Elizabeth, N. J., Consulting Engr.

Kenmore, N. J.—According to local press reports the village authorities have signed a contract with the Depew & Lake Erie Water Co. This company will be shortly merged with the Western New York Water Co. It is stated that the water for Kenmore will be brought in 12-in. mains from Depew, a distance of 14 miles, at a cost of $140,000.

Cincinnati, O.—Local press reports state that the Comrs. of Water Works have awarded the contract for buildings, foundations and drains for the Eastern Pumping Station to the U. S. Const. Co., of Milwaukee, Wis., for $183,231.

Springfield, Ill.—In his report to the Council, Consulting Engr. Daniel W. Mead, of Chicago, recommends the following improvements for the water works: dam, estimated to cost $6,600; sedimentation basin, $14,700; 6,000,000-gal. filter, $60,000; clear water basin, $13,000; other expenses at $9,430, making a total of $103,730.

Muskogee, Ind. Ter.—Bids are wanted July 23 for furnishing material and constructing water works and a sewerage system. Bids will be received for the whole or portions of the work as follows: Building tunnel or pipe line under Arkansas River, 2,500 ft. in length; distribution system, including 10 miles of pipe, power plant, etc.; standpipe, 120x25 ft.; sewer system; two 1,500,000-gal. pumps, cast-iron pipe, etc.

Yonkers, N. Y.—Bids will be received by the Bd. Water Comrs., Aug. 7, for a horizontal, high-duty, compound condensing, duplex, direct-acting pump, having a capacity of 8,000,000 U. S. gals. in 24 hours, at the Low Service pumping station, as advertised in the Engineering Record. Bids are wanted July 7 for 335 lengths of 24-in. pipe at 2,811 lbs. per length of 12 ft., and 20 tons of special castings. Jos. H. Beall, Pres. Bd. Water Comrs.

Bolivar, N. Y.—It is stated that the Village Bd. will receive bids July 25 for the purchase of the water works.

Wellsburg, W. Va.—It is stated that bids are wanted July 26 for a reservoir, water mains and valves. M. E. Boyd, Engr.; Jas. N. Beard, Chmn. Water Bd.

Philadelphia, Pa.—The Common Council has passed the bill creating a temporary bureau for the improvement, extension and filtration of the water supply, to co-operate with and form an adjunct to the Bureau of Water; the bill appropriates $500,000 for the purpose of carrying out the ordinance's terms.

Worcester, Mass.—The City Council on July 14 adopted an order for laying water pipe in Quinsigamond Ave.; estimated cost, $22,386.

Troy, N. Y.—Water works bonds to the amount of $400,000 have been sold.

Springdale, Ark.—Bids will be received Aug. 1 by the Water Wks. Comn. for the construction of water works. C. J. Chapman, Secy.

Yardley, Pa.—Bids will be received Aug. 5 by T. S. Cadwallader, Pres. Yardley Water & Power Co., for cast-iron pipes and appurtenances, laying pipe lines and erecting standpipe, 10x50; about 179 lengths 8-in. pipe, 510 lbs. per length; 339 lengths 6-in. pipe, 346 lbs. per length; 386 lengths 4-in. pipe, 208 lbs. per length; 5 tons specials, etc., will be required.

Warrington, W. Va.—Bids are wanted July 23 for 3,900 ft. 10, 8, 6 and 4-in. cast-iron pipe, cast-iron gates, hydrants, etc. B. E. Mitchell, Chmn. Water Com.

Lewiston, N. Y.—The Lower Niagara River Power & Water Supply Co., of Lewiston, is reported to have been incorporated, with a capital of $5,000,000. Directors: Jas. Low, Jas. S. Simmons and F. J. Brown, of Niagara Falls.

Battle Creek, Mich.—The Bd. of Works has appointed a Com. to look into the matter of installing a filter for the water supply. Probable cost, $30,000.

Buffalo, N. Y.—Local press reports state that the Western New York Water Co. has been mortgaged to the amount of $10,000,000 for proposed improvements. Wm. B. Cutter, Pres.

Richfield, Utah.—The City Council has voted to levy a tax of 1 per cent. for the construction of water works, estimated to cost $18,000.

Columbus, O.—The City Sinking Fund Comrs. are stated to have sold $102,000 Scioto River dam bonds.

Covington, Tenn.—J. A. Omberg, Jr., of Memphis, employed by the town as an expert to estimate the value of the plant of the water works company, estimates the value of said plant at $10,333.

St. Ansgar, Ia.—Bids are wanted July 22 for constructing water works. C. T. Tollefson, Town Clk.

Niles, O.—City Engr. Wm. Wilson writes that the Water Wks. Trus., S. F. Bycraft, Pres., will receive bids Aug. 14 for a well 25 ft. in diameter. Probable cost, $5,000.

Milton, Mass.—At a recent town meeting it was voted to purchase the property and rights of the Milton Water Co. for $315,000.

Avon, S. D.—Press reports state that a system of water works to cost $5,000 will be put in as soon as a water supply is assured.

Worthington, Minn.—The Council contemplates improvements to the water works and electric light plant.

Wickford, R. I.—The Town Council has granted to Thos. F. McDonnell and J. H. Sheed, representing the Wickford Light & Water Co., a franchise for laying water pipes in all streets of the town.

Ruthton, Minn.—At a recent special election it was voted to build a system of water works.

Providence, R. I.—Local press reports state that the contract for constructing the slow sand filtration plant has been awarded to Edw. W. Everson and Fred. E. Shaw, both of Providence. Their joint bid is said to be within the $225,000 appropriation.

Monessen, Pa.—Local press reports state that Burns & Martin are preparing to make improvements that will cost about $1,000,000. Among the improvements contemplated, there will be a water works system.

La Junta, Colo.—The City Council is considering plans for improving the water works.

Hartwell, Ga.—The municipal authorities have decided to erect as soon as practicable water works and an electric light plant. W. T. Johnson, Mayor.

Waynesboro, Pa.—The directors of the Waynesboro Water Co. have determined upon improvements, including the construction of a dam, sluiceway and reservoir.

Zanesville, O.—Local press reports state that the Water Works Trus. propose to bore 20 wells for an increased water supply. Probable cost, $35,000.

Columbia, Pa.—The stockholders of the Columbia Water Co. have authorized an increase of the capital stock from $100,000 to $300,000. Part of this sum to be used for the installation of a filtration plant.

Columbus, Ind.—Local press reports state that a contract is about to be let by the City Council for a new pump with 5,000,000 gal. capacity.

Manchester, Va.—The City Council has appointed J. T. Abbott and A. R. Hooker as a committee to consider some plan for purifying the present system of water works or getting clear water in some manner.

Denver, Colo.—F. F. Noxon, of Colorado Springs, has made a proposition to the city to deed to the city Tarryall Creek reservoir site, 54 miles from Denver. In return for the grant he asks that the city give him the exclusive right to use the water for power purposes between the dam and Deansbury. The cost of the dam to collect the water and of other expenses in connection with the construction of the reservoir, and of flumes and pipe lines to Deansbury, is estimated at $1,800,000.

Bedford, Wis.—The proposition to issue $100,000 bonds for the construction of water mains in the business section of the city carried at the recent election.

SEWERAGE AND SEWAGE DISPOSAL.

Grinnell, Ia.—Prof. A. Marston, Ames, Ia., has designed a 250,000-gal. septic tank system.

City Clk. J. F. Wilson writes that the sewer system is to be extended; work to include 4,000 ft. of 8-in. sewer pipe, 4,000 ft. of 8-in. water pipe, 15,000 vitrified bricks, 5 flush tanks and 3 manholes. J. C. Goodrich, Supt. of Sewers.

Depew, N. Y.—Bids will be received on July 21 by the Village Trus. for labor and material for the construction of a lateral sewer in Ellicott Road. J. C. Glade, Village Clk.

Philadelphia, Pa.—Bids are wanted July 23 for the construction of main and branch sewers, inlets, manholes, laterals, etc.; total estimated cost, $435,000. Wm. C. Haddock, Dir. Dept. Pub. Wks.

Pittsburg, Pa.—Bids are wanted July 23 for constructing a 15-in. pipe sewer on Olney Alley, Orion and Ajax Sts., also for culvert under Oakwood St. J. O. Brown, City Recorder.

Richmond, N. Y.—Bids are wanted July 25 for furnishing all labor and material required for completing a system of sewers in the former village of Tottenville; the engineer's estimate of quantities includes 7,800 ft. of 8-in. vit. pipe laid, 13 flush tanks with siphons, etc. Geo. Cromwell, Pres. Boro. of Richmond, New York City.

Rhinebeck, N. Y.—Bids are wanted July 21 for the construction of a storm water sewer and appurtenances. A. Lee Wager, Pres. Village Trus.

Oneida, N. Y.—A press report states that bids will be received by the Bd. Pub. Wks., July 28, for the construction of vitrified stoneware sewers in 6 streets.

Chester, Pa.—Bids are wanted July 21 for the construction of sewers in 7 streets. Wm. M. Boulden, Chmn. Com. on Sewers.

Cleveland, O.—Bids are wanted Aug. 11 for the purchase of $65,000 sewer bonds, $100,000 water bonds, $100,000 elevated roadway bonds, and $30,000 Walworth Run bridge bonds. J. P. Madigan, City Aud.

Opelousas, La.—Ira W. Sylvester, City Engr., Alexandria, La., has been employed to prepare plans and estimates for the proposed sewer system.

Wapakoneta, O.—Bids are wanted July 28 for improving Water St. by the construction of a main sewer, with connections, etc. Chas. E. Fisher, Village Clk.

Appleton, Wis.—City Clk. A. E. Heideman will receive bids until Aug. 6 for the construction of a double ring brick sewer, 41x56 in., and 620 ft. long, also for several small pipe sewers about 3,200 ft. in the aggregate.

Keokuk, Ia.—City Engr. J. Ross Robertson writes that bids are wanted by Rice H. Bell, Clk. of Council, until July 23 for the construction of an 8-in. tile sanitary sewer 1,250 ft. long, 800 cu. yds. of excavation, 75 inlets, 3 inspection pipes and 1 flush tank.

Menasha, Wis.—Bids are wanted July 22 for the construction of sewers in 3 streets. S. S. Little, City Clk.

Danville, Ill.—City Engr. W. H. Martin writes that J. H. Palmer has received the contract for constructing 600 ft. of 36-in., 1,400 ft. of 30-in. and 300 ft. of 18-in. pipe sewer for $5,690.

San Antonio, Tex.—The City Council has ordered a special election July 31 to vote on the issue of $300,000 bonds for improvements, including sewerage, asphalt paving and iron bridges.

Portsmouth, O.—Bids are wanted Aug. 5 for improving, by grading and constructing necessary sewers, culverts and drains, several streets. R. C. Bratt, City Engr.

Cleveland, O.—The lowest bid opened July 10 for constructing a main intercepting sewer in a portion of Lake St. was from W. J. Gawne, of Cleveland, at $191,100.

Lewiston, Idaho.—City Engr. Ernest McCullough writes that the sewer project has been abandoned for the present.

Birmingham, Ala.—Local press reports state that the Jefferson County Sanitary Comn. has accepted the joint proposition of the Donelson Const. Co., C. M. Burkhalter & Co., and the Pennington Const. Co., for constructing the main county sewer. The cost of same will be about $300,000. According to plan C, which was adopted, the prices to be paid for the work are as follows: 4-ft. sewer, $2.52½ per ft.; 4-ft. 6-in. sewer, $2.82½ per ft.; 5-ft. sewer, $3.14½ per ft.

Newport, Ky.—The Bd. of Sinking Fund Comrs. has sold sewer bonds to the amount of $43,000.

Montreal, Que.—Local press reports state that the contract for continuing the St. James St. auxiliary sewer westward has been awarded to M. Dineen at $27.98 per lin. yd., and if there is any rock excavation to be done a charge of $3.50 per cu. yd. extra.

Sharon, Pa.—Local press reports state that the Council is about to issue $40,000 bonds for the completion of the sewer system.

Hudson, N. Y.—Supt. of Pub. Wks. H. K. Bishop writes that the contract for 1,125 ft. of 4-ft. brick sewer, with appurtenances, has been awarded to Smith Patterson, of Hudson, N. Y., for $7,950.

Hampton, Ia.—Consulting Engr. M. Tschirgi, Jr., of Dubuque, writes that the contract for constructing 23,250 ft. of 8 to 15-in. pipe sewers, with 46 manholes and 10 flush tanks, has been awarded to O. G. Kringle, of Dubuque, at 60 cts., 75 cts. and 50 cts., respectively, for 15, 12 and 8-in. vitrified pipe, $60 for flush tanks, $30 for manholes, $5 for syphons, and $4 for rock excavation; total, $14,166. Average depth of excavation to be 9 ft., principally in loam and clay, with 600 cu. yds. stone.

St. Joseph, Mo.—Mayor Borden has signed the ordinance providing for the completion of the Main St. sewer, which is to be 2.3 ft.x3 ft. in diameter, 1½ rings of hard-burned brick, laid in hydraulic cement mortar. Appropriation, $8,000.

Cincinnati, O.—Bids will be received by the Bd. Pub. Service, July 23, for constructing sewers and drains in Findlay St.; also on Aug. 13 for constructing a trunk sewer and drains on Jerome Ave. Geo. F. Holmes, Clk.

Norristown, Pa.—Bids are wanted Aug. 13 for the construction of salt-glazed vitrified pipe sewers, with laterals to the house line, and appurtenances, on numerous proposed sewers. John H. Rex, Chmn. Sewer Com.

Watertown, N. Y.—Bids are wanted by the Bd. Pub. Wks., July 21, for the construction of sewers in 3 streets. C. O. McComb, City Engr.

Muncie, Ind.—Bids are wanted July 28 for the construction of Plum St. sewer No. 1, to be of vitrified pipe, 8 inches in diameter. F. W. Clevenger, City Clk.

Cleveland, O.—Bids are wanted July 29 for the construction of sewers in 6 streets. Chas. P. Salen, Dir. Pub. Wks.

Watervliet, N. Y.—Bids are wanted July 23 for the construction of a 15-in. and an 18-in. sewer. Luhr Eggers, City Clk.

Zanesville, O.—Bids are wanted July 26 for furnishing material and labor for the construction of a sewer on Harrison St. C. W. McShane, City Clk.

Darlington, S. C.—A commission for a charter has been issued to the Darlington Sewer Co., which proposes to build and equip a sewerage system for the city of Darlington. Incorporators: W. F. Dargan, N. L. Harrell, W. L. Galloway, R. L. Edwards.

New Brighton, Pa.—Bids are wanted July 21 for the construction of 8 and 18-in. pipe sewers. F. C. O'Rourke, Boro. Secy.

Saratoga Springs, N. Y.—Bids are wanted July 22 for furnishing labor and material and constructing an 8-in. terra cotta sewer through Warren St. H. F. Thomas, Clk. Sewer, Water & St. Comn.

Verona, Pa.—Sewer bonds to the amount of $33,000 have been sold by the Council.

Ft. Worth, Tex.—The contract for constructing a sewer through the Armour and Swift properties to Marine Creek has been awarded to C. W. Olcott, of Dallas. The sewer will be of 24-in. tile and 30-in. pipe of double strength and 2,500 ft. long, with 22 manholes. Contract price, $23,000.

San Francisco, Cal.—It has been recommended to the Supervisors by the Bd. of of Pub. Wks. that early action be taken to submit a proposal to vote bonds for a new sewerage and drainage system to cost about $6,000,000. In the tax levy just fixed by the Supervisors an allowance of $50,000 was made for the construction of new sewers during the fiscal year.

St. Louis, Mo.—The House of Delegates has passed ordinances for the construction of drainage sewers in the Tower Grove and Rock Districts. Total appropriation, $55,000.

The Bd. of Pub. Improv. has appropriated $11,000 for drainage work on Vandeventer and Washington Aves.

New York, N. Y.—The Bd. of Aldermen has authorized an issue of $100,000 bonds for the repair and reconstruction of sewers in the Boro. of Manhattan.

Pittsfield, Mass.—The Aldermen have adopted an order appropriating $8,500 for surface drainage.

Minneapolis, Minn.—The City Council Com. on Sewers and Paving has decided that of the $150,000 permanent improvement bonds authorized, $88,000 should be used for paving, $52,000 for sewers and $10,000 for curbing and gutters.

Belleville, Ill.—City Engr. Graver estimates the cost of W. Main St. sewer at about $14,614.

Long Beach, Cal.—The City Trustees have been petitioned to establish a sewer system.

Durand, Mich.—Bids will be received July 28 by Wm. H. Putnam, Village Clk., for 300 ft. of 18-in., 2,000 ft. 10-in., 3,000 ft. of 12-in. and 1,100 ft. 15-in. vitrified pipe sewers.

Youngstown, O.—See "Paving and Roadmaking."

Seattle, Wash.—An ordinance before the City Council provides for the construction of a sewerage system with a septic tank for sewage purification, for Latima and vicinity.

Lancaster, Wis.—Local press reports state that surveys are being made for a sewer system.

Marshfield, Wis.—The City Council has voted to issue $35,000 bonds for a sewerage system.

Avon, N. J.—See "Water."

Greensboro, N. C.—S. M. Gray, of Providence, R. I., has been engaged by this city to advise in regard to improved sewerage works, to consist of intercepting sewers and sewage disposal works.

Mayfield, Ky.—The Council is reported to have voted $50,000 for a sewerage system.

Rochester, N. Y.—John N. McClintock, of Boston, in a report to the city officials, in regard to sewage disposal, estimates the cost of works, which he favors, as follows: Septic tank, having capacity of 5,000,000 gal., $50,000; 6 acres contact bacteria beds, $100,000; 6 acres intermittent filters, $100,000; total, cost, including land and engineering, $250,000.

Oakland, Cal.—City Engr. Turner has prepared plans for a sewer for the East Dist.; estimated cost, $10,760.

St. Charles, Mo.—The City Council has instructed the City Engr. to prepare plans and specifications for a sanitary sewer system.

Worcester, Mass.—The City Council on July 14 adopted orders for a loan of $20,000 for sewer construction, and for the construction of 50 additional filter beds, estimated to cost $60,000.

Boston, Mass.—Mayor Collins in a communication to the Com. on Finance recommends that an item of $100,000 be inserted in the loan bill for abating the sewage nuisance in the Back Bay Fens.

Batavia, N. Y.—This city is considering plans for a new and adequate sewerage system.

Mt. Pleasant, Pa.—At a recent special election it was voted to complete the sewer system at a cost of $16,000.

Berkley, Va.—Local press reports state that contracts will soon be let by the Town Council for extending the sewer system in the 3d Ward, at a cost of $25,000.

Bellevue, O.—The Sewer Com. of the Council has recommended the construction of 2 trunk sewers, estimated to cost $25,000.

Hampton, Ia.—Oliver Kringle, of Dubuque, is stated to have received the contract for constructing a sewer system for $14,166.

Massillon, O.—The Sewer Comn. has decided to recommend to the Council the construction of a sanitary sewer for Duncan and Walnut Sts.

Northampton, Mass.—The Sewer Comrs. have voted to petition the city government for $50,000 for sewer construction.

Williamsport, Pa.—The Select Council has passed the bill which provides $81,000 for the construction of Grafius Run sewer.

Pittsburg, Kan.—Bids are wanted Aug. 2 for furnishing material and labor necessary to construct 12,966½ ft. of 18-in. and 3,750½ ft. 15-in. sewers. A. A. Bumgarner, City Clk.

Muskogee, Ind. Ter.—See "Water."

Plainfield, N. J.—Bids are wanted Aug. 4 for doing the work and furnishing certain of the materials for a storm sewer in Arlington Ave; 600 ft. 30-in., 2,320 ft. 24-in. sewers and 560 ft. 12-in. basin and inlet connections will be required. Jas. T. MacMurray, City Clk.

Parkersburg, W. Va.—Bids are wanted July 23 for 2,725 ft. of 15-in. and 2,210 ft. 8-in. sewers. Jesse L. Cramer, City Clk.

Westfield, Mass.—The State Bd. of Health has approved the plans of Town Engr. O. E. Parks for the surface drainage system.

Syracuse, N. Y.—Bids are wanted July 21 for furnishing material and constructing a 15-in. pipe sewer in W. Fayette St. Geo. J. Wetz, City Clk.

Trenton, N. J.—Bids are wanted Aug. 5 for constructing a sewer in 2d St. and a drain in Southard St. C. Edw. Murray, City Clk.

South Brooklyn, O.—It is stated that bids are wanted July 28 for the purchase of $35,000 sewer bonds. W. T. Pupikoffer, Clk.

Chicago, Ill.—It is stated that bids are wanted July 24 for sewers, curbing and asphalt paving in several streets. J. A. May, Secy. Bd. Local Improv.

Waverly, Ia.—Bids are wanted Aug. 5 for the construction of an 8-in. vitrified pipe sewer. F. H. Munger, City Clk.

Steubenville, O.—City Engr. C. E. Flanagan writes that 1,000 ft. of 15-in. sewer is to be constructed.

Albany, N. Y.—Bids are wanted July 21 for the construction of a vitrified pipe sewer in Central Ave., about 2,760 ft. Isadore Wachsman, Clk. Bd. Contract and Supply.

Toledo, O.—Bids will be received on July 28 for furnishing labor and material and constructing cylindrical pipe sewers, and on Aug. 11 for constructing cylindrical brick and pipe sewers. Chas. H. Nauts, City Clk.

BRIDGES.

Terre Haute, Ind.—Bids will be received by M. G. Hamill, 5th and Main Sts., until July 22 for one 70-ft. single span steel bridge (with 14-ft. roadway set on steel legs 14 ft. long), to be constructed across Clear Creek between the townships of Wabash, Ill., and Sugar Creek, Ind.

Milwaukee, Wis.—Bids are wanted Sept. 5 for constructing a highway bridge across North Menomonee Canal at Muskego Ave. Chas. J. Poetsch, Comr. of Pub. Wks.

General plans have been prepared for the 1st Ave. and 6th St. viaduct, length 2,786 ft., including 2 Bascule bridges over N. and S. Menomonee Canals, 40-ft. roadway, asphalt, and 10-ft. cement walks, plate girder. Estimated cost, $550,000.

Lewisburg, Pa.—The Comrs. of Union Co. and the Street Com. of the Boro. of Lewisburg will receive bids on July 21 for the construction of the substructure and superstructure of a steel girder bridge over Limestone Run, in Lewisburg. W. A. Weidensaal, Chmn., St. Com., Lewisburg.

South Bend, Ind.—The South Bend & Southern Mich. Ry. Co. has awarded to the Canton Bridge Co., Canton, O., the contract for a 3d truss of steel to join the highway bridge over St. Joseph River, 300-ft. span, including steel floor system, at $7,797.

San Jose, Cal.—J. G. McMillan, County Surv., San Jose, is preparing plans for a stone bridge to cross Ligas Creek at Old Gilroy; length of span, 32 ft.; roadway, 30 ft. Contracts for construction will soon be let by the Bd. of Superv.

San Antonio, Tex.—See "Sewerage and Sewage Disposal."

Manila, P. I.—A. L. B. Davies, Secy. Municipal Bd., writes that the time for receiving bids, for a rolling lift bridge, has been extended until Aug. 1.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Erie, Kan.—Co. Clk. B. W. Garvin writes that the contract for constructing 3 steel bridges (bids opened July 12) has been awarded to A. M. Blodgett, Kansas City, Mo., for $6,969.

New Castle, Pa.—See "Electric Railways."

Cincinnati, O.—The Bd. of Pub. Service has been requested to take steps leading to the construction of a viaduct from 4th St. at Pike to some point in Mt. Adams. Estimated cost, $1,000,000.

Grand Rapids, Mich.—It is reported that the North Park Bridge Co. has secured the issue of $40,000 bonds for constructing North Park bridge.

Kenosha, Wis.—City Engr. Moth is reported to have begun plans for a steel bridge over the West Middle St. crossing of Pike River.

Lewiston, Idaho.—It is stated that surveys are being completed for the R. R. bridge over the Cumberland River by Engr. Shaw.

Washington, D. C.—Two plans have been proposed for a viaduct over the Mill St. crossing at Summit St., one to cost about $100,000, the other $50,000.

Bloomsburg, Pa.—Local press reports state that J. C. Brown has been selected to prepare plans and specifications for a Co. bridge over the Susquehanna at Mifflinville.

Knoxville, Tenn.—Efforts are being made to secure a viaduct on Church or Clinch Aves. to connect West Knoxville with the old city proper.

Fonda, N. Y.—The Bd. of Supervs. is stated to have authorized the issuance of $30,000 bonds by the towns of Canajoharie and Palatine in payment for the new river bridge.

Oshkosh, Wis.—Plans and specifications have been made for a double track steel bridge to be built across Fox River by the Wisconsin Central R. R. Co., to be used jointly with the Chicago, Milwaukee & St. Paul R. R. R. B. Tweedy, Ch. Engr., Milwaukee.

Pittsburg, Pa.—It is reported that an ordinance granting permission to erect a viaduct from Cable Ave. to Oak Hill, nearly ¼ mile, was given a first reading by the Borough Council of East Pittsburg. The object is to give room for Pennsylvania R. R. yards.

Regency, Tex.—Local press reports state that the Comrs. Court has closed a contract with the Midland Bridge Co., of Kansas City, for a steel bridge over Colorado River, for $8,300.

Cherry Valley, Ill.—It is reported that Darse & Hughs secured the contract for a bridge over the south branch of Kishwaukee River for $8,490.

Altoona, Pa.—It is reported that the 17th St. bridge is likely to be rebuilt this summer.

Anderson, Ind.—It is reported that the city will probably order an iron bridge across Greens Branch at 22d St. to replace one that collapsed.

Harrisburg, Pa.—According to press reports the State will spend within the coming year from $400,000 to $500,000 for 21 bridges destroyed by floods and fires in the following counties; Juniata, Clearfield, Berks, Carbon, Forest, Bradford, Jefferson, Lycoming, Lackawana, Wyoming, Sullivan, Wayne and Luzerne. The following engineers are among those preparing plans: M. D. Bowman, Mahanoy City; O. E. Thompson, Phoenixville; Emil Swensson, Frick Bldg., Pittsburg.

The Harrisburg Bridge Co., it is reported, will increase its capital by an issue of $85,000 in stock and the same amount in bonds, for the purpose of building a bridge over the Susquehanna.

Macon, Mo.—It is reported that the A. M. Blodgett Bridge Co., of Kansas City, has been awarded the contract for 20 steel bridges in Macon Co.

Waterloo, Ia.—It is stated that the Bd. of Superv. has awarded the contract for the steel bridge across Big Creek at La Porte City to the Kansas City Bridge Co. for about $10,000.

Rockwood, Tenn.—It is reported that the contract for the steel superstructure of the Tennessee Central bridge over the Cumberland, near Hyde's Ferry, has been awarded to the American Bridge Co. for $70,000. Total cost of bridge, $150,000.

Beaver, Pa.—Press reports state that a bridge is to be built over the Ohio from about 300 ft. south of the south line of Monaca borough to the end of 3d St. in the borough of Freedom. Among the incorporators are J. T. Reeves, F. F. Brierly and F. G. Barker.

Grand Forks, Minn.—Press reports state that an iron bridge is contemplated over Red Lake River to connect with East Grand Forks.

Springfield, Mass.—Press reports state that a special Comn. to have control of widening the St. James Ave. bridge over the N. Y., N. H. & H. R. R. tracks has been appointed. The members are L. A. Frothingham and M. J. Murray, of Boston, and Clinton White, of the State R. R. Comn.

Las Animas, Colo.—It is reported that the Bullen Bridge Co. has secured contracts for Co. bridges to the amount of $11,460.

Pueblo, Colo.—Local press reports state that City Engr. Wm. Peach will at once prepare plans for improving the Northern Ave. viaduct. Appropriation, $9,000.

Arkwright, N. Y.—Press reports state that the Rochester Iron Bridge Construction Co. has secured the contract for 12 iron bridges at a total of $15,000.

Chambersburg, Pa.—Local press reports state that the Cumberland Valley R. R. intends to construct a stone arch at Falling Waters, W. Va., to replace trestle. M. C. Kennedy, Vice-Pres.

Wheeling, W. Va.—The Baltimore & Ohio bridge over Wheeling Creek on the Pittsburg Div. is reported washed away. J. E. Grenier, Bridge Engr., Baltimore, Md.

South Bristol, N. Y.—Press reports state that Superv. F. B. Holcomb is making arrangements to raise $20,000 bonds to pay for repairs to highways and bridges.

Glenwood, Pa.—Press reports state that the Baltimore & Ohio R. R. intend to reconstruct the bridge over the Monongahela at a cost of $200,000, contracts to be let in the near future. J. E. Greiner, Bridge Engr., Baltimore, Md.

Des Moines, Ia.—Local press reports state that the Chicago Great Western R. R. bridge has been washed out. Loss, $20,000.

St. Paul, Minn.—It is reported that $28,000 of the annual appropriation will be used for road and bridge improvement during the coming year.

Berkley, Pa.—Press reports state that an iron bridge is wanted to replace stone arch crossing the Davis Mill dam.

Ellijay, Ga.—It is stated that bids are wanted July 25 for building a bridge over the Cartecay. Bridge to consist of 3 spans, a center-span, high-truss pattern, 60 ft. in length and end spans respectively 25 and 36 ft. long. J. C. Allen, Co. Ordinary.

Pembroke, Ont.—It is stated that bids are wanted Aug. 2 for constructing a stone or steel bridge with stone abutments over Bonnechere River, at the village of Eganville. S. E. Mitchell, Co. Clk., Pembroke.

St. Louis, Mo.—See "Railroads."

Carrollton, Mo.—Bids are wanted Aug. 5 for the construction of several wood or steel bridges. Silas Ballard, Bridge Comr.

Painesville, O.—It is reported that the Lake Co. Bd. has passed a resolution in favor of a bridge over Chagrin River, north of Willoughby village; cost to be between $10,000 and $30,000.

Struthers, O.—Press reports state that the Pittsburg & Lake Erie R. R. will probably erect an overhead bridge near the Youngstown Iron, Sheet & Tube Co.'s mill. J. A. Atwood, Ch. Engr., Pittsburg, Pa.

Galena, Ill.—The Comr. of Elizabeth Township is reported to have petitioned for aid in building a bridge over Apple River. M. McGuire, Co. Clerk.

Pittsburg, Pa.—See "Railroads."

Waynesburg, Pa.—Press reports state that Allison's bridge over Ten Mile Creek has been entirely swept away. The approaches to the Buchanan bridge are also reported washed away, together with the Co. bridge just below.

Oneonta, N. Y.—The Structural Iron & Steel Co., of Baltimore, Md., is reported to have secured the contract for the steel bridge over the D. & H. track on Main St., for $29,365.

Cross Keys, Pa.—Press reports state that plans for the Berks Co. bridge over the Schuylkill here, to be rebuilt by the State, are being prepared by M. D. Bowman, of Mahanoy City, and contract will be let as soon as they are ready.

Gallipolis, O.—Local press reports state that the contract for the 100-ft. bridge over the Chickamaugua has been let to the Columbia Bridge Co.

Nebraska City, Neb.—Press reports state that the Co. Comrs. estimate the Co. bridge loss, due to floods, at $50,000.

McMinnville, Tenn.—The Nashville Bridge & Construction Co. is reported to have been awarded the contract for 4 Co. bridges for $9,000.

The Co. Court is reported to have authorized the rebuilding of 2 bridges at Hennessee's Ford and Falls City.

PAVING AND ROADMAKING.

Atchison, Kan.—The City Council has passed a resolution declaring it necessary to pave 10th St. with vitrified brick. Fred Giddings, City Engr.

Tacoma, Wash.—The Council has voted to pave St. Helen's Ave. with bituminous macadam.

Mobile, Ala.—City Engr. D. M. N. Ross writes that the City Council and the Bd. of Pub. Wks. have agreed on the extension of the paving district; the next specification will call for 30,000 yds. of rock asphalt and 16,000 yds. brick laid on a sand foundation. Contracts for this work will soon be let. J. N. Hazelhurst, Engr. Bd. of Pub. Wks., in Charge.

San Antonio, Tex.—See "Sewerage and Sewage Disposal."

Rock Island, Ill.—City Engr. Wallace Treichler writes that the City Council has passed an ordinance for the paving of 2 blocks on 21st St. with asphalt. Estimated cost, $8,700.

Freehold, N. J.—The Bd. of Chosen Freeholders is stated to have awarded contracts for constructing county roads as follows: Macadam road between Keyport and Keansburg, to Fields & Swackhammer, at 71 cts. per sq. yd., total $10,575; stone road, from Matawan Station to Freneau, to J. R. Shanley, at 66 cts. per sq. yd., total $9,270; stone road, with gravel surface, between Monmouth Beach and North Long Branch, to J. R. Shanley, at 91 cts. per sq. yd., total $15,083.

Des Moines, Ia.—The City Council on July 7 ordered portions of E. 12th, E. 2d and E. 1st Sts., Mary Ave. and 2 alleys paved with brick; also curbing for 11th, 1st, 2d and Des Moines Sts.

Atlantic City, N. J.—State Road Comr. Henry I. Budd, Trenton, has recommended the construction of a new stone road between Atlantic City and Pleasantville; also that the State pay 1/3 of the cost, which would probably be about $150,000.

Huntington, L. I., N. Y.—Edwin Bailey, Jr., of Patchogue, is Chmn. of the Com. appointed by the Suffolk County Bd. of Supervisors to investigate the question of cross island roads to be built under State aid, as provided by the Higbie-Armstrong law.

Worcester, Mass.—Mayor Edw. F. Fletcher has directed Street Comr. Wright S. Prior to take immediate action toward repaving Main St. with granite block on a Portland cement concrete base.

Jersey City, N. J.—Local press reports state that the old Belleville turnpike, also known as Arlington turnpike, extending from Newark turnpike to Belleville bridge, is to be widened to 100 ft. and macadamized under the State road act, according to a resolution recently adopted by the Hudson Co. Bd. of Freeholders.

Watertown, N. Y.—The only bid received for sheet asphalt paving on a portion of Washington St. is reported to have been from the Barber Asphalt Paving Co. at $1.98 per sq. yd.; total, $25,188.

Cincinnati O.—The Bd. of Pub. Service has decided to pave several streets on Mt. Adams with brick and asphalt.

Fulton, N. Y.—The Bd. of Pub. Wks. has decided to pave portions of Oneida St. with brick, First St. with asphaltum and Broadway with either brick or asphaltum.

Alexandria, Ind.—The Council is stated to have awarded contracts for improving Madison and Liberty Sts. to F. M. Kemp & Sons, of Middletown, O., at $18,277, or $8.27 per ft. for Madison St., and $4,722, or $7.75¼ per ft. for Liberty St.

Rome, N. Y.—The Common Council has adopted plans and specifications for the paving of a portion of West Embargo St. with either asphalt, macadam or brick.

St. Paul, Minn.—The estimated cost of paving Ramsey St. from W. 7th St. to Pleasant Ave. with asphalt is $13,104 for the city's part and $9,140 for the street railway's portion, or at the rate of $5.31 a front ft. It is estimated that the city's part would cost $11,265, or $4.56 a ft., if paved with brick, and with sandstone, $14,203, or $5.78 a ft.

Mayor Smith has vetoed the Council's final order for paving with sandstone, W. 7th St. from Ramsey to Tuscarora Sts. The majority of the property owners are said to favor asphalt paving for this street.

City Engr. Rundlett estimates the cost of paving University Ave. at $84,118 for asphalt, and $93,349 for sandstone.

The Bd. of Pub. Wks. has decided to pave Robert St. with brick. Estimated cost, $22,792.

North Adams, Mass.—Bids will be received by Comr. Temple, July 23, for paving Holden St. with vitrified brick; 2,300 sq. yds.

Haddonfield, N. J.—The Bd. of Co. Freeholders, Camden, has instructed the Co. Engr. to prepare plans and specifications for the stoning of Haddonfield and Gibbsboro road.

Norristown, Pa.—The Schuylkill Valley Traction Co. (G. Hoeger, Supt., Norristown), will pave with Warren's bituminous macadam waterproof pavement on De Kalb St. for a distance of 3,410 ft.x36 ft., for the privilege of extending its tracks to the Boro. line.

Port Huron, Mich.—The Common Council on July 7 rejected all bids for paving 7th St. and instructed the Supt. of Pub. Wks. to ask for new bids on Warren's bituminous macadam, brick, tar macadam or asphalt block.

Elizabeth, N. J.—Bids are wanted Aug. 1 for 6,480 sq. yds. of oblong trap block pavement in Livingston St., with 3,100 ft. of curb reset and 100 ft. of new curb. W. H. Luster, Jr., City Surveyor.

Auburn, N. Y.—City Clk. E. H. Herrling writes that bids will probably be received this month for asphalt pavement in one of the principal streets; estimated cost $30,000, and bids will probably be asked in Aug. for asphalt paving in another street; estimated to cost $6,000.

Harrisburg, Pa.—Bids are wanted July 21 for paving Short St. with Warren's bituminous macadam waterproof pavement and curbing with bluestone.

Champaign, Ill.—Bids are wanted July 21 for paving and curbing Park St.; 6,450 sq. yds. of brick will be required. C. J. Mullikin, Chmn. Bd. Local Improv.

Mt. Vernon, O.—The contract for paving Gambier St. with Townsend's wire-cut fireclay block on gravel foundation, with Murphy grout filler and Berea sandstone curb, has been awarded to W. J. Berry. The total cost is said to be about $28,744.

Pittsburg, Pa.—The grand jury has approved the proposed improvement of the following roads: Steubenville pike, Chartiers township; parts of Washington pike, Scott township; Pitcairn road, Patton township; Oakdale and McDonald road, North Fayette township; Middleton and Ewing's mill road, Stowe and Robinson townships.

Windsor, Conn.—Bids will be received by the Bd. of Selectmen, July 23, for the construction of a macadam road. T. S. Loomis, 1st Selectman.

Norwich, N. Y.—Bids are wanted July 28 for paving Lock St., 2,320 sq. yds. vitrified brick, and 1,900 lin. ft. of stone curbing will be required. A. R. Chonles, Clk. Bd. Village Trus.

Crookston, Minn.—City Clk. W. A. Lanctot writes that bids are wanted Aug. 12 for asphalt paving, estimated to cost $40,000. Geo. A. Ralph, Engr. in Charge.

Chattanooga, Tenn.—Local press reports state that the only bid received July 8 for the paving of W. 9th St. was from the Southern Paving & Construction Co. at $2.70 per sq. yd.; the contract calls for 1,728 sq. yds. of asphalt paving, 180 sq. yds. of brick guttering, and 30 sq. yds. of brick crossings.

Boston, Mass.—Jas. Donovan, Supt. of Streets, has placed the estimated cost of paving with granite block and regulating Norfolk Ave. from E. Cottage St. to the New England R. R., at $10,500.

Irvington, N. J.—The Special Speedway Com. of the Bd. of Freeholders has decided to locate the proposed driveway for fast horses in the town of Irvington. There is an appropriation of $22,000 for grading, paving and beautifying this roadway.

Newark, N. J.—The Bd. of Pub. Wks. has awarded the contract for paving Mott St. to the Barber Asphalt Paving Co., for $8,600.

Owosso, Mich.—The Common Council has ordered the Bd. of Pub. Wks. to get estimates for a macadam or crushed stone pavement on W. Main St.

Burlington, Ia.—Bids are wanted July 21 for paving 2 streets with brick. Emmet Steece, City Engr.

Watertown, N. Y.—Bids are wanted July 21 for about 15,500 sq. yds. of bituminous macadam waterproof pavement, with trap rock surface; also for 3,275 sq. yds. brick pavement. C. O. McComb, City Engr. Estimated cost, $45,000.

Toledo, O.—Bids are wanted Aug. 11 for paving Union and Cherry Sts. with block. Chas. H. Nauts, City Clk.

Chicago, Ill.—See "Government Work."

North Bend, O.—Corp. Clk. W. D. McClurkin writes that on July 14 it was voted to issue $20,000 bonds for sidewalks and street improvements.

Redlands, Cal.—Street improvement bonds to the amount of $50,000 have been sold.

Wilkesbarre, Pa.—Local press reports state that the contract for resurfacing certain asphalt streets has been awarded to the Warner-Quinlan Asphalt Co., Syracuse, N. Y., at $1.25 per sq. yd. for 28,000 sq. yds. of asphalt, $6 per cu. yd. for 300 cu. yds. of binder and $4.25 per cu. yd. for 1,000 cu. yds. of binder and $4.25 per cu. yd. for 1,000 cu. yds. of concrete; total, $41,050.

Covington, Ky.—Mayor Johnson has approved the ordinance authorizing the issue of street improvement bonds to the amount of $100,000.

Greenwich, Conn.—Bids will be received July 26 by S. D. Minor, Room 5, Trust Bldg., for macadamizing about 6,000 ft. of road for the Field Point Land Co.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service, July 30, for paving Westside and Eastside Aves. with macadam, and Kuhlman Ave. with brick; also on Aug. 12 for paving Beekman St. with granite block and Jones St. with brick; also on Aug. 13 for paving Southside Ave. with macadam. Geo. F. Holmes, Clk.

Chicago, Ill.—See "Sewerage and Sewage Disposal."

Centerville, Ind.—It is stated that bids are wanted Aug. 24 for 40,000 sq. ft. cement on brick sidewalks. J. F. Frame, Res. Engr.

Lincoln, Neb.—It is stated that bids are wanted Aug. 4 for the purchase of $215,000 paving and other improvement bonds. B. C. Fox, City Treas.

Toronto, Ont.—It is stated that bids are wanted July 22 for asphalt, cedar block, tar-macadam and other paving, and concrete sidewalks in 30 streets. G. H. Howland, Chmn. Bd. Control.

Albany, N. Y.—Bids are wanted July 21 for paving 3 streets with vitrified paving blocks and 1 street with granite block. Isadore Wachsman, Clk. Bd. Contract and Supply.

Oneida, N. Y.—A press report states that bids will be received by the City Clk. Aug. 4 for the purchase of $20,000 bonds, for paving Main St. and Lenox Ave.; also for $5,000 sewer bonds.

Paoli, Ind.—Bids are wanted Aug. 4 for construction of about 35,246 ft. of new road in Orangeville Township, to be of gravel or macadam. Geo. T. Tegarden, Co. Aud.

Topeka, Kan.—The Road & Bridge Com. of the Commercial Club has presented to the Co. Comrs. a petition for a 20-ft. pavement of vit. brick to extend from the end of the W. 6th Ave. pavement to the Kansas River bridge. Probable cost about $12,000.

Verona, Pa.—Paving bonds to the amount of $12,000 have been sold.

Nashville, Tenn.—It is proposed to pave a portion of Broad St. and West End Ave. with bituminous macadam, at a probable cost of $28,000.

Sandusky, O.—According to plans and specifications prepared by City Engr. Miller, the estimated cost of paving a portion of Hayes Ave. with different materials would be as follows: Brick, $28,860; block asphalt, $40,915; sheet asphalt, $36,200; bituminous macadam, $31,368.

New York, N. Y.—The Bd. of Aldermen on July 15 approved an appropriation of $1,250,000 to regulate and grade the Grand Concourse.

Albany, N. Y.—The Mayor has signed ordinances for the paving of portions of Van Zandt, Fulton and Plain Sts.; also the repaving with sheet asphalt of a portion of Broadway.

Chicago, Ill.—The Comrs. of North Shore Park Dist. have instructed the Board's attorney to draft an ordinance for the paving and improvement of Pratt boulevard from Clark St. to the lake, at a cost of $31,000.

Winnipeg, Man.—The City Council has given notice of intention to pave a portion of Young St. with asphalt, at an estimated cost of $11,985. C. J. Brown, City Clk.

Bridgeport, Conn.—Bids will be received July 29 by the St. Com. of Common Council for the construction of a macadam and telford road.

Cortland, N. Y.—Local press reports state that Port Watson St. is to be paved with macadam, at an estimated cost of $15,900.

Minneapolis, Minn.—See "Sewerage and Sewage Disposal."

East Hampton, Conn.—The Selectmen were authorized at a recent town meeting to construct a new highway north from Mill St.

Emeryville, Cal.—Local press reports state that the Town Trustees have awarded contracts for street work amounting to $48,500 to Hutchinson, Ransome & Co., of Oakland, their detail bid being as follows: Grading, 1 ct. per sq. ft.; wooden curbing, 10 cts. per lin. ft.; paving and grouting gutter, 9½ cts. per sq. ft.; bituminous crosswalks, 17 cts. per sq. ft.; 7x30-in. square cast iron culverts, $3.50 per lin. ft.; and macadamizing, 10 cts. per lin. ft.

Youngstown, O.—It is reported that bids are wanted Aug. 2 for paving Holmes St.; also for the construction of a sewer in Wilson Ave. C. E. Cross, Clk. City Comrs.

Grossepointe, Mich.—The Township Bd. is stated to have awarded the contract for macadamizing Jefferson Ave. to Jas. Hanley for $92,274.

Denver, Colo.—The following bids were opened July 9 for grading and curbing Capitol Hill Improv. Dist. No. 2: R. P. McDonald, $90,740; The Colorado Co., $90,325; J. M. O'Rourke Con. Co., $87,630; Western Realty & Paving Co., $90,398; John Gaffy, $92,790; Thomas J. Tully, $80,519.

Superior, Wis.—The contract for paving the strip between the outside rails of the street car tracks has been awarded by the Council to P. McDonald, of Duluth, for $11,000.

Leavenworth, Kan.—The Council has passed resolutions to pave a portion of 4th St. with brick and a portion of Broadway with asphaltum.

Milwaukee, Wis.—Bids are wanted July 22 for repaving 16th St. viaduct with creosoted pine blocks. Estimated cost, $40,000. Chas. J. Poetsch, Comr. of Pub. Wks.

Chester, W. Va.—A vote will be taken July 28 on the question of issuing $20,000 bonds for street paving.

East Liverpool, O.—Bids are wanted July 28 for paving College St. and Drury Lane with brick.

Menominee, Mich.—The City Council has directed the City Engr. to prepare plans and specifications for a brick pavement on Main St. from Ogden Ave. to the lower bridge.

Detroit, Mich.—Local press reports state that the following are the lowest bids received July 10 for paving portions of numerous streets: Cedar—Adelaide St., J. A. Mercier, $1,893; per sq. yd., $1.62; 24th St., W. E. Lennane, $12,774, or $1.44 per yd.; Vinewood Ave., J. A. Mercier, $8,896, or $1; Lebrosse St., W. E. Lennane, $8,111, or $1.49; Congress St., A. Grant, $8,975, or $1.51; St. Aubin Ave., J. Grant, $8,755, or $1.42; Wabash Ave., J. A. Mercier, $7,298, or $1.52; Humboldt Ave., J. A. Mercier, $8,080, or $1.60; Wabash Ave., J. A. Mercier, $7,273, or $1.51; High St., J. Porath, $6,578, or $1.51; Brick—Forest Ave., J. McLoughlin, $12,818, or $1.93; Hastings St., W. Lappin, $8,333, or $1.98; Beaubien St., J. A. Mercier, $11,746, or $2.02.

Brooklyn, N. Y.—The Interstate Paving Co., of Utica, was lowest bidder for four contracts for asphalt paving, for which bids were opened July 11, the four bids amounting to $30.030. The detailed bids on the largest contract, for Dean St., were as follows: A, Interstate Paving Co.; B, Bklyn. Alcatraz Asph. Co.; C, M. T. Meagher; R. Cranford Co.; E, Green River Asph. Co.; F, Uvalde Asph. Co.:

	Asph., 4,305 sq. yds.	Conc., 598 cu. yds.	Excav., 1,657 cu. yds.	Conc. curb, 2,330 ft.	Cement walk, 11,602 sq. ft.	Total.
A	$1.32	$1.10	$.25	$.50	$.18	$10.008
B	1.40	5.25	.40	.55	.15	12,851
C	1.65	5.50	.60	.65	.20	15,221
D	1.07	4.25	.30	.60	.16	10,899
E	1.25	4.00	.30	.45	.16	11,175
F	1.40	5.00	.30	.45	.15	12,303

Bids were also received for Medina sandstone pavement on concrete foundation, Jas. H. Holmes & Co. lowest bidder in one case, for 1,440 sq. yds. pav't at $2.35 and 280 cu. yds. concrete at $4.75, and T. F. Byrnes in another, for 1,320 sq. yds. pavt. at $2.47 and 270 cu. yds. conc. at $4.60.

M. T. Meagher was lowest bidder for 5,090 sq. yds. granite pavt. on sand for Meserole and Waterbury Sts., including 3,030 ft. bluestone curb and 13,930 sq. ft. cement sidewalks; total of bid, $15,295.50.

POWER PLANTS, GAS AND ELECTRICITY.

Baltimore, Md.—The Continental Trust Co. has financed the scheme for developing the power at three points on the Peach Bottom Rapids of the Susquehanna River. Each station will deliver 50,000 H.-P. The first development calls for two dams of 1,400 and 4,400 ft. and a power station on Lower Bare Island, with ten 5,000-H.-P. units. James H. Harlow, Pittsburg, is engineer of the work, and Dr. Coleman Sellers, John Bogart and Clemens Herschel are among the consulting engineers.

Kirkwood, Ill.—The Village Bd. is stated to have granted a franchise to Clifford West, of Biggsville, Ill., for an electric light plant for Kirkwood.

Lead, S. D.—The City Council is stated to have granted the Dickinson-Ames Co. a franchise for a gas plant.

Kirksville, Mo.—C. H. Payson is stated to have petitioned the City Council for a franchise for a gas plant.

Columbus, O.—Mayor Hinkle is stated to have approved the ordinance granting a franchise to the East Columbus Htg. & Lighting Co.

Redding, Cal.—Bids will be received by the McCloud River Electrical Power Co., Redding, until Aug. 1 for furnishing labor and material to build a dam, canal and power house on McCloud River, about 40 miles n. e. of Redding.

Washington, D. C.—Bids are wanted July 26 for furnishing underground signal and telephone cables for the Fire Alarm and Police Telegraph and Telephone Service in the Dist. of Columbia, during the fiscal year ending June 30, 1903, as advertised in The Engineering Record.

Annapolis, Md.—Baldwin & Pennington, 44 South St., Baltimore, architects, for a central heating and electric light plant, to be constructed at Annapolis, write that as soon as plans and specifications are prepared bids will be asked for said work.

Webster City, Ia.—The City Council is stated to have appropriated $5,000 to construct a municipal heating plant.

Madison, Wis.—The Governor is stated to have approved plans for the new ventilating, heating and electric lighting plant, to be installed in the Capitol, as submitted to him by the Special Commission, consisting of Prof. Storm Bull, Archt., Lew Porter and Prof. Bernard V. Swenson; estimated cost, $60,000.

Boulder, Colo.—The Boulder Electric Light & Power Co. is stated to have voted to issue $160,000 bonds. New engines and dynamos are to be purchased, and later the tracks are to be extended to the sanitarium in the northwestern part of town.

Hyattsville, Md.—The Town Council is stated to have received a proposition from the Washington, Baltimore & Annapolis Electric Ry. Co. (Jas. Christy, Vice-Pres., 405 Bond Bldg., Washington, D. C.), for the installation and maintenance of an electric lighting plant in Hyattsville. This company also proposes erecting a power house in Hyattsville for the purpose of furnishing power to the Berwyn & Laurel Electric Ry. and for its own line to Baltimore via Landover.

Carthage, Mo.—D. C. Brainard, of Carthage, is reported to have petitioned the Council for a franchise for a gas plant.

Summit, N. J.—See "Water."

Silverton, Colo.—Town Clk. R. H. Cooper writes that the contract for installing an electric lighting plant has been awarded to Skinner & Sethman, of Denver, for $19,770 (less building); the contract for the building has not yet been awarded.

Batesburg, S. C.—E. F. Strother, Atty., writes that surveys have been started by the Saluda River Electric & Const. Co. for the building of a dam across Saluda River, power house, etc. A. G. La Motte, of Columbia, S. C., Engr. in Charge.

Bennettsville, S. C.—This city will install a complete steam driven electric light plant. Collier & Brown, Consulting Engrs., of Atlanta, Ga., have charge of the work.

Eminence, Ky.—City Clk. W. J. Tutt writes that J. C. Helburn, J. A. Crabb and G. A. Holland, all of Eminence, bought the city franchises for electric light and electric railway.

Grand Rapids, Minn.—Edw. P. Burch, Consulting Engr., 1210 Guaranty Bldg., Minneapolis, writes that the contract for constructing an electric light plant has been awarded to J. G. Robertson, of St. Paul, at $24,800 for steam and electric machinery and $4,200 for the building.

New York, N. Y.—Bids are wanted July 25 by Thos. Sturgis, Comr. Fire Dept., for furnishing and delivering 60,000 ft. of underground telegraph cable, consisting of 20,000 ft. each 16.20 and 26 conductor cable.

Dunn, N. C.—See "Water."

Ferndale, Minn.—O. Claussen, of St. Paul, is reported to be preparing plans for an electric light plant.

Flushing, L. I.—The Newtown & Flushing Gas Co. is stated to have closed a contract with the United Gas Improvement Co., of Philadelphia, Pa., for the installation of a new generating plant at its works here. The new plant will have a capacity of nearly 1,000,000 cu. ft. per day.

Camden, N. J.—The Bd. of Freeholders is stated to have adopted a resolution authorizing the South Jersey Gas, Electric & Traction Co. to lay its pipes on River Road from Camden to the Burlington Co. line.

Cripple Creek, Colo.—The citizens are stated to have voted on June 30 to grant 2 electric franchises, one to H. P. Kerin and the other to the Peoples Electric Light Co.

Davenport, Wash.—C. O. Green is reported to have petitioned for a franchise for an electric light plant.

Waterbury, Conn.—J. Harry and Thos. F. Fagan are reported interested in the construction of an electric light plant.

Fremont, O.—The Logan Natural Gas Co. is stated to have petitioned the Council for permission to lay its pipes and supply natural gas in Fremont.

Chicago, Ill.—The City Council has granted the Chicago Yaryan Co. a franchise to operate a lighting and heating system in the territory bounded by North Ave., 52d Ave., 12th St. and Austin Ave.

Shenandoah, Ia.—The citizens are stated to have voted to grant Mr. Hayes and associates a franchise for a gas plant.

Emporia, Kan.—It is reported that bids will be received by G. O. Mathewson, City Clk., July 24 for 2 alternating current generators and electrical apparatus, and on July 28 for 2 steam boilers and other apparatus for an electric light plant.

New Matamoras, O.—The Council is stated to have granted J. B. Parker, of New Matamoras; C. C. Stover, of Sistersville, W. Va., and others, a franchise to lay a gas pipe system.

Worthington, Minn.—See "Water."

Montreal, Que.—The Standard Light & Power Co. is reported to be considering the construction of a steam heating plant.

Belzoni, Miss.—S. Castleman writes that he will receive bids in about 60 days for the construction of an electric light and power plant.

Constantine, Mich.—It is stated that bids are wanted July 21 for embankment, road work, piling, masonry work, etc., in connection with the proposed power plant for the Constantine Hydraulic Co.

Petersburg, Ind.—Bids will be received by Frank Thomas, Clk. Town Trus., for the construction of an electric light plant.

Lewiston, N. Y.—See "Water."

Helena, Mont.—The new owners of the Helena Power & Light Co. are reported to have incorporated as the Helena Light & Traction Co. The company is empowered to own and improve water power, develop and deal in electricity, gas and steam for all purposes, and to operate street railways to Broadwater, East Helena, Ft. Harrison, Kenwood, Lenox, the University of Montana and other points; capital, $100,000. Directors: Thos. A. Marlow and Norman B. Holter, of Helena, and Kenneth Clark, of St. Paul, Minn.

Hartwell, Ga.—See "Water."

Koala Zumpur, Malay Peninsula.—Bids will be received at the Office of the Crown Agents for the Colonies, Downing St., London, S. W., England, on or before Aug. 21 for the following plant and material in connection with the electricity supply scheme for the town of Koala Zumpur, in the protected Native State of Selangor, Federated Malay States: Contract A—Supply, delivery and erection of generating station, consisting of 2 600 H.-P. high pressure turbines, with pipes; 2 400 Kw. 3-phase alternators; switchboards, etc.; also sub-station plant, consisting of 3 150-Kw. motor generators, 2 balancers, switchboards, etc. Contract B—To supply and deliver, f. o. b., at a European port, steel poles, cross-arms, insulators, copper wire, etc., for high-pressure transmission line. Contract C—To supply and deliver, f. o. b., at European port, arc lamps, iron posts, controlling apparatus, glow lamps and fittings. Specifications, drawings, general conditions and forms of tender may be obtained from the Crown Agent for the Colonies, London, on the payment of £2 for Contract A, £1 for Contract B and £1 for Contract C.

ELECTRIC RAILWAYS.

Cardington, O.—The City Council is stated to have granted a franchise to the Mansfield, Mt. Gilead & Delaware Electric Ry. Co.

Fairfield, Cal.—The Bd. of Superv. is stated to have granted J. E. Woolley, of Vacaville, a franchise for the construction and operation of an electric railway on the public roads of Solano County, to connect Suisun, Vacaville, Winters, Elmira and Cement City.

Norristown, Pa.—See "Paving and Roadmaking."

Tuscumbia, Ala.—J. T. Crass, of Chattanooga, Tenn., is stated to have secured an electric railway franchise.

Oneida, N. Y.—A certificate for the extension of the Oneida Ry., from Oneida to Sylvan Beach, is stated to have been filed with the Secy. of State.

Pontiac, Mich.—The Town Bd. of the Township of Pontiac is stated to have granted a franchise to the promoters of an electric railway which is projected from Pontiac to Flint by way of Drayton Plains, Waterford, Clarkston, Davisburg, Holly and Fenton. Jas. A. Randall, of Detroit, Mich., is reported interested.

Loudonville, O.—The City Council is stated to have granted a franchise to the Wooster & Mansfield Electric Ry. Co.

Kansas City, Kan.—The Kansas City & Olathe Ry. Co. is stated to have petitioned the Wyandotte Co. Comrs. for a franchise to construct a railway from Rosedale to Olathe.

Mt. Holly, N. J.—The Peoples Traction Co. has been incorporated, with a capital of $175,000, to construct an electric railway between Mt. Holly and Burlington. Josiah K. Bougher, of Philadelphia, and Dr. W. C. Parry, of Hainesport, N. J., are among the incorporators.

Rogersville, Tenn.—The Comrs. of Hawkins County are stated to have voted to issue $100,000 bonds to aid W. T. Goffe in the construction of an electric line from Bean Station or Tate Springs, to Gate City, Va.

Sheboygan, Wis.—The City Council is stated to have granted a franchise to the Sheboygan & Elkhart Lake Electric Ry. Co.

Struthers, O.—The Mahoning Valley Southeastern Ry. Co. is stated to have petitioned the Mahoning Co. Comrs. for a franchise in Struthers.

Hamilton, O.—The Butler Co. Comrs. are stated to have granted a franchise to the Hamilton, Eaton & Richland Electric Ry. Co.

Southwick, Mass.—Charles H. Parsons and Fred T. Ley, of Springfield, and A. J. Forward, of Southwick, representing the Southwick St. Ry., have petitioned the Selectmen for franchises to the Westfield and Agawam town lines.

Boulder, Colo.—See "Power Plants, Gas and Electricity."

Wheeling, W. Va.—The Co. Comrs. are stated to have granted the City Ry. Co. a right of way over the Wheeling and Fairmont pike and up the Frazier's run road, to the line dividing Ohio and Marshall Counties.

Coatesville, Pa.—The Council is stated to have granted the West Chester St. Ry. Co. a franchise from the eastern to the western borough lines.

Walla Walla, Wash.—The City Council is stated to have granted F. B. Romo and N. Meliman a franchise to operate a general electric business and lay rails for the construction of a street railway along the streets of the city. It is stated that they propose constructing an electric railway between Dayton, Wash., and Pendleton, Ore., passing through this city. About $1,250,000 will be expended on the project.

Urbana, O.—The Co. Comrs. are stated to have granted a franchise to the Springfield, Piqua & Sidney Traction Co.

Jacksonville, Fla.—The City Council has granted G. W. Shook a franchise to construct and operate a street railway.

Mineola, L. I., N. Y.—The Mineola, Hempstead & Freeport Traction Co. is stated to have petitioned the Bd. of Superv. for permission to build and operate its lines on the Jericho Turnpike and on the Co. highways from Freeport west to the Co. line, and also a spur line from Rockville Center to Long Beach.

Columbus, Ind.—The Co. Comrs. are stated to have granted a franchise to Jos. L. and W. G. Irwin to extend their electric line from Franklin through Bartholomew Co. to this city.

New Castle, Pa.—A charter has been granted to the West Pittsburg Connecting R. R. Co. The new electric railway will be built this summer from Chewton to New Castle, a distance of 9 miles. A bridge with a span of 900 ft. will be built over Beaver River to West Pittsburg. Directors: Henry O. Evans, Chas. A. Glaser, Angus McD. Taylor and others, all of Pittsburg.

Durand, Mich.—D. M. Estey, of Owosso, is reported to have petitioned the Council for a franchsie for an electric railway to be constructed from Durand to Owosso.

Jamestown, N. Y.—The Warren & Jamestown Electric R. R. Co., of Jamestown, has been incorporated to operate an electric railway 10 miles in length; capital, $100,000. Directors: D. H. Siggins, J. M. Siegfried and H. M. Preston, Warren, Pa.

Akron, O.—The Cleveland, Richland & Akron Transit Co. is stated to have purchased a site in this city for a power house.

Elizabeth, N. J.—The East Jersey Traction Co. is reported to be considering the extension of its line from Elizabeth to Rahway.

Helena, Mont.—See "Power Plants, Gas and Electricity."

Knoxville, Tenn.—E. N. Harris, Ch. Engr., has about completed survey for the Knoxville, Kimberlin Heights & Sevierville Electric R. R., from Knoxville to Sevierville, Tenn.

Eminence, Ky.—See "Power Plants, Gas and Electricity."

Harrisburg, Pa.—Bids are wanted July 21 for grading the route of the Singlestown & Blue Mountain St. Ry. Co. G. W. McIlhenny, Secy.

Youngstown, O.—The Youngstown & Southeastern Electric Ry. Co. has been incorporated to construct an electric railway from Youngstown to Struthers and Poland. Incorporators: E. H. Moore, J. Gordon Cook, and others.

Tuscarora, N. Y.—The Tuscarora Valley R. R. Co. has filed with the State R. R. Comrs. a notice of its intention to construct an electric railway in Addison, Tuscarora, Woodhull and Jasper.

Hyattsville, Md.—See "Power Plants, Gas and Electricity."

Sault Ste. Marie, Mich.—Bids are wanted July 24 for the grading, track laying, bridge work, etc., as required on about 8 miles of electric railway construction in this city, for the Trans-St. Mary's Traction Co. Address G. W. Chance, 44 McTavish Bldg.

Canal Dover, O.—Bids are wanted July 24 by the Canton, New Phila. & Coshocton Ry. Co., at Canal Dover, for grading, trestling, pile driving and masonry for 21 miles of road. W. W. Ely, Ch. Engr.

Jasper, Ind.—The Jasper, French Lick, West Baden & Northwestern Traction Co. is reported incorporated, with a capital of $100,000. Incorporators: Sam'l Reavis, J. W. Brown and others, all of Princeton.

RAILROADS.

Orange, Tex.—The Orange & Northwestern R. R. Co. is stated to have filed an amendment to its charter providing for the construction of 350 miles of additional road. The extensions are to be made from a point on the line in Jasper County to Marshall, Tex., a distance of 150 miles, from Buna, Tex., to Corsicana, a distance of 195 miles, and from Orange to West Orange, a distance of 5 miles. J. W. Maxey, Ch. Engr., Orange.

Pittsburg, Pa.—Local press reports state that the Pennsylvania R. R. Co. will expend about $6,000,000 in terminals for Pittsburg. The work is reported to include a bridge from the West Penn. division at the west end over to Herrs Island; also a double track steel bridge over Allegheny River, which, with approaches, will be 2,000 ft. long. W. H. Brown, Ch. Engr., Philadelphia.

Bloomington, Ind.—A press report states that 4 of the townships of Green County have voted a subsidy of about $100,000 for the proposed Indianapolis Southern R. R.

Hannibal, Mo.—The Hannibal Connecting R. R. Co., of Hannibal, has been incorporated, with a capital of $80,000, by J. R. Maxwell, A. Denorve, Henry Groves and others, to construct and operate a road from Itasca to Hannibal, a distance of 8 miles, to connect with the Hannibal & St. Joseph R. R.

Harrisburg, Ill.—A charter is stated to have been granted to the Ohio River Coal & Ry. Co., with a capital of $100,000, to construct a line from a point on the Ohio River near RosecIaire, through Hardin, Pope, Saline and Williamson Counties, to Marion, Ill., and from Harrisburg to Galatia. Incorporators: Collins B. Hubbard, New York City; John W. Shaw, Harrisburg, Ill., and others. Principal office to be at Harrisburg.

Clarinda, Ia.—The Clarinda, College Springs & Southern Ry. Co. has been incorporated, with a capital of $100,000, to build a steam or electric line from Blanchard to Des Moines. Incorporators: E. B. Dunham, A. P. Tukey and others.

Hutchinson, Kan.—The Hutchinson & Arkansas City R. R. Co. has been incorporated, with a capital of $50,000, to construct a railroad from Hutchinson to Keechi. Frank Vincent and W. Y. Morgan, of Hutchinson, are among the directors.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Novinger, Mo.—Bids are wanted by Wm. Kenefick, Centerville, Ia., for about 50 miles of work on the Iowa & St. Louis Ry. from Novinger to Macon City, Mo.

Nashville, Tenn.—It is stated that the Nashville, Chattanooga & St. Louis R. R. Co. is to extend its line from Lebanon to Smithville and from Murfreesboro to Woodbury. Hunter McDonald, Ch. Engr.

El Paso, Tex.—The El Paso & Southern Ry. Co., of El Paso, has been incorporated, with a capital of $2,000,000, to build a belt line around the city of El Paso and touching the territory of Mexico. Distance, about 6 miles. Incorporators: W. G. Choate, A. Courchesue and others, of El Paso.

St. Louis, Mo.—Local press reports state that the St. Louis Terminal Depot Co. has been incorporated, and has for its object the building of a bridge over the Mississippi River at Mullanply St., extensive terminals on the river front, an elevated road to Forest Park and a new depot near 12th St. and Lucas Ave. Incorporators: J. C. Van Blarcom, Vice-Pres. Nat. Bank of Commerce; Edw. G. Goltra, Pres. Amer. Steel Fdy. Co.; Mayor M. M. Stephens, of East St. Louis, Ill., and others.

Acme, Tex.—The Acme, Red River & Northern Ry. Co. has been chartered to construct a railway from Acme, a station on the Ft. Worth & Denver City Ry., north to Red River, a distance of about 8 miles; capital stock, $25,000. E. H. and A. L. East, of Sherman, Tex.; John Summerfield, of Dallas; F. K. Sterrett, of Abilene, and others, are the incorporators.

St. Louis, Mo.—Bids are wanted July 31 for the grading, masonry and timber bridging on about 32 miles of heavy work near St. Louis, for the Missouri & South Eastern Construction Co. W. W. Wambaugh, Supt. of Construction, 508 Granite Blk.

Minneapolis, Minn.—The Rock Island, Minneapolis & Terminal Transfer Co. has been incorporated to maintain and operate a railroad with sidetracks, yards and station houses in the block bounded by 8th and 9th Aves. S, and 4th and 5th Sts., the object being to form a junction with the Chicago, Milwaukee & St. Paul R. R.; capital, $150,000. Incorporators: Roland G. Brown and Andreas Ueland, of Minneapolis, and Thos. H. Brown, of Sioux Falls, S. D.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Lexington, Ky.—The plans of H. L. Rowe, Northern Bank Bldg. are stated to have been accepted for a $60,000 Carnegie Library.

Ottawa, Kan.—Geo. P. Washburn & Son, 413 S. Main St., are stated to have prepared plans for a Carnegie library, to cost $15,000.

Riverside, Cal.—The citizens of Riverside Co. are stated to have voted July 8 to issue $150,000 bonds for a court house.

Yankton, S. D.—Bids are wanted July 25 for the erection of a Carnegie Library. F. L. Van Tassel, Chmn. Bldg. Com.

Clarksburg, W. Va.—It is stated that a jail and sheriff's residence will be erected for Harrison Co., to cost about $50,000, and it is stated that the Co. Clk. will receive bids for the erection July 28.

Beatrice, Neb.—The Library Bd. is stated to have authorized the Secy. to secure plans for an $18,000 library.

New York, N. Y.—The Bd. of Estimate is stated to have decided to allow the Health Dept. $75,000 for repairs to the hospitals at Kingston Ave., Brooklyn, at Riverside, and at North Brother Island.

Concord, N. H.—The plans of Warren, Smith & Biscoe, 110 Boylston St., Boston, Mass., are stated to have been accepted for the new city building to cost $100,000.

New York, N. Y.—The Armory Bd. is stated to have authorized Clinton & Russell, 32 Nassau St., to prepare plans for the reconstruction of the 71st Regt. Armory. It also decided to repair the 7th Regt. Armory heating plant, at a cost of about $12,000.

Dobbs Ferry, N. Y.—York & Sawyer, 150 5th Ave., are stated to have been selected to prepare plans for new buildings for the New York Juvenile Asylum to be erected at Dobbs Ferry, to cost about $1,500,000.

Indianapolis, Ind.—Wm. P. Jungclaus, 827 Mass. Ave., is stated to have secured the contract for erecting the Bona Thompson Memorial Library, for $40,000.

San Antonio, Tex.—The congregation of the First Presbyterian Church is stated to have decided to erect an edifice on Marlin and Navarro Sts., to cost about $50,000.

Washington, D. C.—Local press reports state that the work of erecting 2 new buildings for the National Bureau of Standards will soon be begun. The contract for the mechanical laboratory is stated to have been awarded on July 8 to Pavarini & Greer, and the contract for the larger building to be used for a physical laboratory will be let shortly. The 2 buildings are to cost together $325,000.

Trenton, N. J.—Bids are wanted July 28 for the purchase of $100,000 county building bonds. Thos. H. Thropp, Co. Collector.

Marquette, Mich.—Bids will be received by County Clk. Ross until Aug. 6 for the erection of a court house; probable cost, $120,000. Charlton & Gilbert, Archts., Hester Blk.

Great Falls, Mont.—Bids are wanted July 28 for the construction of a library. W. H. Smith, City Clk.

Toledo, O.—The Council is stated to have approved an issue of $20,000 bonds for the erection of a small-pox hospital.

Yonkers, N. Y.—The lowest bid received for erecting the Carnegie Library is stated to have been submitted by W. H. Sergeant, for $46,945.

Fairmont, W. Va.—Bids are wanted by Badgley & Smith, Archts., Court House, until July 21 for the construction of the new St. Peter's Church, at Jackson and Madison Sts. Rev. A. Boutlou, Fairmont.

Athens, Ga.—The City Engr. has been directed to prepare plans for a city hall, to cost $30,000.

Pomona, Cal.—Bids are wanted July 26 for the construction of a brick library to be located at Main and Center Sts. Burnham & Bliesner, Archts., Los Angeles. C. I. Lorbeer, Secy. Probable cost, $15,000.

Benton Harbor, Mich.—It is stated that plans have been completed for a $20,000 Carnegie Library.

New Bedford, Mass.—J. W. Bishop & Co., of Providence, R. I., are stated to have secured the contract for erecting an armory at Pleasant and Sycamore Sts. for $136,000.

Montreal, Que.—The Trus. of St. Patrick's Orphan Asylum are stated to have decided to make extensive alterations.

Atlanta, Ga.—The plans of W. F. Denny, Prudential Bldg., are stated to have been accepted for an edifice for the First Methodist Church to be erected on Peachtree St. and Porter Pl., to cost about $60,000. Geo. Winship, Chmn. Bldg. Com.

Escanaba, Mich.—Theo. F. Lohff, of Escanaba, is stated to have prepared plans for the Carnegie Library, to cost $20,000.

Anderson, Ind.—The plans of Richards, McCarty & Bulford, Roggery Bldg., Columbus, O., are stated to have been accepted for the Carnegie Library; probable cost, $50,000.

Schenectady, N. Y.—It is stated that $35,000 has been given to the Ellis Hospital for the erection of an annex.

Paterson, N. J.—The David Henry Bldg. Co., of Paterson, is stated to have secured the contract for rebuilding St. Joseph's R. C. Church, for $56,800.

Harrisburg, Pa.—A press report states that the Capitol Comn. has approved the plans of Architect Hutton for the new State Capitol, and the contract will soon be let for its erection.

New Orleans, La.—Gov. Heard is reported to have approved the bill providing for the erection of a court house in New Orleans.

Buffalo, N. Y.—The following bids are stated to have been opened by the Bd. of Superv. for the excavating and sewer work necessary for the building of the new 65th Reg. Armory: Mosier & Summers, $64,684; Barber Asphalt Paving Co., $67,185; Brown & Stabell, $65,646; Niederpruem, Gibbs & Schaff Co., $68,300.

Wilkinsburg, Pa.—Bids are wanted July 26 for remodeling the borough building and erecting an engine house. W. B. Jones, Boro. Clk.

La Crosse, Wis.—Shick & Roth, of La Crosse, are preparing plans for the proposed $135,000 court house.

Atlantic, Ia.—Bids are wanted July 25 for the erection of a public library. Architects, Liebbe, Nourse & Rasmussen, Des Moines. W. A. Follett, Secy. Library Bd.

Madison, Minn.—Bids are wanted July 30 for the erection of a city hall, from plans prepared by Buechner & Orth, St. Paul. Jas. H. Chalmers, City Recorder.

Toledo, O.—Bids will be received Aug. 13 by John F. Kumler, Pres. Bd. Trus. Miami Children's Home, for the erection of a hospital from plans of Thos. A. Wade, Builders' Exchange.

Goderich, Ont.—Bids are wanted Aug. 12 for the erection of the North St. Methodist Church. Address Rev. Dr. Daniels.

Shreveport, La.—A press report states that bids will be received by the Trus. of the Charity Hospital, Aug. 14, for erecting a hospital.

Decatur, Ind. Bids are wanted July 22 for erecting a brick church. Chas. F. True, Secy. Bldg. Com.

Toledo, O.—Bids will be received by the Bd. Trus. of Toledo State Hospital, Aug. 14, for the erection of an annex for employes' quarters and dining room and remodeling general dining room. Architect, David L. Stine, 405 Valentine Bldg. H. A. Tobey, Secy.

BUSINESS BUILDINGS.

Chariton, Ia.—Bids will be received by C. W. Huntley until July 24 for the erection of a 3-story Pythian Temple and business block, 60x100 ft. Architects, Lieble, Nourse & Rasmussen, Des Moines.

Little Rock, Ark.—C. W. Clark is stated to have secured the contract for erecting the Concordia Assoc. building at 8th and Scott Sts., for about $30,000.

Paducah, Ky.—It is stated that plans are being prepared by A. L. Lassiter for a warehouse to be erected by W. Y. Noble at 9th and Madison Sts. It will be of brick and will be 120 ft. long and 92 ft. wide.

Pittsburg, Pa.—A press report states that plans are being prepared for the erection of a department store building to be erected on the present site of St. Paul's Cathedral, for Henry C. Frick.

Spokane, Wash.—Mrs. Carrie Harris, of Spokane, has had plans prepared by Archt. Austin, of Los Angeles, Cal., for a 3-story brick block, 70x60, to be built in Spokane at a cost of $25,000.

Shamokin, Pa.—The Shamokin Silk Mill Co. is about to erect a 3-story addition, 120x40 ft., to its present building. Estimated cost, $10,000.

Birmingham, Ala.—Local press reports state that T. C. Thompson & Son, of Birmingham, have secured the contract for the stone and brick work for the car shop and barn for the Birmingham Ry., Light & Power Co., for $61,677.

Auburn, N. Y.—The Auburn Savings Bank building is about to be remodeled and enlarged at an estimated cost of about $60,000, including elevators and all modern improvements. Archt., S. E. Hilger.

Marlboro, Mass.—The N. Y., N. H. & H. R. R. is about to build a brick depot with slate roof, 83x40 ft. Cost, $12,500. Archt., C. B. Ingersoll, New Haven, Conn.

Sunbury, Pa.—The Directors of the Odd Fellows' Orphans Home, of Central Pennsylvania, are reported to have decided to erect a new fireproof structure to cost $30,000 near this place. Royal H. Bussler, of Newberry, is Dist. Deputy Grand Marshal.

Atlanta, Ga.—Willis F. Denny, Prudential Bldg., is stated to be preparing plans for a $25,000 business building to be erected on Whitehall and Alabama Sts. for H. Silverman.

Cleveland, O.—Knox & Elliott, 233 Bank St., are stated to be preparing plans for a 10-story building to be erected on Ontario and Prospect Sts. J. J. Phillips is reported interested.

New York, N. Y.—Plans have been filed for a 9-story brick hotel to be erected on Bway. and 103d St. J. A. Pinchbeck, 674 Columbus Ave., is the owner, and H. A. Jacobs, 1133 Bway., the Archt.; cost, $750,000.

Georgetown, S. C.—Bids will be received at the Bank of Georgetown until July 28 for the erection of a banking house. Architect, Chas. C. Wilson, 1422 Main St., Columbia, S. C.

Menominee, Mich.—The plans of Geo. M. Garnsey, 185 Dearborn St., Chicago, Ill., are stated to have been accepted for a $35,000 opera house.

Monessen, Pa.—Anton Fritz is reported interested in the erection of a $75,000 opera house.

Jackson, Miss.—Bids are wanted July 28 by Walter G. Kirkpatrick, Jackson, for constructing the Cumberland Telephone Exchange Bldg., at Jackson, 3-story brick structure.

Los Angeles, Cal.—M. Paul Martin, of Los Angeles, is the architect for a 106-room hotel (hot water heating system) to be built for the Hinman Investment Co., W. E. DeGroot, Pres.

New Haven, Conn.—Richard Williams has prepared plans for a $25,000 addition to be built of brick and stone, for the Union League. Geo. B. Martin, Pres.

Philadelphia, Pa.—Hales & Ballinger, Archts. and Engrs., 1200 Chestnut St., have completed plans and specifications, and are inviting bids for a business building, to be erected for F. W. Ayer, of N. W. Ayer & Co., Advertising Agents. Plans call for a 7-story and basement structure, to be erected at 8th and Sansom Sts., with a frontage on Sansom St. of 90 ft. and on 8th St. of about 95 ft. It will be of combination steel frame and slow burning construction, having all steel work fireproofed, and will be of light gray brick, with terra cotta trimmings, and will be equipped with two boilers, two electrical generators for power and lighting and one passenger and two freight elevators of modern type.

Boston, Mass.—Archts. Andrews Jacques & Rantoul, 1 Somerset St., have filed plans for a 10-story steel frame, fireproof office building, 93x149 ft., to be located on Congress St. and Exchange Pl., for the Congress St. Associates, the building to be known as the State Mutual Bldg. The height will be 125 ft. Estimated cost, $1,000,000.

Plans have also been filed for a 10-story office building by Archts. Hartwell Richardson & Driver, 66 Devonshire St., to be erected at 39-41-43 Tremont St. It will be 36x114 ft. and 125-ft. high. Builders, Geo. A. Fuller Co., Boston. Owners, J. Laforme, Winslow Warren and A. C. Reggis, Trus. for Carney Hospital. Estimated cost, $350,000.

Tonawanda, N. Y.—The Tonawanda Board & Paper Co. is to erect a mill here. The buildings will be of brick and iron, 375x256 ft. Contract for power plant already let.

DWELLINGS.

New York, N. Y.—Maurice Hebert is stated to have prepared plans for a residence to be erected for Chas. M. Schwab on West End Ave. and 73d St., to cost about $2,000,000.

Kalamazoo, Mich.—C. A. Fairchild, of Kalamazoo, is stated to have completed plans for a brick apartment house for Mr. Allen, of that city, to cost $35,000.

Boston, Mass.—Permit has been granted to build a 5-story $45,000 dwelling on Bay State road, for Chas. W. Hubbard, Treas. of the Ludlow Mfg. Co., of Weston, Mass. His Boston address is 133 Essex St. Builders, G. H. Cutting & Co., Worcester, Mass.

Richmond, Va.—The contract for erecting the Chesterfield apartment house is stated to have been awarded to W. A. Chesterman, of Richmond, for about $230,000.

SCHOOLS.

Alameda, Cal.—W. W. Anderson, of San Francisco, is stated to have secured the contract for erecting a high school for $49,733.

Denver, Colo.—W. W. Atkinson is stated to have secured the contract for erecting Stratton Hall at the School of Mines, for $35,880.

Chattanooga, Tenn.—Bids will be received by J. C. Howell, Chmn. Bd. Pub. Wks., July 22, for the installation of a steam heating plant in the 1st Dist. School.

Salisbury, Mo.—Bids are wanted July 22 for the erection of a 10-room, 2-story brick school. W. L. Garver, Archt., Chillicothe, Mo.; Jas. W. Wayland, Secy. School Bd.

Watervliet, N. Y.—Bids are wanted July 24 for the purchase of $32,000 school bonds. Henry M. Burrus, City Chamberlain.

Mingo Junction, O.—Bids will be received by John G. Brand, Clk. Bd. Educ., July 24, for the erection of a school in Mingo Special School Dist.

Baltimore, Md.—Bids will be received July 30 by the Bd. of Awards for the erection of a school at Johnson and Heath Sts.; separate bids will be received for ventilating and heating said school. Thos. G. Hayes.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., until July 23 for improving the sanitary condition of several schools in Bronx Boro.; also on same date for the construction of addition to and alterations in School No. 92, Boro. of Manhattan, and in School No. 51, Boro. of Queens. Bids will also be received by C. B. J. Snyder until July 25 for the erection of School No. 190, Boro. of Manhattan; also on same date for the erection of School No. 65, Boro. of Bronx.

Camden, N. J.—School bonds amounting to $50,000 have been sold.

Warren, O.—A press report states that bids are wanted Aug. 4 for erecting an addition to the high school; probable cost, $30,000.

Stoughton, Mass.—Bids are wanted July 24 for erecting a high school. Geo. W. Pratt, Secy. Bldg. Com. Architect, G. W. Capen, 179 Summer St., Boston.

Trenton, N. J.—Bids are wanted July 24 for erecting a brick and stone school on Fillmore St. J. C. Bloom, Chmn. Com. on Grounds & Bldgs., Bd. of Educ. Architects, Brouse & Arend, First Natl. Bank Bldg.

Middletown, N. Y.—It is stated that an $18,000 school will be erected in the 1st Ward.

Cleveland, O.—The School Council Bldg. Com. is stated to have purchased a site on Mill St. and will erect on same a $60,000 school.

Oneida, N. Y.—Geo. F. Avery, 111 Elizabeth St., is stated to have secured the contract for erecting the high school for $27,821, not including ventilating and heating.

Buffalo, N. Y.—Plans have been filed for a 2-story brick school to be erected on Delavan and Bailey Aves. for St. Gerard's R. C. Church, to cost $25,000.

Huntsville, Ala.—A. M. Booth, of Huntsville, is stated to have secured the contract for erecting a school for $21,650.

Columbus, O.—The Ohio State Univ. Trus. are stated to have decided to erect a new veterinary building to cost $35,000, also an addition to the Chemical Building, to cost $25,000.

Dallas, Tex.—The plans of Hubbell & Greene are stated to have been accepted for 2 new schools to be erected here this summer.

Denton, Tex.—Rosser Thomas, Chmn. Bldg. Com., Girls' Industrial College of Tex., writes that the contract to prepare plans and specifications for a 3-story brick and basement brick building, with stone foundations, has been awarded to Dodson & Scott, of Waco, Tex.; probable cost, $45,000.

Munhall, Pa.—This town is about to erect an 8-room school at a cost of $60,000. M. M. Mechling, Secy.

Chicopee, Mass.—F. P. Cobb, City Engr., writes that an addition 45x67 ft. is to be constructed to the High School buildings. Cost, including heating, etc., about $10,000.

Milwaukee, Wis.—Bids are wanted July 22 for erecting a school at Concordia Ave. and Fratney St. Chas. J. Poetsch, Comr. of Pub. Wks.

Buffalo, N. Y.—The Bd. of Aldermen on July 14 rejected all bids received for the ventilating and heating of Lafayette High School.

New York, N. Y.—Bids are wanted July 28 for installing ventilating and heating apparatus in Morris High School, Boro. of Bronx. C. B. J. Snyder, Supt. School Bldgs.

Dorchester, Mass.—It is stated that bids are wanted July 28 for erecting a primary school in Westville St. Address the Schoolhouse Comrs. of Boston.

Steubenville, O.—It is stated that bids are wanted July 24 for erecting a school. John Quinn, Pres. Bd. Educ.

Worcester, Mass.—Bids will be received by Chas. H. Peck, Supt. Pub. Bldgs., July 23, for a 6-room addition to the Upsala St. School, from plans of John P. Kingston, 418 Main St.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids will be received by John McGaw Woodbury, Comr. of St. Cleaning, 21 Park Row, until July 25 for the final disposition of garbage and rubbish and light refuse, in the Boro. of Bronx.

Brooklyn, N. Y.—Bids are wanted by John McG. Woodbury, Comr. of Street Cleaning, New York City, until July 28 for the final disposition of ashes, street sweepings and rubbish and light refuse in the Boro. of Brooklyn.

The Bd. of Estimate has granted Street Cleaning Comr. Woodbury $141,000 for the purchase of a new street cleaning plant in Brooklyn.

Hoboken, N. J.—Bids are wanted July 23 for the removal of ashes and garbage, rubbish, street sweepings, etc. John Haggerty, City Clk.

Los Angeles, Cal.—Bids are wanted July 28 for the collection and disposal of garbage during a period of 3 years; specifications provide that the party securing contract shall erect a crematory. C. H. Hance, City Clk.

East Orange, N. J.—Local press reports state that new bids are to be asked for the scavenger work.

Oakland, Cal.—In the annual report of the Bd. of Health, Sanitary Inspector S. F. Gimmel recommends the establishment of a crematory.

Dayton, O.—Crematory bonds to the amount of $75,000 have been sold by the Council.

Cohoes, N. Y.—It is reported that bids are wanted July 21 for the purchase of street sweepers.

Waterford, N. Y.—Bids are wanted July 21 for a 2-horse street sweeper. T. F. Bootman, Village Clk.

GOVERNMENT WORK.

Philadelphia, Pa.—Bids will be received on Aug. 2 by Mordecai T. Endicott, Ch. of Bureau Yards & Docks, Navy Dept., Washington, D. C., for constructing a brick and steel building at the Navy Yard, League Island, Pa.; appropriation, $57,500.

Boston, Mass.—Bids will be received by Mordecai T. Endicott, Ch. of Bureau Yards & Docks, Navy Dept., Washington, D. C., until July 26 for the construction of a concrete and steel conduit and laying a 16-in. water main at the Navy Yard, Boston; estimated cost, $34,000.

New Iberia, La.—The following bids were opened July 10 at the Treas. Dept., Washington, D. C., for the construction (including plumbing, heating apparatus, electric wiring and conduits) of the U. S. Post Office at New Iberia: C. C. Wenzel, Houston, Tex., $38,563; Congress Con. Co., Chicago, $28,937; M. Yeager & Son, Danville, Ill., $28,697; A. L. Skovy, Shreveport, La., $35,581; Phillips & Taylor, New Iberia, $36,650; Miles & Bradt, Atlanta, Ga., $24,860.

Denver, Colo.—Bids are wanted at the Treasury Dept., Washington, D. C., until Aug. 19, for the safety vaults, vault doors and work incidental thereto in the U. S. Mint, Denver, as advertised in The Engineering Record.

New York, N. Y.—Bids are wanted at the U. S. Engineer Office until Aug. 14 for dredging Harlem River, as advertised in The Engineering Record.

MISCELLANEOUS.

New York, N. Y.—Bids are wanted July 24 for improving the northern portion of the Botanical Garden, in Bronx Park; time for the completion of the work, 200 consecutive working days; amount of security required, $30,000. Wm. R. Willcox, Comr. of Parks.

Pittsburg, Pa.—Bids are wanted July 23 for the improvement of lower Bedford reservoir for recreation grounds. J. O. Brown, City Recorder.

Alexandria, Va.—The City Council has adopted an ordinance providing for the issue of $50,000 bonds for general improvements.

Sioux City, Ia.—The City Council will on Aug. 1 receive bids for changing the channel of Floyd River in Sioux City. Approximate estimate of excavation is 60,000 cu. yds.

McHenry, Ill.—Property owners have voted to construct a dam across Fox River at McHenry. Henry L. Hertz, Chmn. of Association, has the matter in charge.

The Carey Salt Co., Hutchinson, Kan., is building a 2-story cold-storage plant 80 ft. square, containing about 128,000 cu. ft.

The Hubu Elevator Co., Minneapolis, Minn., is erecting a 60x70-ft. working house 145 ft. high and of 170,000 bu. capacity, with a 300-H.-P. engine and a 145-ft. brick stack, the storage to be either tile or concrete tanks. The total capacity of the plant will be 1,000,000 bu.

The Franklin, Pa., Supply Co. will erect a new plant in the fall and install machinery for making gas and steam engines and oil well supplies.

The Studebaker Bros. Mfg. Co., South Bend, Ind., will build a power plant, for which Geo. M. Brill, Marquette Bldg., Chicago, is consulting engineer.

The Fournier-Searchmont Automobile Co., 1230 Orkney St., Philadelphia, Pa., will erect a large factory and place contracts for masonry work, roofs, power plant, electric installation, etc.

The Buffalo, N. Y., Pottery has broken ground for a 9-kiln pottery. A power house to contain six 150-H.-P. boilers and engines in proportion, will be erected. The contract has been let for two 150-H.-P. boilers and a 150-H.-P. engine.

New Orleans, La.—Maj. G. McC. Derby, Corps of Engrs., U. S. A., writes that the following bids were opened July 8 for enlarging levees in Pontchartrain Levee Dist.: Bidders—A, W. F. Barbour & Son, Albermarle, La.; B, Thompson & Powell, Waggaman, La.; C, Menzies & Co., New Orleans, La.; D, Batt O'Brien, Darrow, La.; E, G. D. Leeper, Delta, La.; F, Jas. R. Marlow, Union, La.; G, Geo. Y. Andrews, Baton Rouge, La.; H, Helgason Bros., Vicksburg, Miss.; I, M. L. Linnan, Cofield, La.; J, I. R. Bobbitt, Cofield, La.; K, Rich. T. Clark, Natchez, Miss.; L, H. F. Garbish, Vicksburg, Miss.

Bidders.	Virginia Levee, 863.5-L. B., 76,500 cu. yds.	Ophelia Levee, 865-L. B., 32,700 cu. yds.	Gem Levee, 881-L. B., 65,400 cu. yds.	Dicharry Levee, 882-L. B., 65,200 cu. yds.	81 Mile Pt. Levee, 883-L. B., 66,300 cu. yds.	Alta Villa Levee, 898-L. B., 66,700 cu. yds.	Rapidan Levee, 899-L. B., 66,600 cu. yds.	Uncle Sam Levee, 901-L. B., 63,500 cu. yds.	Convent Levee, 903-L. B., 63,000 cu. yds.	College Pt. Levee, 904-L. B., 34,500 cu. yds.	Belmont Levee, 908-L. B., 54,000 cu. yds.	Hester Levee, 909-L. B., 55,000 cu. yds.	Poché Levee, 911-L. B., 45,600 cu. yds.	St. Joseph Church Levee, 912-L. B., 45,400 cu. yds.	Golden Grove Levee, 914-L. B., 53,000 cu. yds.	Sport Levee, 915-L. B., 52,400 cu. yds.	Mt. Airey Levee, 916-L. B., 51,500 cu. yds.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
A	19.00	18.00	23.00	22.00	15.40	18.00	17½	14.00	16½	14.60	.....	19.00	14.00	15.00	14.40	16.00	18½
B	18½	18.00	30.00	30.00	16.25	15.00	15.00	14.99	15½	16.00	40.00	40.00	14½	14½	16½	16½	18½
C	.....	.....	15¼	15¼	15¼	*13.25	*13.25	.....	.....	.....	24.00	24.00	13.25	13.25	*13.25	*13.25	*13.25
D	.....	.....	.....	.....	13.73	14.98	14.73	15½	16.00	15.73	.....	.....	14.98	.....	.....	14.73	.....
E	*13⅞	*13⅞	17½	*13.49	*13.49	14.90	14.90	15½	15½	15½	19½	19½	15½	15½	16.00	16.00	.....
F	.....	.....	.....	.....	.....	14.87	15.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
G	20.00	20.00	18.00	18.00	18.00	18.00	18.00	18.00	16½	16½	.....	.....	.....	.....	.....	.....	.....
H	13.95	14.98	*15½	15½	13.95	14½	13.95	14.98	15.95	15.95	21½	20.45	16.00	17⅞	15.43	14.25	16.95
I	19.83	17.50	17.49	18½	15.49	14.75	14.75	14.75	18½	20.00	27.33	24.74	15.50	18.90	18.75	15.44	22.00
J	16.83	16.83	18.40	18.80	15.87	15.4	13.40	15.24	15⅞	.....	.....	.....	14.70	14.70	16⅞	14.89	19.20
K	16.40	15.75	16.90	16.40	14.99	13.40	13.40	13.75	16.90	16.90	20.40	18.40	13.40	14.99	13.90	13.90	16.40
L	15⅞	15⅞	17½	15.45	13⅞	13.90	13.90	14.00	14.00	14.00	25.00	18⅞	13.90	15.00	14.74	14.74	.....

Prices bid are per cubic yard. *Accepted bids.

Norfolk, Va.—Local press reports state that Col. P. C. Hains, Lieut. Col. Chas. J. Allen and Maj. J. B. Quinn, Corps of Engrs., U. S. A, have been appointed by Gen. Gillespie, Ch. of Engrs., to superintend the improvement of the waterway in Norfolk harbor.

Bremerton, Wash.—The following bids were opened July 12 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a coal storage and handling plant at the Navy Yard, Bremerton: *a*, for complete plant, cost not to exceed appropriation, $128,000; *b*, bid made contingent upon additional appropriation of $137,000 being made by Congress: J. J. Meany, Seattle, *a* $260,000, *b* $260,000; Cotton Bros., Oakland, *a* $128,000, *b* $265,000; Puget's Sound Bridge & Dredging Co., Seattle, *a* $128,000, *b* $265,000; Snare & Triest, New York, *a* $265,000, *b* $265,000; W. R. Nichols, Tacoma, *a* $264,800, *b* $264,900.

Cleveland, O.—Bids are wanted at the U. S. Engr. Office until Aug. 14 for improving Sandusky Harbor, O., by dredging, as advertised in The Engineering Record.

Chicago, Ill.—Bids will be received by Col. E. B. Atwood, Ch. Q. M., at the office of the Q. M., Chicago, until Aug. 12, for constructing a macadam road on Ft. Sheridan Military Reservation.

Philadelphia, Pa.—Plans for improving the channel of the Delaware River are reported to have been approved by the Engineer Dept. in Washington, and it is stated that bids will soon be asked by Capt. Spencer Crosby for work under the recent act of Congress, whereby $600,000 was placed at the command of the department for immediate use, and the engineers are empowered to enter into contracts for an additional sum amounting to $2,400,000 for the 30-ft. channel.

Memphis, Tenn.—Bids will be received Aug. 6 by Capt. E. E. Winslow, U. S. Engr. Office, 280 2d St., for constructing, repairing and enlarging levees in Lower St. Francis, White River, Upper Yazoo and Reelfoot levee districts, in all about 1,790,000 cu. yds.

Wheeling, W. Va.—The following bids were opened July 14 by Capt. W. E. Craighill, Corps of Engrs., U. S. A., for building 400 ft. of Chanoine dam, for navigable pass of Dam No. 5, Ohio River:

Items and Quantities.	Robt. A. Cummings, Pittsburg.	Aetna Const. Co., Wheeling.	Evansville Cont. Co., Pittsburg.
Timber:			
Hemlock, 172,937 ft. B. M.	$35.00	$45.00	$57.00
Oak, 15,377 ft. B. M.	70.00	70.00	90.00
Piling:			
Sheet, 40,800 lin. ft.	50.00	65.00	70.00
Round, 11,532 lin. ft.	.50	.50	.60
Filling:			
Stone, 1,427 cu. yds.	3.50	4.50	3.80
Common, 12,292 cu. yds.	.50	1.00	.75
Common excav., 12,157 cu. yds.	.50	.50	.55
Iron & steel, 255,314 lbs.	.04	.04½	.05
Wire rope, 6,450 lin. ft.	.07	.15	.25
Wire rope clips, 486 pieces.	.30	.30	.25
Iron pipe, 2-in., 480 lin. ft.	.35	.40	.50
Iron pipe, 3-in., 824 lin. ft.	.60	.60	.75
Iron pipe, 4-in., 412 lin. ft.	.80	1.00	1.00
Concrete, 6,840 cu. yds.	7.50	7.50	7.50
Total	$95,256	$107,069	$109,414

Pittsburg, Pa.—Separate bids will be received at the office of the City Controller, July 31, for the following work in Schenley Park: Construction of retaining wall between Panther Hollow Bridge and Hall of Botany, stone wall near the Conservatory and asphalt roadway between Panther Hollow Bridge and conservatories. Regrading and repairing of driveway leading to Greenfield Bridge, including necessary excavation and draining. Construction of retaining wall near Greenfield Bridge. J. O. Brown, City Recorder.

St. Bernard, La.—In his report to the Bd. of Comrs. for Lake Borgne Basin Levee Dist., State Engr. Sidney F. Lewis recommends the construction of a new levee in front of Scarsdale plantation, amounting to about 45,000 cu. yds. of earthwork.

Syracuse, N. Y.—City Engr. Frank C. Schnauber, in his report to the Council upon plans for improving Onondaga Creek, estimates the cost of said improvement, according to plan recommended by him, at $42,000, including $12,000, the cost of a new steel girder bridge at Onondaga St.

Monroe, La.—Bids will be received July 31 by W. T. Barham, Pres. Tensas Basin Levee Bd., Monroe, care Col. L. Potter, U. S. Engr. Office, Memphis, Tenn., for the enlargement of Fulton Lake Levee, Desha County, Arkansas.

Redding, Cal.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids are wanted Sept. 6 for furnishing and erecting a coal and ash conveying equipment for the Trumbull St. pumping station, as advertised in The Engineering Record.

Sunbury, Pa.—I. H. Dissinger, Clk. of Council, writes that bids will be received July 25 for river bank improvement, estimated to cost $30,000. Geo. F. Keefer, Engr. in Charge.

St. Louis, Mo.—Bids will be received by Isaac S. Taylor, Dir. Wks., Administration Bldg., World's Fair Site, until July 22 for the construction of a wooden conduit under waterways.

NEW INDUSTRIAL PLANTS.

A. D. Beatson, Tryon, N. C., is interested in the erection of a 2-story, 100x40-ft. knitting mill.

The Buffalo Cotton Mills, Union, S. C., are in the market for a 20-ton ice plant and a 20-ton cottonseed-oil mill. L. G. Young, Engr.

The Portsmouth, O., Cereal Co. has been organized, with a capital of $30,000, and will erect a 150x100-ft. mill with an elevator in connection with it. The plant will use about 3,000 bu. of corn daily.

The Ozark Cold Storage Co., Mountain Grove, Mo., is in the market for machinery for a 2-story, 100x137-ft. building for storing 20,000 bbls. of apples.

The Donovan Wire & Iron Works, Toledo, O., have bought a tract of land, on which they propose to erect new factory buildings.

The Truesdell Elevator Co., Minneapolis, Minn., has been incorporated, with a capital of $100,000, and will build elevators in Western Canada. Probably 12 of them will be built this year.

The Samson Iron Works, Stockton, Cal., will erect a $50,000 plant within a few months. The power plant will consist of several oil engines made by the company.

The Signa Chemical Co., Wiscoy, N. Y., will erect a 44x100-ft. factory building. An office building and power house, for which plans have not yet been drawn, will also be erected. About 1,300 H.-P. electric power will be developed.

Steinberger & Marriott, Rockwell City, Iowa, are erecting a brick plant to have a daily capacity of 30,000 brick.

The Westbrook, Minn., Milling Co. is erecting a 3-story and basement, 30x58-ft. mill, 16x30-ft. engine room, 18x30-ft. boiler room and a coal room 18-ft. square. A Corliss engine will be installed.

The Brookside Mills, Knoxville, Tenn., are ready to begin the extension of their plant to three times its present capacity. About 800 people are now employed. The company will also build 100 cottages. W. T. Lang, Supt.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
July 21.	Corp. cocks, Milwaukee, Wis.	July 19
July 22.	St. Ansgar, Ia.	July 19
July 22.	Bird Island, Minn.	July 19
July 23.	Crystal Falls, Mich. Adv., Eng. Record, July 19.	July 19
July 23.	Muskogee, Ind. Ter.	July 19
July 23.	Pipe, etc., Mannington, W. Va. Adv., Eng. Record, July 19.	July 19
July 23.	Mt. Gilead, O. Adv., Eng. Record, July 12.	July 12
July 24.	Milford, Ind.	July 19
July 24.	Pumping plant, Brooklyn, N. Y. Adv., Eng. Record, July 12, 19.	July 12
July 24.	Caldwell, Idaho	July 12
July 24.	Pipe, etc., Hammonton, N. J. Adv., Eng. Record, July 12, 19.	July 12
July 24.	Standpipe, Hammonton, N. J. Adv., Eng. Record, July 12, 19.	July 12
July 25.	Gibbon, Minn.	July 19
July 25.	Bolivar, N. Y.	July 19
July 25.	Boston, Mass. Adv., Eng. Record, July 12, 19.	uly 12
July 26.	Eden Valley, Minn.	July 19
July 26.	Reservoir, etc., Wellsburg, W. Va.	July 19
July 29.	Sand, Poughkeepsie, N. Y. Adv., Eng. Record, July 19.	July 19
Aug. 1.	Springdale, Ark.	July 19
Aug. 5.	Stand pipe, etc., Yardley, Pa.	July 19
Aug. 7.	Pump, Yonkers, N. Y. Adv., Eng. Record, July 19.	July 19
Aug. 7.	Pipe, etc., Yonkers, N. Y.	July 19
Aug. 12.	Pumping plant, etc., Wash., D. C. Adv., Eng. Record, July 19.	July 19
Aug. 13.	Engines, Chicago, Ill. Adv., Eng. Record, June 21, 28.	June 14
Aug. 14.	Well, Niles, O.	July 19
Aug. 15.	Monterey, Nuevo Leon, Mex. Adv., Eng. Record, July 12, 19.	June 21
Aug. 18.	Whatcom, Wash.	July 19
Sept. 5.	Engine and boiler, Milwaukee, Wis.	July 19

SEWERAGE AND SEWAGE DISPOSAL.

July 21.	Depew, N. Y.	July 19
July 21.	Rhinebeck, N. Y.	July 19
July 21.	Chester, Pa.	July 19
July 21.	Albany, N. Y.	July 19
July 21.	Syracuse, N. Y.	July 19
July 21.	Watertown, N. Y.	July 19
July 21.	New Brighton, Pa.	July 19
July 22.	Menasha, Wis.	July 19

July 22. Saratoga Springs, N. Y. ..... July 19
July 22. Cleveland, O. ..... July 12
July 22. Columbia, Mo. ..... July 12
July 22. White Plains, N. Y. ..... July 12
July 22. Binghamton, N. Y. ..... July 5
July 22. Des Moines, Ia. ..... July 5
July 23. Philadelphia, Pa. ..... July 19
July 23. Pittsburg, Pa. ..... July 19
July 23. Keokuk, Ia. ..... July 19
July 23. Cincinnati, O. ..... July 19
July 23. Watervliet, N. Y. ..... July 19
July 23. Muskogee, Ind. Ter. ..... July 19
July 23. Parkersburg, W. Va. ..... July 19
July 23. Lockhart, Tex. ..... July 12
July 23. Des Moines, Ia. ..... July 12
July 24. Chicago, Ill. ..... July 19
July 24. Des Moines, Ia. ..... July 12
July 24. Long Island City, L. I., N. Y. ..... July 12
July 25. Richmond, N. Y. ..... July 19
July 25. Monticello, Ind. ..... July 12
July 26. Zanesville, O. ..... July 19
July 26. De Pere, Wis. ..... July 12
July 26. Grafton, N. D. ..... July 12
July 28. Wapakoneta, O. ..... July 19
July 28. Muncie, Ind. ..... July 19
July 28. Durand, Mich. ..... July 19
July 28. Toledo, O. ..... July 19
July 29. Cleveland, O. ..... July 19
July 31. Williamsport, Pa. ..... June 28
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Aug. 1. West Point, N. Y. ..... July 19
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PROPOSALS.

Proposals for Furnishing Sand.

Office of the Board of Public Works.
POUGHKEEPSIE, N. Y., July 15, 1902.

Sealed proposals will be received at this office until 8 o'clock P. M., Tuesday, July 29, 1902, for furnishing about 2,000 cubic yards of sand for filter beds. Specifications can be obtained on application to the undersigned. The right is reserved to reject any or all proposals.

CHAS. E. FOWLER,
Superintendent of Public Works.

Sewers.

PITTSBURG, KANSAS.

Sealed bids will be received until 5 o'clock P. M., August 2, 1902, by the City Clerk of the City of Pittsburg, Kan., for furnishing all material and performing all labor necessary to construct 12,966½ ft. of 18-in. Sewer and 3,750½ ft. of 15-in. Sewer.

All bids must be made upon the forms prescribed by the City, and be accompanied by a certified check upon a local Bank of the City in the sum of $250, payable to the Treasurer of the City of Pittsburg, to be forfeited in event the bidder fails to enter into contracts with good and sufficient bonds to construct said sewers according to the plans and specifications within ten days of notice of award.

The City reserves the right to reject any and all bids.

A. A. BUMGARNER,
City Clerk.

Water-Works.

MANNINGTON, W. VA.

Bids will be received until 9 o'clock P. M., July 23, 1902, for the following:

1,900 ft., 10-in. cast-iron pipe;
100 " 6-in. " "
1,500 " 8-in. " "
400 " 4-in. " "
4 10-in. cast-iron gates;
4 8-in. cast-iron gates;
6 6-in. stand. fire hydrants, buried 4 ft.;
Roadway boxes for gates, cast-iron;
Fittings and specials for above pipe.

Bids will be for doing the labor alone; and for doing the labor and furnishing the pipe; and furnishing pipe, etc.; alone.

A certified check for 5 per cent. of contract is required to accompany bid.

The Water Committee reserves the right to reject any or all bids.

B. E. MITCHELL,
Chairman Water Committee.

Storm Sewer.

PLAINFIELD, N. J.

Sealed proposals for doing the work and furnishing certain of the materials for the construction of a Storm Sewer in Arlington Ave., will be received by the Common Council of the City of Plainfield, on Monday, Aug. 4, 1902, at 8 P. M., at the Council Chamber.

Each proposal must be accompanied by a certified check for $300, payable to the Treasurer of the City of Plainfield.

The Engineer's approximate estimate of the quantities of materials required, and the work to be done is as follows:

600 ft. 30-in. sewer;
2,320 ft. 24-in. sewer;
560 ft. 12-in. basin and inlet connections;

Above to include trenching, laying and cementing sewer, and backfilling; pipe to be furnished and delivered on the ground by the city:

3 manholes;
18 branches on 24-in. sewer;
4 catchbasins;
20 inlets;
40 cu. yds. concrete.

Copies of plans, forms of proposal, specifications, contract and bond, may be examined at the office of the Engineer, 149 North Ave., Plainfield, N. J.

The right to reject any or all bids is expressly reserved by the Common Council.

All proposals should be endorsed "Proposals for Sewers."

JAMES T. MACMURRAY,
City Clerk.

ANDREW J. GAVETT,
Engineer-in-Charge.

U. S. ENGINEER OFFICE, 1637 INDIANA AVE., Chicago, Ill., June 28, 1902.—Sealed proposals for constructing foundations for five locks and one aqueduct bridge, the walls for eight locks, and the piers and abutments for five aqueduct bridges and one highway bridge, will be received here until noon, July 28, 1902, and then publicly opened. Information on application here or to Assistant Engineer L. L. WHEELER, Sterling, Ill. J. H. WILLARD, Maj., Engrs.

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THE ENGINEERING RECORD.

Volume XLVI., Number 4.

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Specialization in Engineering Education.

There is probably no question on which there is a greater variety or a greater number of opinions among practicing engineers, and possibly among engineering educators themselves, than in connection with the subject matter and methods in the professional engineering schools. Masses of papers and addresses and discussions of them have been published within the last ten or a dozen years bearing directly upon practically all features of engineering education, and yet there is probably not one of those features on which opinion is unanimous or anywhere near so. This is mainly due, obviously, to the rapid progress which has been made in all branches of engineering during that period. Indeed, so rapid has been the development and expansion of engineering specialties, and so urgent has been the demand for educated young men to take positions in those specialties that many engineering educators have endeavored to meet the requirements of the situation by extraordinarily specialized lines of engineering education. This specialization of educational training has led to courses in mechanical engineering, electrical engineering, hydraulic engineering, railroad engineering, and in almost numberless other "engineerings" characterized by great intensity of work along the special lines which they represent, which is another way of saying that these developments of educational training are more or less narrow in scope, and in some cases very narrow. These restricted courses of engineering study have, in some cases at least, been confined between such narrow limits as to detract most seriously from their professional value. Many engineering educators throughout the country have frequently publicly expressed their regrets at this extreme specialization, and have not hesitated to state in papers and discussions that it was likely to trench most injuriously not only upon the broad, educational value of the courses of study, but also upon the ultimate professional efficiency and standing of the young men so narrowly educated. While some practicing engineers have from time to time taken the same general view of the subject, it is only lately that this particular phase of engineering education has attracted much attention from the profession in general. It is markedly significant that some of the strongest expressions regarding these mooted questions have emanated from that portion of the broad field of civil engineering which is devoted to what is probably the most specialized work of the engineer, both in practice and in the professional schools, i. e., electrical engineering.

At the recent annual meeting of the American Institute of Electrical Engineers, the president, Mr. C. P. Steinmetz, made an address bristling with pointed references to this matter, which amounted in essence, if not in form, to emphatic disapproval of too much specialization. Among other things he states: "If, of the amount of material in electrical engineering as well as other branches which the educational institution of to-day attempts to teach, one-half or more would be dropped altogether, but the rest taught so as to be fully understood, with special reference to general principles and methods, the product of the institution would be far superior and more successful in practical life." Again: "Design of engineering apparatus is of very secondary utility and rather objectionable, with the exception, perhaps, of some very simple apparatus." Finally he states that the professional school should "give the student all the ground work required to be successful in future practice, but not the impossible aim of giving him a complete education as practical engineer." These quotations from Mr. Steinmetz's address go straight to the very pith and substance of the whole question of professional education. The function of the professional school, as he states, is not to attempt to make a finished practitioner, but to ground the young man especially in general principles of that which is too often disapprovingly called the theoretical work of the engineer, but in such a way as consistently to show its intimate relation to practical matters and how it is to be applied in the practical work of the engineer.

A number of other speakers at the same annual meeting criticized in an outspoken manner the dangers of too much specialization in the particular field of electrical engineering. Prof. Esty, of the University of Illinois, laid down the following general proposition: "Teach thoroughly those things which are fundamental; devote little time to highly specialized subjects; introduce the student to those branches of knowledge which in his later life he can acquire, if at all, only with increasing difficulty."

But one more quotation will be offered, although a considerable number of others might be made, and that from the address of Mr. H. W. Buck, electrical engineer of the Niagara Falls Power Company. He asserted "that many instances may be cited of men who have been prominent as electrical engineers who have been dropped out of place in the course of the rapid progress which has been made on account of lack of a theoretical foundation in their knowledge."

These are observations of unusual significance from the special field of electrical engineering; but views quite as strong upon the same general subject are held in other quarters, as illustrated by many papers which have appeared in the "Proceedings" of the Society for the Promotion of Engineering Education, one of the last of which is by Prof. Edgar Marburg, presented at the recent meeting in Pittsburg. His observations are quite pointed against too much specialization in civil engineering, and they are undoubtedly justified by the present tendency in many quarters.

It is a most serious question whether educators in engineering having charge of the professional courses in engineering study throughout the country should not carefully reflect upon these evidences of disapproval of too much specialization, both from the fields of practice and of education, and consider whether the intense specialization now being carried on among educators is not working damage both to the broad educational value of these specialized courses of study and to the future engineering work of the young men taking them. This specialization of professional study is not found in the law or medical schools of the country, although there is quite as much intensity of specialization in actual practice in both of those fields. Their courses of study, however, are much more wisely administered in this respect in that every student in law and medicine is obliged to pursue a broad and comprehensive professional course of educational training, giving him a familiarity with and a control of all the general principles underlying the practice of his profession in all of its specialties. The result is a course of study in the highest degree valuable, as such, endowing him with the best possible foundation for any special field of professional practice which he may subsequently desire to follow. The broadly educated specialist, other things being equal, is by far the best specialist; he attains that end both in consequence of a better knowledge of his own special field and of those lines of work affiliated with it; his grasp of general principles enables him to accomplish far more and to do it better than the narrowly educated man, and it will be but a short period after the beginning of his practice before he will outstrip him in every line of special work. While this is true of the specialist, it applies with greatly enhanced force to those engineers who fill administrative or executive positions requiring thorough knowledge of the fundamental principles of a number of affiliated specialties. Indeed, whether the specialist, the general practitioner or the executive engineer be considered, the broad, thorough course of educational training will qualify him for the greatest measure of success.

The Brooklyn-Manhattan Rapid Transit Railroad briefly described in this journal a fortnight ago will be built by the McDonald-Belmont syndicate. On Thursday the contract for the work was awarded to it by the Board of Rapid Transit Commissioners for $2,000,000, exclusive of $1,000,000 allowed for terminals by the Board, the only other bid received being one of $7,000,000 from a representative of the Brooklyn Rapid Transit Company. Mr. McDonald and his associates in the New York Rapid Transit Railroad contract have thus undertaken to construct for about a quarter or a fifth of its cost an underground and subaqueous route connecting the New York system with the heart of Brooklyn and with one of the terminals of the Long Island Railroad. They have also secured control of the underground route from the Post Office in Manhattan to the Battery, and they have acquired the rights to a route in Brooklyn which brings them into touch with a fairly comprehensive system of surface cars not controlled by the Brooklyn Rapid Transit Company. A few months ago they secured the control of a moribund corporation authorized to tunnel under the East River, and have resuscitated its dry bones into a skeleton of pretty sturdy appearance. They also have a scheme for extending their Bronx lines north to Port Chester, and they have offered to build for $1,100,000, less than half its cost, a subway under Broadway from Forty-second Street to Union Square.

Power Plant of the Berkshire Street Railway Co., Pittsfield, Mass.

The Berkshire Street Railway Company has now about completed near Pittsfield, Mass., an interesting power plant for the operation of its railway, a new electric trolley line extending from Cheshire to Great Barrington, a total distance of about 40 miles. The alternating-current method of power distribution, at 13,300 volts, will be used, distributing to three sub-stations, in all of which there will be rotary converters for supplying direct-current to the trolley wires. Two 750-kilowatt units are at present installed in the power station, direct connected to cross-compound condensing engines. Vertical twin jet condensers are employed, and for warming the constant indraft of feed water, and utilizing the heat in the exhaust steam, primary heaters are located in the main engine exhaust pipes and an auxiliary heater is arranged to receive the exhaust from all auxiliary machinery. The live-steam, exhaust and water piping is quite complete.

The station is a brick structure, built with the engine and boiler rooms side by side, the former 62x107 feet in plan and the latter 42x95 feet. It is located alongside the main line of the Boston & Albany Railroad, from which it has a siding for the delivery of coal, and is near a small stream from which it obtains both feed and condensing water. The engine room is 8 feet 8 inches above the floor of the boiler room and underneath the engine room is a basement, the floor of which is 12 feet below that of the engine room. Alongside the division wall it is depressed, to form a condenser pit, 5 feet 4 inches below the boiler room floor. In this are located the condensers and steam and water piping, including the primary heaters, leaving the engine room unobstructed in this respect. The auxiliary feed-water heater, together with the feed and circulating pumps, are in the boiler room, under ready control of the firemen.

The boiler equipment consists of four water-tube boilers built by the Aultman-Taylor Machinery Company, of Mansfield, O., set in two batteries, with space remaining for a third battery. The power house is situated considerably below the steam railroad tracks, and the coal is dumped from the railroad cars against the boiler house wall. The coal is taken through a door over a platform scale and carried to the firing places in 2,000-pound side-dumping cars, made by the Hosher Platt Company. The products of combustion are carried from the boiler into a brick chimney rising outside of and independent of the station building. This was erected by the Alphons Custodis Chimney Construction Company with its radial brick, and is 175 feet high and 8 feet in diameter at the top. Each boiler contains about 3,930 square feet of heating surface arranged in 4-inch tubes, in 16 sections, each 12 tubes high, and has 68 square feet of grate surface. Each boiler has two steam drums 42 inches in diameter and 20 feet 2 inches long. A steam pressure of 150 pounds is carried, and each boiler is rated to evaporate 11,800 pounds of water per hour.

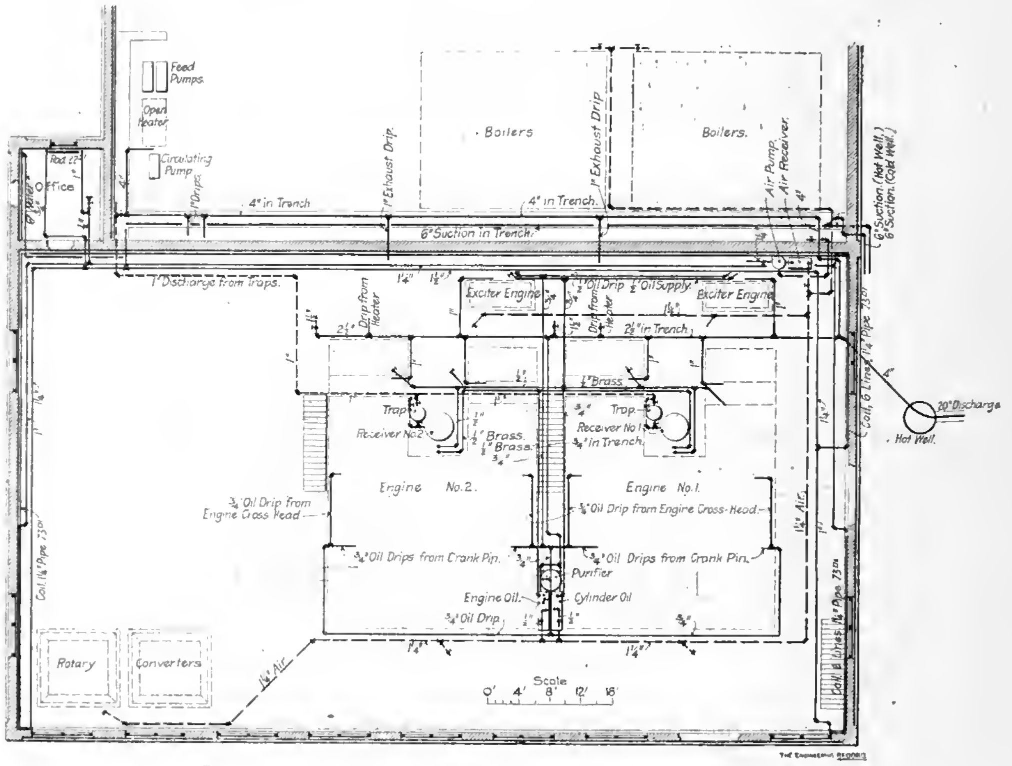
There are two steam mains or headers, one for the main units and the other for all the auxiliary machinery. For the supply of the main header each boiler is provided with an 8-inch connection starting from an automatic stop and check valve on the cross pipe connecting the two drums and bending horizontally, and then vertically downward to the header, where there is a gate valve about 8 feet above the floor level, controlling the boiler supply pipe. The header itself is about 6 feet above the floor, and connections from it to the engines are taken horizontally immediately below the basement ceiling. The header is 14 inches in diameter and each half may be operated independently. All the steam piping is extra strong, with Chapman valves and Crane fittings, the flange dimensions conforming to the schedule of extra heavy flanges, which were put into effect on January 1 of this year, according to agreement by many leading pipe manufacturers, as printed in The Engineering Record of October 12, 1901. Two thicknesses of thin Jenkins packing with corrugated copper between were used.

Each engine is supplied also by an 8-inch pipe, carried horizontally, as stated, from the main header, and has a Cochrane separator just before the steam is taken upward to the engine cylinder. As indicated in the accompanying drawings, the live steam can be fed, if necessary, to both cylinders of the engine, and, of course, to either of them, but in the branch leading to the low-pressure cylinder a Kieley reducing valve has been introduced, by means of which the mean effective pressure on the large piston of the low-pressure cylinder can be regulated throughout a considerable range. For the disposition of drips from the separators and condensation from the headers, an interesting adaptation of the Holly system of returning water to the boilers without pumping has been installed under the supervision of Westinghouse, Church, Kerr & Company. The drip lines are led in the usual way to a header, which is located in the condenser pit against the division wall, low enough to receive the water by gravity, and the water is drawn from the Holly header by a forcing tee which has a direct connection with the main steam header. A $1\frac{1}{2}$-inch riser carries the steam and entrained water to the condenser of the system, which is located on the roof of the boiler house, 37 feet above the boiler room floor. In addition to the condensation of steam taking place in this condenser by reason of its exposed position, a pipe fitted with a relief valve leads from the top of it to the auxiliary feed-water heater. A 3-inch return pipe carries the water to a 2-inch header extending across the front of the boilers for the return to the boilers of the water of condensation from the high-pressure steam lines.

The exhaust piping, as well as the live-steam piping, represents good modern practice, as already stated. The high-pressure cylinder exhausts into a receiver, or when the low-pressure cylinder is out of commission, into the main exhaust header. This header is 16 inches in diameter and toward each end feeds through a primary feed-water heater. It is arranged with valves so that, if necessary, the exhaust into one end can pass through the exhaust outlets corresponding to the other unit. The heaters, which are 1,000 horse-power Goubert horizontal feed-water heaters, having 333 square feet of heating surface each, are provided with the usual by-pass. Immediately beyond the heaters, the steam reaches the condensers, at which point is the relief valve allowing for the escape of steam when the condenser is not in operation. The condensers consist of vertical twin pumps and a jet condenser built by the Warren Steam Pump Company, of Warren, Mass. The pumps have twelve-inch steam cylinders, 30-inch water plunger and 18-inch stroke.

The generating units consist of Westinghouse alternators and Rice & Sargent engines built by the Providence Engineering Works, of Providence. The engines have 22 and 44-inch cylinders and 48-inch stroke and are operated at 94 revolutions per minute. The alternators are of the revolving field three-phase type and have a full load rating of 32.6 amperes per phase at 13,300 volts and 25 cycles per second. The generators are separately excited and for that purpose there are two 20-kilowatt 125-volt direct-connected Westinghouse units, employing $7\frac{1}{2}$x7-inch double-cylinder vertical Westinghouse steam engines. For the supply of the neighboring sections of the railroad, rotary converters are installed in one corner of the engine room, and for the distant sub-stations the current is transmitted directly from the alternators at 13,300 volts, being stepped down by banks of static transformers in the sub-stations to 380 volts alternating and converted by rotary converters to direct current at 660 volts.

For the supply of the exciter units and the various steam pumps, an auxiliary header has been provided, as mentioned. The steam connection from each boiler for this system is taken at the point where the safety valve is fitted, and the connections from each pair of

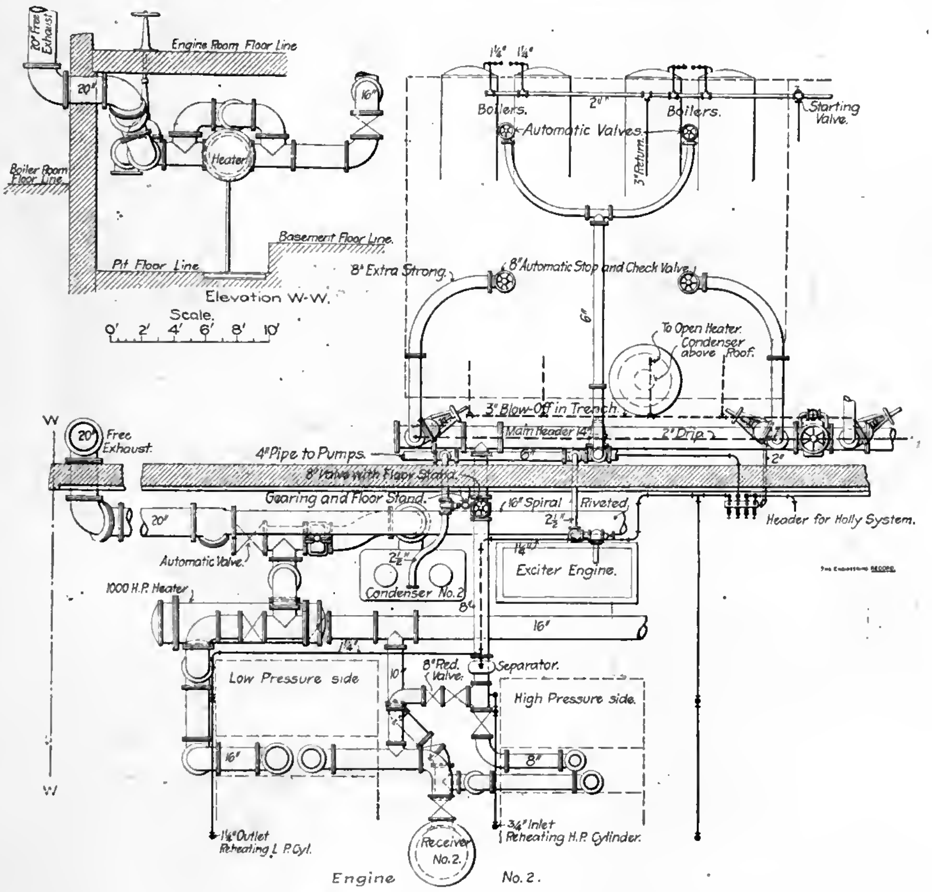


PLAN OF THE STATION, SHOWING DRIP, AIR AND OIL PIPING.

boilers is united and passes 6 inches in size to the header. The header is located just below the main header against the division wall. The connection from each boiler is fitted with an automatic valve at the boiler, and each battery is controlled by a gate valve immediately above the header. The branches to the various auxiliaries are taken from the top and no separators are used.

The supply of water for the plant is taken from the Housatonic River in the bed of which a stone well was sunk about 10 feet below bottom. Each condenser is provided with an independent suction pipe from this, of cast iron, 10 inches in diameter, and there is a 6-inch suction leading to the boiler-feed pumps in the boiler room. The latter is joined by a 6-inch pipe from a hot well, which is just outside the building, receiving the discharge from the condensers, each condenser having a 16-inch discharge, which has thus an area about 2.5 times that of the corresponding injection pipe, and the two discharge pipes uniting in one 20 inches in diameter. Near the pumps in the boiler room ceivers being provided with a trap for the purpose. The auxiliary exhaust is cross-connected with the main exhaust in the boiler room, with a valve in the cross-connection, so that when desired the main exhaust riser can be used to carry off the exhaust from the auxiliary plant or the exhaust from the main engines may be utilized in part in the auxiliary or secondary heater. The boiler-feed pumps can be controlled by means of an automatic valve inserted in a live-steam supply to them, the valve being actuated by the level of water in the heater.

Among the accessories of the plant is a system of compressed air pipes with five outlets distributed about the engine room, arranged for ¾-inch hose connections for cleaning purposes. The air is furnished at 70 pounds pressure by a Westinghouse compressor connected with a receiver. A system of lubricating oil pipes has also been installed, including an oil purifier, oil reservoirs, etc. The oil is distributed by air pressure furnished by the air pump above mentioned, the oil tanks being placed in the engine room basement. The en-



STEAM CONNECTIONS TO ENGINE NO. 2.

a 4-inch line carrying Pittsfield city water is connected into the 6-inch suction, so that the plant may receive water from both the hot and cold wells and the city mains. Ordinarily a 6x6x6-inch Warren duplex pump takes the water, discharges it in a 4-inch wrought-iron line to the primary heaters, and from them in a brass pipe, to the auxiliary feed-water heater, which is a 2,000 horse-power Cochrane combination open feed-water heater and purifier. From this the water is taken by either of two 10x6x12-inch Warren pumps, installed in duplicate, which feed to the boilers. The small or low-pressure pump can also discharge directly into the Cochrane heater and the boiler-feed pumps can also receive the water from the hot and cold wells and pump either directly into the boilers or through the primary heaters, and thence into the boilers. The open heater receives the steam from the exciter units and the steam pumps, and also the condensation from the heating system for the building and the drips from the engine receivers, each of the re-

gine room is spanned by a 15-ton hand-power traveling girder crane.

The plant was designed by Mr. Charles K. Stearns, of Boston, Mass., and the building was erected by Messrs. Dodge & Devanney, of Pittsfield.

The Hydraulic Dredge, "J. Israel Tarte," built last year for the Canadian Department of Public Works by the Polson Iron Works from the designs of Mr. A. W. Robinson, has been at work long enough to demonstrate its success. It has a steel hull 160 feet long, 42 feet wide and 12½ feet deep, and has a power plant of 1,500 horse-power. It was designed to excavate a channel through the blue clay deposits in the St. Lawrence between Montreal and Quebec, and can dredge to a depth of 50 feet, if necessary. The clay is broken up by a patented cutter, which feeds it into the suction pipe, the main pumps being used solely to transport the dredged material, for which purpose there is a 36-inch floating discharge pipe 2,000 feet long.

The "Rust Stains" From Water Containing Crenothrix.

The precipitation of iron from water has been for some time the cause of serious trouble in numerous cities which have taken their supplies from filtered or ground sources. This precipitation has usually been accompanied by a heavy growth in the water of the giant bacterium known as Crenothrix. Such was the case in 1878, when the Tegel water supply of Berlin became seriously contaminated by the precipitation of flocculent iron, and the wells sunk near Tegel Lake had to be abandoned as a source of supply. A similar precipitation of iron brought about the abandonment in 1887 of a set of sand filters which derived their water from the river Maas, at Rotterdam. During the last ten years this iron bacterium has caused serious trouble in numerous cities both in America and in Europe, and much expense has been involved in the replacing or treatment of the supplies affected. Immediate practical value is accordingly attached to a paper by Mr. Daniel D. Jackson on the precipitation of iron, manganese and aluminum by bacterial action, recently printed in the "Journal" of the Society of Chemical Industry, of which an abstract follows:

Crenothrix occurs chiefly in ground waters, and only grows with rapidity when the dissolved oxygen is lacking or nearly so, and when the special salts which it precipitates are present. The presence of much organic matter, the absence of light, and the presence of carbonic acid in the water are also usual conditions, and seem to favor the growth of the organism.

In many places this growth has occurred in driven-well tubes, and has either stopped up the tubes or has been carried on to clog the screens. If allowed to go through the well screens, it has made the waters disagreeable in appearance, and unfit for domestic use or for industrial purposes. It grows rapidly in the bottoms and sides of filter galleries and dug wells and in the dead ends of pipes where the oxygen dissolved in the water has been exhausted. Growth may also take place in the bottoms of ponds which have become stagnant.

Partially filtered surface waters are more subject to growths of Crenothrix than other waters, and the various ground waters follow next. The Crenothrix found in brooks and rivers usually comes originally from other sources, and is not natural to the streams themselves. Surface waters are comparatively free from the organism because the conditions for growth are not often found in such waters. The presence of Crenothrix in filtered water means improper conditions for filtration, leading to a reduction of the dissolved oxygen and causing conditions which would favor the reduction and solution of the metallic elements in the soil.

The growth of Crenothrix, wherever it occurs in water, causes a disagreeable turbidity which may be yellowish white, yellow, red, brown, or black. It may be stringy in appearance, but usually occurs in flocculent masses, which in time settle to the bottom of the bottle in which the water has been collected. Under the microscope these masses are shown to consist largely of an organic growth composed of long strings of bacteria inclosed in a gelatinous sheath, in which is imbedded the precipitated metallic hydrate.

There are three species of the genus Crenothrix. The common species, Crenothrix kühniana, precipitates iron hydrate, and is consequently red or reddish brown in appearance. The second is less common and less widely known among botanists and bacteriologists.

It was formerly known as Leptothrix ochracea, but is now more properly called Crenothrix ochracea. This species precipitates aluminum hydrate, and is yellow to yellowish white in appearance. Its usual color is that of ochre, as it nearly always precipitates some iron with the aluminum. The third species, Crenothrix manganifera, is rare in occurrence and has been found as yet in but two places, the Neponset River and the filter galleries which supply the city of Newton, Mass. It precipitates manganese hydrate, and is dark brown or black in appearance.

There are several points of interest chemically in the analyses of the materials precipitated by these three species. The analyses show that about one-third of the entire dried precipitate consists of the special oxide which the species throws down in the form of hydrate; another third or more consists of organic matter and is chiefly that which is the living portion of the organism; while the remainder, which may be merely accidental and not a true constituent, is largely silica and aluminum silicate.

Analyses of waters which contain Crenothrix show that they contain salts which especially favor the growth of the particular species which they propagate. For example, waters which produce Crenothrix kühniana contain a predominating amount of iron, while aluminum and manganese are the predominating metals in water containing the ochracea and manganifera species respectively.

The theoretical conclusions to be drawn from a study of this subject are:

(1) Each of the three species seems to use a selective power in precipitating the special oxide ascribed to it, and about one-third of its dry weight is composed of the oxide selected, whether it be of iron, manganese or aluminum.

(2) Crenothrix kühniana is very common, because iron in quantity is a common constituent of water; Crenothrix ochracea is rather uncommon, because aluminum sulphate or aluminum combined with carbonic acid and organic matter is uncommon in water; Crenothrix manganifera is very rare because manganese seldom occurs in sufficient quantity in water to produce any very noticeable growth of the organism.

(3) The growth of all three species is due to the lack of oxygen, with a consequent reducing action in the soil or water. This reducing action may be produced by stagnation in the bottoms of ponds or by improper or too rapid filtration in wells or filter galleries, thus causing the solution of iron, manganese or aluminum from the soil. These, combined with organic matter, seem to furnish the food material for the organisms, while the oxides of iron, manganese or aluminum which are precipitated in their gelatinous sheaths are the dross of the operation.

As practical suggestions leading to the prevention of the growth of the organism the following are offered:

(1) Keep the water of wells and filter galleries as thoroughly aerated as possible, and blow off the dead ends of pipes frequently when there is danger of the loss of dissolved oxygen. The Crenothrix in the latter case takes its iron from the pipes themselves.

(2) Avoid driving wells through large deposits of peaty matter.

(3) Avoid driving wells or filter galleries too close to the shores of ponds or streams having large deposits of organic matter on their banks.

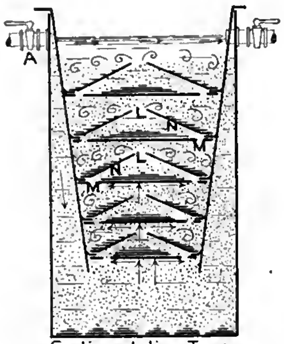
(4) Avoid pumping too heavily from any wells or filter galleries, as the conditions are often thus produced which are favorable to disastrous growths of Crenothrix.

Scrubbers for Preparing Water for Filtration.

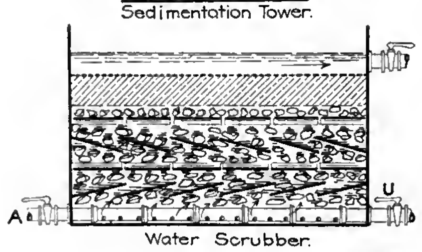
Abstract of a paper presented to the American Water-Works Association by Mr. P. A. Maignen, Assoc. Am. Soc. C. E.

More than twenty years ago the writer became convinced that however well plain sand filters might work at slow rates with a comparatively clear influent, they were unsuccessful when the applied water was dirty or the rate was high. His first plan was to protect the sand against mud by an artificial membrane serving as a substitute for the "schmutzdecke" of a natural filter, and this was found to be satisfactory except when the applied water was very roily. Settling ponds were considered undesirable on account of the growth of algae and fish in them, and decantation in long, narrow channels would not intercept the fine suspended matter. Recourse was therefore had to experience gained in removing the fine suspended carbonate of lime from water which had received a softening treatment.

The first principle which such experience establishes is that in decantation the shallower the stratum of water the more effective the work. The second principle is that the alternate expansion and contraction of the water-way will cause settling of solid matter. This is occasionally seen on a large scale below the piers of a bridge, where the material in suspension in the water in the narrowed channel at the piers is deposited lower down stream as sandbars when the velocity is checked in the more open channel. The third principle is that some other means than decantation must be employed to eliminate the lightest particles from water. This is shown in the separation of ores by washing them down a channel crossed by depressions or troughs varying in cross section, the smallest being at the top of the channel. In such an apparatus the material is sorted into several sizes, the largest pieces in the smallest trough, but there are nevertheless particles too light to be precipitated and these float away.



Sedimentation Tower.



Water Scrubber.

The Engineering Record.

The application of these principles requires an apparatus different from the common idea of a decanting tank. The latter has usually a series of vertical or inclined baffle plates and the water passes alternately below and above them. In this arrangement there may be a few small nooks where a little sediment can settle, but as the velocity of the water is practically the same throughout its passage there is no reason why more sedimentation should occur in one place than another.

In the sedimentation tower devised by the writer the principles outlined above have been applied so as to avoid the defects of the usual type of construction. The water enters at A, in the diagram, descends as shown by the arrows, and then rises through a nest of cones. The bottom of each cone has ¾-inch holes arranged around its periphery and an opening of 2 or 3 inches in the apex. The bottom and conical plates have a rubber gasket at their joint. The water strikes the horizontal base of the cone, travels sideways to the holes M, follows the inclined surface NL and then emerges from the hole in the apex.

A modification of this same idea is employed in the scrubber for the preparation of water for filtration and in general to separate matters in suspension from the liquids in which they are held. Instead of the expensive metal cone, only applicable to small apparatus, plates or slates are arranged as shown in the diagram and the intervening space filled with broken stone, slag or coke, not less than 1½ inches in size. The water entering at A rises through these obstacles, which cause it to flow in various directions, sometimes throttling it and at other times allowing room for eddies and sedimentation. There also seems to be some sort of attraction exerted by the large particles on those of smaller size. When the accumulation of sediment is sufficient to interfere with the working of the scrubber, the valve U is opened and the deposits flushed out. The very light particles which would either choke a sand filter or go through it are intercepted by an elastic layer of sponge, peat or excelsior on the top of the scrubber.

Some of the results attained with these scrubbers are shown by the following figures:

Scrubber A was operated from September 5 to November 16, 1901, at an average rate of 63,000,000 gallons per acre daily, during which time the (silica) turbidity was reduced from 15.4 to 2.8, or 78.3 per cent., and the bacteria from 3,088 to 175, or 98 per cent. More detailed figures of other runs are given in the accompanying table.

Results Obtained with Scrubber A in 1901.

From	April 25	June 6	Aug. 8
To	June 5	Aug. 8	Aug. 28
No. of days	41	63	20
Rate; mil. gals.	57	66	64
Turbidity, before	31	18	16
" after	10	4	6
" removal, per cent.	68	78	63
Bacteria, before	3,700	1,800	2,000
" after	400	180	180
" removal, per cent.	89	90	91

Scrubber B, during a run from September 13 to November 16 at an average rate of 64,600,000 gallons, reduced the turbidity from 13 to 1.09, 93 per cent., and the bacteria from 3,117 to 131, 95 per cent.

Scrubber D was operated for a time at the rate of 123,000,000 gallons, and at this high rate the turbidity was reduced on an average from 18.4 to 2.9, 84 per cent., and the bacteria from 2,042 to 181, 91.1 per cent.

An examination of the results with these scrubbers, all working with a loss of head not exceeding 2 feet, shows a constantly high removal of the bacteria owing to some function of the apparatus not yet clearly understood. It may be biological or physical or both; all that can be done now is to call attention to the fact and leave its explanation to be determined by further investigation.

An Aerial Tramway 4,200 feet long and having a difference in elevation of 2,100 feet between terminals has been built at Deep Gulch, Colo., for the American Gold Mining Company by the A. Leschen & Sons Rope Company. There are two supporting cables, one of 1⅛ inches diameter for the loaded buckets to come down on, and the other of 1-inch for the empties; the endless hauling rope is ¾-inch. The tramway carries both men, supplies and ore.

Self-Purification in the Sudbury River.

Abstract of a paper by A. G. Woodman, C. E. A. Winslow and Paul Hansen in the "Technology Quarterly" for June.

The Sudbury River, in the eastern part of Massachusetts, furnishes, in some respects, a particularly favorable opportunity for the study of self-purification. Of its total watershed of 164 square miles, the upper portion, including 94 square miles of steep and hilly country, is used as the source of part of the water supply for the Metropolitan District of Boston. The Legislative Act under which this water privilege was granted provided that 1,500,000 gallons of water per day should be allowed to flow past the lowest point at which water was taken by the city; and in dry weather the flow of the river immediately below scarcely exceeds this amount. From the reservoir of the Metropolitan Water-works to the village of Saxonville, the stream is practically unpolluted, except at times of very heavy rain. At Saxonville it is dammed to furnish power for the Saxonville Mills, and from the mill grounds it flows off, heavily charged with manufacturing wastes. Measurements of these waste liquors, made by the Massachusetts State Board of Health in 1900 and 1901, showed their amount to be 30,000 gallons per day, and this may now have increased somewhat on account of enlargements in the mills. The wastes, when studied by the Board, were made up of about 21,000 gallons of wool-scouring liquor, 7,000 gallons of dye liquor, and 2,000 gallons of yarn-washing liquor.

Besides the manufacturing wastes from the mills, a certain small amount of domestic sewage probably enters the river from the village of Saxonville. Below the village, however, beyond Station 10, the stream flows for 16 miles to the town of Concord without any appreciable additional pollution. For the first 3 miles below Saxonville it runs rather rapidly, in places perhaps at a rate above 2 miles per hour. Beyond Station 9 the river enters the Wayland and Sudbury meadows, and for the rest of its course winds sluggishly along through a weedy channel with a speed of not over ¼ mile per hour. There are no dwellings, with the exception of half a dozen summer camps in the proximity of the river, in all this distance; and it is entered by only a few small tributary brooks.

We have, then, in the Sudbury River, during the dry season, a small stream polluted at a single point to an extent of about 2 per cent. of its total volume by a liquid three to five times as strong as ordinary city sewage. For 16 miles below this point no additional pollution enters, and (at times of low water) comparatively little dilution occurs. For most of this distance the flow is very sluggish, and the conditions of self-purification decidedly favorable. The report of the Massachusetts State Board of Health upon the sanitary condition of the Sudbury and Concord Rivers, May, 1901, contains analyses of samples taken from seven points between Saxonville and Concord on August 15, 1900, from eight points on August 29, 1900, and from five points on February 27, 1901. In general, these analyses showed a marked purification; and in commenting upon them the engineer of the Board noted that near the outlet of Hurd's Pond, 4 miles below the Saxonville dam, half the pollution as measured by free and albuminoid ammonia disappeared, and that at Canal Bridge, 7½ miles below the dam, practically all evidence of pollution was removed. No bacteriological analyses, and no determinations of dissolved oxygen, were made upon these samples. The object of the present investigation was to extend the study of the State Board of Health by making complete chemical and bacteriological analyses of a more extended series of samples taken at the time of minimum flow of the stream, when the conditions for the study of self-purification are most favorable.

All field-work and collection of samples has been done by Messrs. Winslow and Hansen; all chemical work by Mr. Woodman; and all bacteriological work by Mr. Winslow. For the conclusions the authors are alike responsible.

The first set of samples, ten in number, were collected October 25, 1901, the first sample, at Concord, being taken at 11 A. M., and the last, above the Saxonville dam, about 8 P. M. Station 1 was about 16 miles below the dam and just above the first houses of the town of Concord; Station 2 was at the outlet, and Station 3 at the inlet, of Fairhaven Bay, the only considerable pond on this part of the stream; Stations 4 to 7 were at points 2 or 3 miles apart in the course of the stream through the meadows; no sample was taken at Station 8 on this first day; Stations 9 and 10 were at bridges, respectively 2.7 miles and 3,000 feet below the Saxonville dam; no sample was taken on this day at Station 11, 150 feet below the entrance of the raceway from the mill; Station 12 was in the mill-pond, just above the dam. One week later, November 1, a second set of samples was taken, covering all the twelve stations, but in the inverse order, beginning at Saxonville at 9 A. M. and ending at Concord at 5 P. M. The weather on both days was clear, except for a shower in the afternoon of November 1, beginning about 3 P. M.; and for several weeks previously there had been very little rain. The temperature of the water was taken on the second day and varied only between 11 and 12 degrees Centigrade, except at Station 11, just below the mill, where it was 18 degrees. It was not possible to make measurements either of the amount of water flowing in the river or of the velocity. As regards the latter point, however, it is certain that ¼ mile per hour would be an outside estimate of the speed below Station 8. At each station three samples were taken, one for bacteriological analysis, one for chemical analysis, and one for the determination of the dissolved oxygen; and each sample was collected in three portions, from each side and from the center of the stream. Inspection at the time of taking the samples showed the existence of pollution evident to the eye above Station 6, but no farther down the river. At Station 11 the stream, which had almost all passed through the mill, was highly discolored with dye liquor and very offensive. At Station 10 the milky look had somewhat disappeared, but the water was obviously foul; and between this point and Station 9 the stream flowed swiftly over a bed of rocks largely overgrown with Leptomitus, or some other sewage fungus. Between Stations 9 and 7 the speed of the river slackened, and an opportunity was furnished for sedimentation. At Station 6 the last ocular evidence of contamination was noticed, consisting of a considerable amount of flocculent suspended material in the water.

The analysis of the bacterial samples was begun on the evening of collection. Gelatin plates were made in duplicate and kept at room temperature, and agar plates were made and incubated at 37 degrees to give some idea of the proportion of thermophiles present. The agar plates were counted after 18 hours, the gelatin plates after 60 hours. Four or five portions of each sample were incubated in dextrose broth to determine the presence of bacillus coli. In the first set of samples portions of 1 cubic centimeter, 1/10, 1/100, and 1/1000, and in the polluted portions of the river, of 1/10000 cubic centimeter were used. In the second set of samples, a definite portion was selected for each station, 1/100 for Stations 10 and 11, 1/10 for Stations 8 and 9, and 1 cubic centimeter for the other points, and five duplicate tubes were inoculated. From the tubes showing fermentation of dextrose, litmus-lactose-agar plates were made; and if red colonies appeared, three were fished from each plate and subcultures made. Only those organisms giving typical reactions in dextrose broth, milk, nitrate solution and peptone solution, in the gelatin stab and on the agar streak, were considered to be colon bacilli.

The methods of chemical analysis followed were in the main similar to those employed in the systematic examination of water supplies by the Massachusetts State Board of Health. They are quite fully described in published reports of the Board, and it will be necessary to mention specifically only a few minor points.

The chemical analysis was begun on the morning following the collection of the samples. A portion of the sample was filtered through washed Swedish filter paper, and the filtered water was used for the determination of residue on evaporation, oxygen consumed, and color. The albuminoid ammonia was determined on both the filtered and unfiltered water, thus giving the amount in solution and suspension.

Color was determined by comparison with natural water standards, and is expressed in terms of the standard ammonia solution. Nitrites were estimated by Ilosvay's modification of the Griess method after decolorization with milk of alumina. Oxygen consumed was determined by Kubel's hot acid method, adding the reagents cold and boiling for five minutes. Oxygen dissolved was determined by Winkler's method on special samples collected at the same time as the samples for the main analysis.

In a general way, the pollution was not so great with the set of samples collected on October 25 as with the set of November 1; however, this apparent difference is partly due to the absence, in the first set, of a sample for Station 11, where the pollution would naturally be expected to be at its maximum. Another striking feature is the absence of the factor which usually proves the most valuable indicator of pollution, the free ammonia. This is no doubt due to the peculiar nature of the contaminating material, one entirely different from house sewage, in that it decays only slowly. For this reason this particular case is in some ways better, in some ways worse, than might have been desired. On the one hand, a factor usually relied upon for convicting evidence is removed; on the other, the changes taking place in such material are probably more prolonged than those which affect domestic sewage, and are therefore more readily followed and studied. Further, the Saxonville sewage did not very notably increase the chlorine content of the water, the nitrogen present as nitrites, or the organic matter oxidized by potassium permanganate.

The albuminoid ammonia curves show a rise on both days, with a maximum at the station nearest the mill. From this point the amount of albuminoid ammonia decreases gradually, the last point at which an excess is noted being Station 7. The "suspended" albuminoid ammonia drops still more quickly, and shows a more regular change, a fact due, no doubt, to the direct and constant influence of sedimentation, assisted possibly by the filtering effect of weeds or sedges. The residue and hardness show a somewhat similar relation, with the important difference that the fixed residue and hardness do not return quite to the normal in the whole length of the river, being perhaps added to by leakage of ground water along the course of the river. The very marked excess on the second day, however, disappeared below Station 8.

The irregular fluctuations of the nitrates are somewhat hard to understand. The rise at Station 10, with a subsequent decrease, is evident in both curves; and the fall at Station 11, on the second day, is interesting as suggesting a reduction of the nitrate normally present in the water. The dissolved oxygen shows the pollution and self-purification very clearly. A strong decrease on November 1, and a slight decrease on October 25, are followed by a gradual rise, reaching the normal between Stations 6 and 7, this region seems to be the crucial point of the chemical purification.

Bacteria per Cubic Centimeter.

Station.	Series I, Oct. 25. Gelatin, 20 deg.	Series I, Oct. 25. Agar, 37 deg.	Series II, Nov. 1. Gelatin, 20 deg.	Series II, Nov. 1. Agar, 37 deg.
1	180	46	170	18
2	300	33	390	29
3	770	36	720	29
4	4,230	27	1,320	37
5	6,400	44	1,390	39
6	8,100	70	1,900	72
7	7,100	130	2,900	71
8	.....	.....	4,600	43
9	17,000	610	73,000	870
10	6,000	1,400	33,000	4,300
11	.....	.....	150,000	8,200
12	320	22	160	455

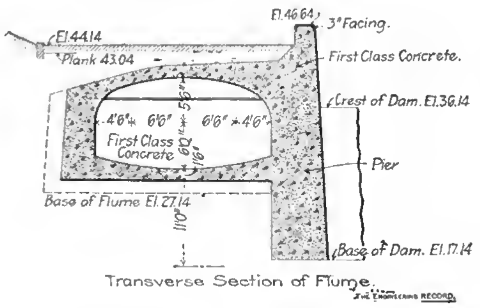
The results of the bacteriological analysis are very instructive. The total number of bacteria present in the water, as determined by growth on gelatin at 20 degrees, rose from one or two hundred to many thousand; a comparison of the figures for Stations 9 and 10 on the two dates showing, as do the chemical results, that the pollution was much greater on November 1 than on October 25. That the fact that on both occasions Station 10 gave lower numbers than Station 9, may be due to the fact that a small spring feeds the river at the former place. The pollution, as measured by the bacteria, is evident as far down as Station 3, considerably below the point at which the chemical purification appears to be complete. The thermophiles, as measured by the growth on agar at 37 degrees, show a similar increase, but their disappearance in the river is more rapid, the numbers reaching about their normal values at Station 6 on the first day, and at Station 8 on the second. The examination of the samples for the colon bacillus, on the first day, showed that organism to be present in 1/100 cubic centimeter at Station 10, and in 1 cubic centimeter below that point to Station 6. At Station 5 it happened that it was isolated from 1/10 cubic centimeter and not from the whole cubic centimeter examined; below that point it was not found. On the second day a certain dilution was chosen, and five duplicate samples examined. Bacillus coli was present four times out of five in 1/100 cubic centimeter, at Station 11, but not at all in that quantity at Station 10. It was found in a majority of cases in 1/10 cubic centimeters at Station 8 and 9. It appeared in a large majority of the single cubic centimeters examined from Stations 5, 6 and 7; in two cases out of five at Station 4, and in one case out of five at Station 2; not at all at Stations 1 and 3.

To summarize: The sewage of the Saxonville Mills, on the days observed, introduced into the Sudbury River a considerable amount of nitrogenous matter in the form of albuminoid ammonia, a considerable amount of mineral matter appearing mainly as fixed residue and hardness, and great numbers of bacteria, many of them thermophiles with some intestinal bacilli. During the 6 miles between Stations 11 and 7, organic pollution decreased and practically disappeared, at first rapidly, later more gradually. The thermophilous bacteria were removed during the same period. The total number of bacteria present was also greatly reduced, but remained distinctly above the normal during the sluggish flow of the stream to Station 4, 4 miles below. The colon bacillus also persisted in appreciable numbers down to Station 4.

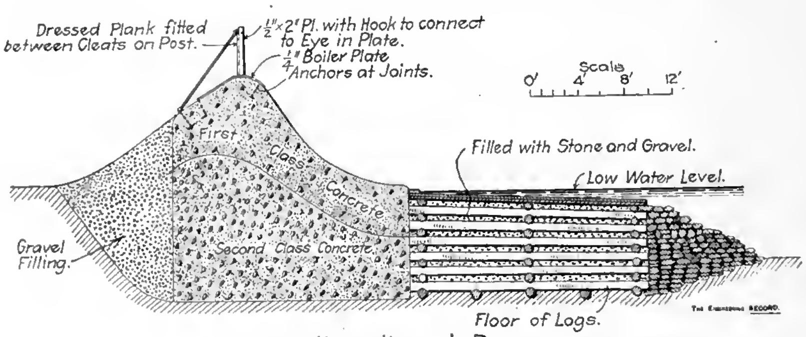
It appears, then, that under certain conditions bacteria, and even intestinal bacteria, may persist in a stream after self-purification from organic material has been effected; and that they may be found, even in a very sluggish stream, at a distance of 10 miles below their point of entrance.

A Concrete Dam Near London, Ontario.

The construction of a concrete dam across the Thames River at Springbank, Ontario, is described in a paper by Mr. J. A. Heaman, recently read before the Canadian Society of Civil Engineers. The dam furnishes power for the London water-works, and was built to replace a timber cribwork and pile structure which had been washed out. The latter was built in 1878 and needed constant attention to keep it safe and watertight. In the spring an ice jam usually occurs at a railroad bridge a few miles above the dam, and the failure of the old dam is ascribed to large cakes of ice



Transverse Section of Flume.



Section through Dam.

coming down from this jam when the water was not sufficiently high to carry them clear of the dam. These cakes gradually loosened the planking of the cribwork and the filling then washed out, after which the piles were either broken or washed away.

The new dam is about 350 feet long and about 19 feet in height above the foundation, which is a clay hardpan, except in one place where a vein of loose gravel was consolidated by ramming dry concrete into it. The dam was built in sections about 50 feet long with joints of sheet iron covered with a coating of sand and pitch to allow for expansion and contraction. It was built of the heavy section shown in the illustration because of the danger from ice in the spring. The first class concrete, which was used in the exposed part of the work consisted of 1 part of Portland cement, 3 parts sand, 4 parts screened gravel and 2 parts broken stone. Second class concrete was of the proportions 1:3:5:3. In the second class concrete stones averaging 9 inches in diameter were set by hand as the work progressed. The outside faces of the concrete were carefully floated with steel trowels before permanent setting had taken place.

By means of flashboards the water can be raised to a height of 4 feet above the crest of the dam, and it is stated that these flashboards can be put in position with 9 inches of water going over the crest. The sluiceway, which is at the further end of the dam from the flume and wheelpit, is about 7 feet lower than the dam. The sluiceway is in two parts, each 24 feet wide and separated by a concrete pier 6 feet thick at the top. Stop logs 12 inches square are used to raise the crest of the spillway to any desired level. Below the dam a timber apron was constructed of round timber, green pine and elm being used for this purpose. The logs were framed, notched and gained together, drift-bolted at all intersections and through-bolted at ends of timber, with ¾ inch bolts. Timbers running across stream were not less than 24 feet long, and were laid so as to break joint. The other timbers were in one length, and drift bolts of ¾ inch square iron were driven through three timbers on every course. The last row of sleepers or covering sills were flattened to grade lines to receive the two thicknesses of 2-inch elm planking. Below the apron a filling of stone, hand placed and bonded, was put in.

During the construction of the dam, although the season was favorable for operations on the Thames River, the contractor suffered considerable loss by repeated failures of his cofferdams and temporary works. The main cofferdam consisted of two thicknesses of 2-inch sheet piling resting against a framework of two rows of piles cross-braced together and further reinforced by long diagonal piles braced against the top of the sheet piling. In the deepest portions the two rows of piles were replaced with stone-filled cribwork. On the water side of the sheet piling were placed two rows of barrels filled with sand. The piles and sheet piling were nearly all driven by a heavy maul operated by hand. The inadequacy of this construction was frequently shown by a portion of the dam washing away.

The concrete arched flume carrying the water to the wheelpit is about 75 feet long, and has a section shown in the accompanying cut. Nearly 250 feet of concrete retaining wall was built at the same time with the dam. It is estimated that 3,541 cubic yards of first class concrete were laid at $5.50 per yard, and 2,605 cubic yards of second class concrete at $5.00 per yard. The cost of the whole work was $44,050. Mr. John M. Moore was the engineer in charge of construction, with Mr. John Kennedy as consulting engineer.

The Belated Publication of Municipal Reports has probably never been equalled by the record recently made by the city of New York. In the official journal of that city for July 21 there has just been printed the report of the commissioner of public works, General Collis, for the last quarter of 1897. Another New York document that should have appeared long ago but has not is the Water Bureau report for 1901.

Improvement of the Mersey and Irwell Rivers, England.

The purification of trade wastes which has been effected through the efforts of the Mersey & Irwell Joint Committee, organized ten years ago in order to prevent the serious pollution of those rivers, is a matter of considerable interest to sanitary engineers in this country as well as abroad, particularly as an example of some features of a system of river control suggested at the Washington convention of the American Society of Civil Engineers. In the recently issued report of Mr. R. A. Tatton, M. Inst. C. E., chief inspector of the committee, the present condition of the watershed is clearly presented. Of a total of 445 manufacturing establishments where purification works are necessary, 294 have efficient sewage treatment plants, 139 have plants not regarded by Mr. Tatton as efficient, 5 have works being constructed and 7 have adopted no method of treatment, in which the last class two years ago there were 17. It is stated that among those works not regarded as efficient there are many where the surroundings are too limited to allow of an efficient plant being installed. Of the 294 establishments having efficient disposal plants there are 84 dye works, 54 bleach works, 44 woolen mills, 37 print works, 18 paper works, 14 chemical works and a smaller number of industries of other classes. In addition to these 445 works there are about 250 more, which drain into public sewers and the waste waters of which are dealt with by the local authorities.

Of the 94 local authorities on the watershed, having a total population of over 2,450,000, there are 86 which have sewage disposal works in operation, 3 have works under construction, 2 are taking preparatory steps and only 3 have no scheme whatever under consideration. The various methods of treatment adopted by these local authorities is given in a voluminous table at the end of the report, which contains many interesting data. The system adopted in most cases is chemical precipitation followed by intermittent and in some cases continuous filtration through cinders, gravel or other comparatively coarse material. The precipitant most generally used is alumino-ferric. Lime and sulphate of iron are used to some extent, and in several cases settling tanks are used without any precipitant. The sludge from the precipitation tanks is in most cases pressed and disposed of to farmers. In a number of cases a septic tank and contact bed system is used, and it is stated that "biological treatment is being adopted more and more, and is of great value where suitable land [for intermittent filtration] cannot be obtained."

That manufacturers now generally recognize the necessity of treating their trade waste is shown by the fact that for the last four years it has not been found necessary to take any legal proceedings against them. However, it is stated that it continues to be a grievance on the part of the manufacturers of this watershed that similar progress is not being made with the purification of the rivers in other parts of the country. The question of creating a separate commission, or a new department of the Local Government Board, which shall have final authority in matters relating to rivers and their purification throughout the whole country is now being agitated.

The results of the ten years' work of the Committee is summed up by Mr. Tatton as follows: "As to the condition of the rivers generally, we must admit that considerable improvement has been brought about, but yet there still remains much to be done, and more especially by the sanitary authorities. Pollution of solid matter is, to a great extent, kept out of the rivers, but serious pollution is caused by the soluble putrescible organic matters which give rise to offensive emanations in warm and dry weather. Half measures for the purification of sewage are of little or no use. In fact, a partially treated sewage, which has perhaps been held up for some hours in tanks, and in which decomposition has advanced to some considerable extent, will cause more nuisance in the upper reaches of the stream into which it is discharged even than raw sewage in which the advanced stages of decomposition will not be reached until it has been diluted and brought into contact with the larger volume of the main rivers."

The Westchester Avenue Rolling Bridge, New York.

The new bridge over the Bronx River in the Borough of the Bronx, New York, is a low-level movable highway span with a timber trestle approach and is built on the site of an old bridge. It is a single-span deck-girder structure 60 feet wide over all, including two 10-foot sidewalks, and its axis makes a considerable angle with the parallel abutments, which are 40 feet apart in the clear. One end of the bridge is parallel with the abutments, but the other end makes an angle with them and extends in shore from one abutment, so as to allow the structure to be supported on trucks traveling on tracks parallel with this end, as shown in the plan. This gives a length of about 150 feet to the long side and about 60 feet to the short side of the bridge platform. The bridge moves on its rollers about 50 feet in a direction oblique to its axis, so that the sides of the platform move parallel to themselves and the bridge in opening recedes from one bank until the end is withdrawn from one abutment, completely across the channel to a position at the opposite end of the other abutment.

The substructure is unusually extensive for a bridge with such a short span and consists of two abutments and their curved wing walls, a long pier wall for one track and separate piers for the columns supporting the other tracks. The abutments are faced with coursed ashlar and the cap stones and coping are of cut stone; all the rest of the masonry is of Portland cement concrete and all footings are carried down to solid rock. This construction included about 5,000 cubic yards of earth excavation with sheet piling, pumping and back filling, 1,000 yards of rock excavation, 1,000 yards of earth filling, 4,500 yards of concrete, 650 yards of ashlar masonry and 3,600 cubic feet of coping, cap stones and bridge seats. The west abutment is 17½ feet thick at the base, about 45 feet high above the footing and 24 feet high above water level; the east abutment is not as large. Both of them are protected from collision with boats by three lines of horizontal 10x12-inch white oak fenders 72 feet long bolted to the face of the masonry above and below water line. The track columns are seated on concrete piers 55 inches square with cap stones secured by four long anchor bolts which extend down to bearing plates bedded two or three feet deep in the concrete.

The principal members of the platform are three longitudinal plate girders 20 feet 8 inches apart, two oblique end plate girders, nine lines of transverse lattice girder floorbeams 14 feet 10½ inches apart and perpendicular to the longitudinal girders, two fascia plate girders, fourteen longitudinal lines of 12-inch I-beam roadway stringers parallel to the main girders and about 3 feet apart, and two sets of horizontal lateral angles connecting both top and bottom flanges of the main girders and floorbeams.

One of the longitudinal girders is on the center line of the bridge, and the others are nearly under the curbs between the roadway and sidewalks; their lengths are respectively about 74½ feet, 105 feet and 135½ feet. The webs are 60x⅜-inch plates; the flanges are pairs of 6x6x⅝-inch angles and 14-inch cover plates; the web stiffeners, about 5 feet apart, are pairs of 3½x3½-inch angles with fillers, every third stiffener being a double pair of angles. The web splices are made with double cover plates with six vertical rows of field rivets. The flange splices are made with pairs of cover angles and single cover plates. The rear end girder E is about 85 feet long and has a ⅜-inch web plate 6 feet deep and a single angle in each flange. The tops of the roadway stringers are flush with the top flange and are seated on a continuous shelf angle. End girder D is similar to E, but is only about 67 feet long and 4 feet deep and has single 4x4-inch flange angles. Both end girders are web-connected to the longitudinal girders with field-riveted bent plates as shown in cross-section in one of the detail illustrations.

The floorbeams are lattice girders, as shown in the sectional elevation, and are made in four sections each, one section under each side of the roadway and one section under each sidewalk. The two middle sections are field-riveted at both ends to the vertical web stiffeners of the longitudinal girders and are about 5 feet deep at the center of the bridge and about 5 inches shallower at the curb, making the top flange inclined so as to conform to the crown in the roadway. The sidewalk girders are cantilevers riveted to the tops and bottoms of the vertical web stiffener angles of the longitudinal girders. The top flange of the floorbeam is parallel to the chord of the curve of the crown of the pavement and carries across it the longitudinal stringers, of uniform depth. In order to make the heights of the stringers conform to the ordinates of the curve those intermediate between the center line and the curve are seated on filler plates varying from 5/16-inch to 11/16-inch in thickness. The sidewalks have longitudinal 3x10-inch wooden joists overlapping on the top flange of the cantilever brackets, to which they are secured by horizontal bolts through the vertical flanges of short connection angles riveted across it. The top flange is about 2 inches higher at the outer end than it is at the curb so as to give the sidewalk the required pitch towards the curb.

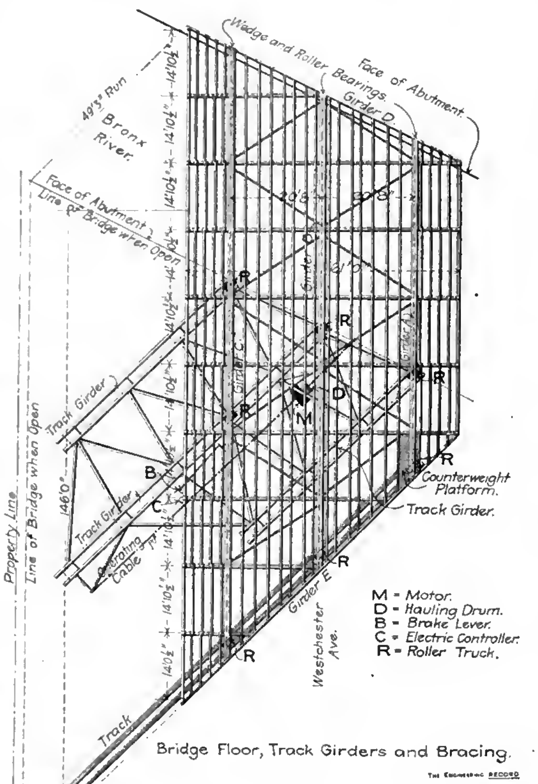
The steel curb has a Z-bar with one horizontal flange riveted to the top flange of the longitudinal girder and the other one supporting the ends of the roadway planks. To the vertical web is riveted a face plate which protects the sidewalk joist and is finished on top with a 2½-inch half-round piece of steel riveted on. The fascia girder has a ⅜x22-inch web plate and one 3½x3½-inch angle for the lower flange and one 5x3½-inch angle for the upper flange. The web is riveted to the insides of the flanges of the angles and the horizontal flanges project towards the center of the bridge, enclosing the ends of the brackets and the edges of the sidewalk floor.

When closed the forward end of the bridge is supported on three roller bearings at the ends of the longitudinal girders, under end girder D, and the rear part is supported on seven four-wheel trucks under the longitudinal girders at their intersections with the track girders in the positions marked R, R, in the general diagram. When the bridge is opened the roller bearings are removed and the end of the bridge from the forward rollers, R, R, R, to girder D is a cantilever counterweighted by the rear part of the platform. To increase the stability a solid steel plate floor is supported on the lower flanges of girders A and E near their intersection, and by longitudinal girders which form sides of a sort of open box in which 95,000 pounds of cast-iron ballast are carried.

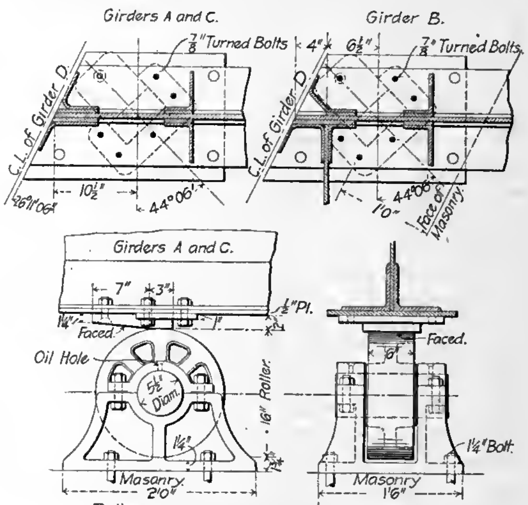
The abutment rollers are mounted in cast-iron frames anchor-bolted to the masonry as shown in the illustration, and engage tapered base plates bolted to the bottom flanges of the longitudinal girders so that when the bridge closes it is lifted slightly and throws a portion of the weight on the abutment, and the girders change from cantilevers to regular spans for all live load and a part of the dead load stresses. The trucks, as shown in another illustration, have solid cast frames bushed to receive the roller bearings of the axles, which are shouldered out at the ends where they are keyed to the wheels. A swivel bearing with the longitudinal girder is made by a vertical cylindrical seat projecting from the top of the truck to engage the cap plate, which is bolted to the bottom flange of the girder. The illustration shows the trucks under the rear ends of the girders where the rails are supported on masonry piers; the rails under the other trucks are carried by elevated track girders. These girders have double webs 24 inches deep and 26 inches apart, which at every vertical web stiffener angle are connected by vertical transverse diaphragm plates. Each web has a T-shaped bottom flange and an L-shaped top flange, the horizontal flanges of both the top flange angles being turned out and the flange of the inside angle resting on top of the flange of the outside angle and forming a smooth track for the truck wheel. At the shore ends of the girders the web plates project on the upper sides to form stops for the truck wheels. At the river ends cast-iron stop blocks are bolted to the top flanges, and cast-iron clamps are bolted to both ends of the rails, which are laid on the longitudinal pier.

The total weight of the structural steel is about 352,000 pounds, and the machinery weighs about 50,000 pounds. The bridge is very simply operated by means of a fixed 1-inch horizontal steel rope parallel and adjacent to track girder G and attached to it with clevises and screw adjustments at both ends. The cable takes one turn around a grooved drum which is operated by a 25-horse-power electric motor and moves the bridge forwards or backwards according as the drum is driven ahead or reversed. The drum is controlled by a band brake with a counterweighted lever and a system of cranks and links for its operation from the bridge platform above. The driving shaft is also geared to a mechanism by which it can be operated by hand.

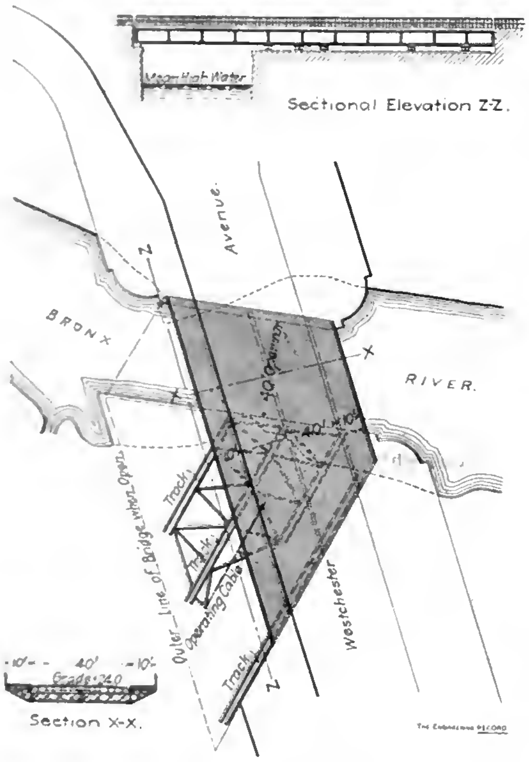
The bridge was designed by the Department of Bridges of the city of New York while Mr. John L. Shea was commissioner and Mr. S. R. Probasco was chief engineer. Its construction was commenced under the direction of Mr. Gustave Lindenthal, commissioner. Mr. John G. Tait, New York, is the general contractor; Messrs. Wynkoop & Braly are the sub-contractors for steelwork, Mr. R. B. Stone for electric plant, and Messrs. Joseph Edwards & Company for the machinery.

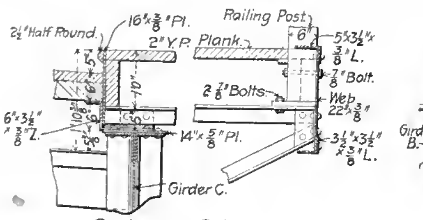


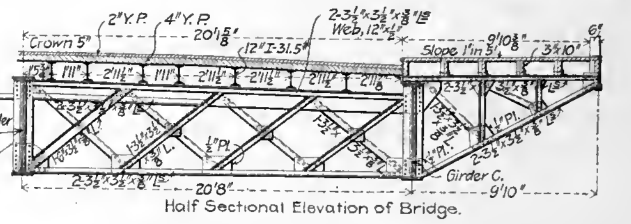
Bridge Floor, Track Girders and Bracing.

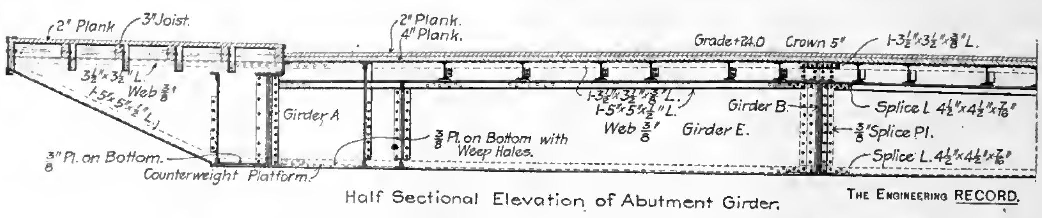


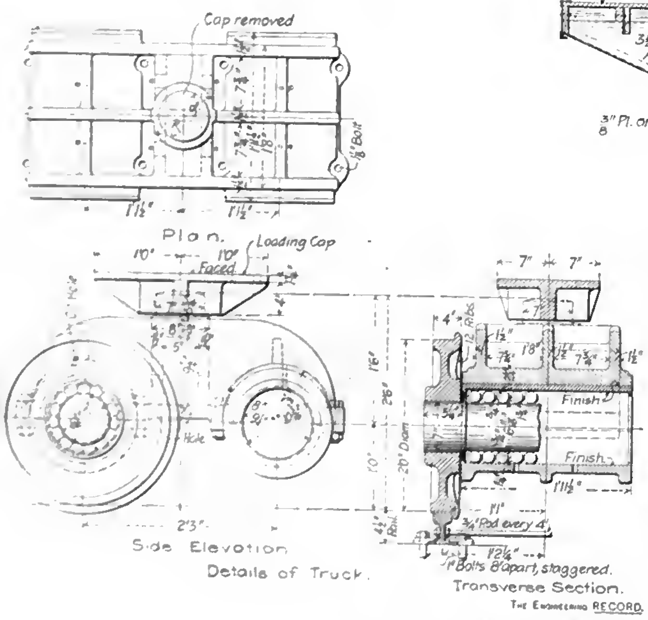
Rollers and Wedge at End of Bridge.

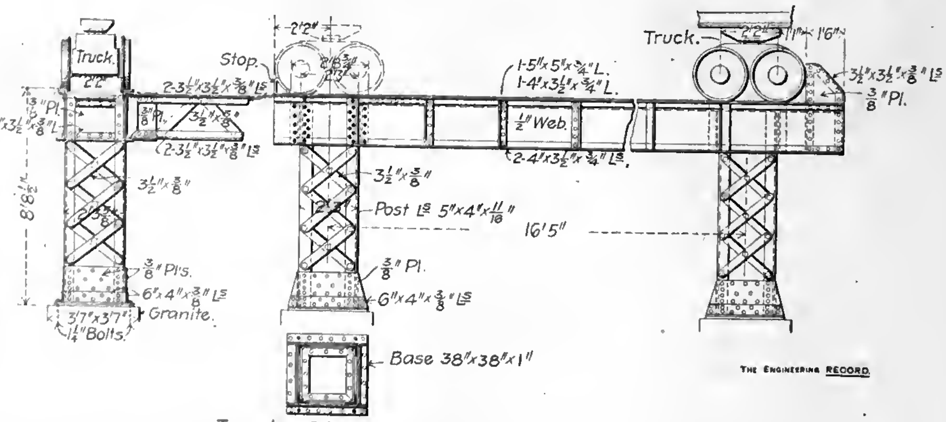

Sectional Elevation Z-Z.
Section X-X.
Plan of Bridge Closed.


Curb and Sidewalk.


Half Sectional Elevation of Bridge.


Half Sectional Elevation of Abutment Girder.

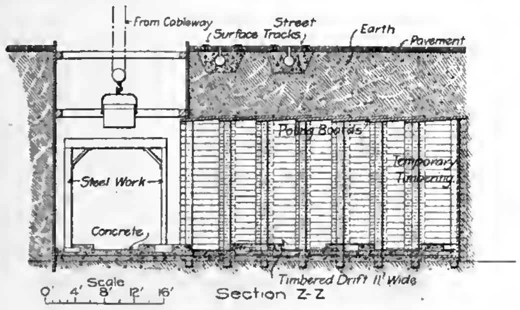

Plan.
Side Elevation
Transverse Section.
Details of Truck.

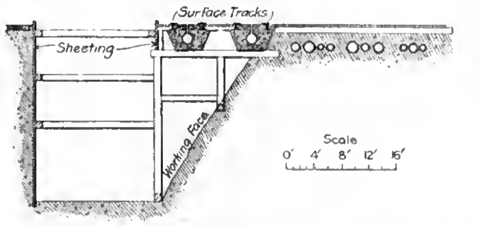

Track Girders and Columns.

ROLLING HIGHWAY BRIDGE OVER BRONX RIVER, NEW YORK CITY.

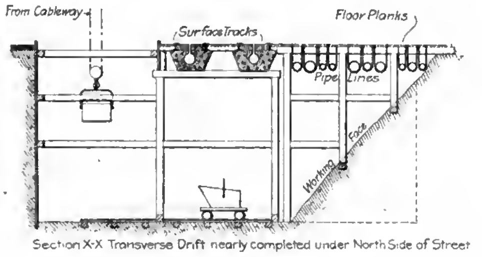
The Second Division of the New York Rapid Transit Railroad.—II.

That portion of Division 2 of the New York Rapid Transit Subway which extends from 41st Street and Park Avenue to 47th Street and Broadway, is about 4,300 feet long and includes the 42nd Street station, near the Grand Central Station. Mr. W. E. Swift is the assistant engineer for the Commissioners, and the work is being executed by the Degnon-McLean Contracting Company, Mr. H. C. Sanford engineer in charge. The structure beyond its connection with the Park Avenue tunnels, is the standard four-track subway except where it is widened at the depot. Above it in the narrow street there are double tracks for electric cars in addition to such a constant and heavy traffic that the excavation was a difficult matter and has been executed largely in tunnel with various systems of headings which make one of the most elaborate and interesting systems of construction on the line.

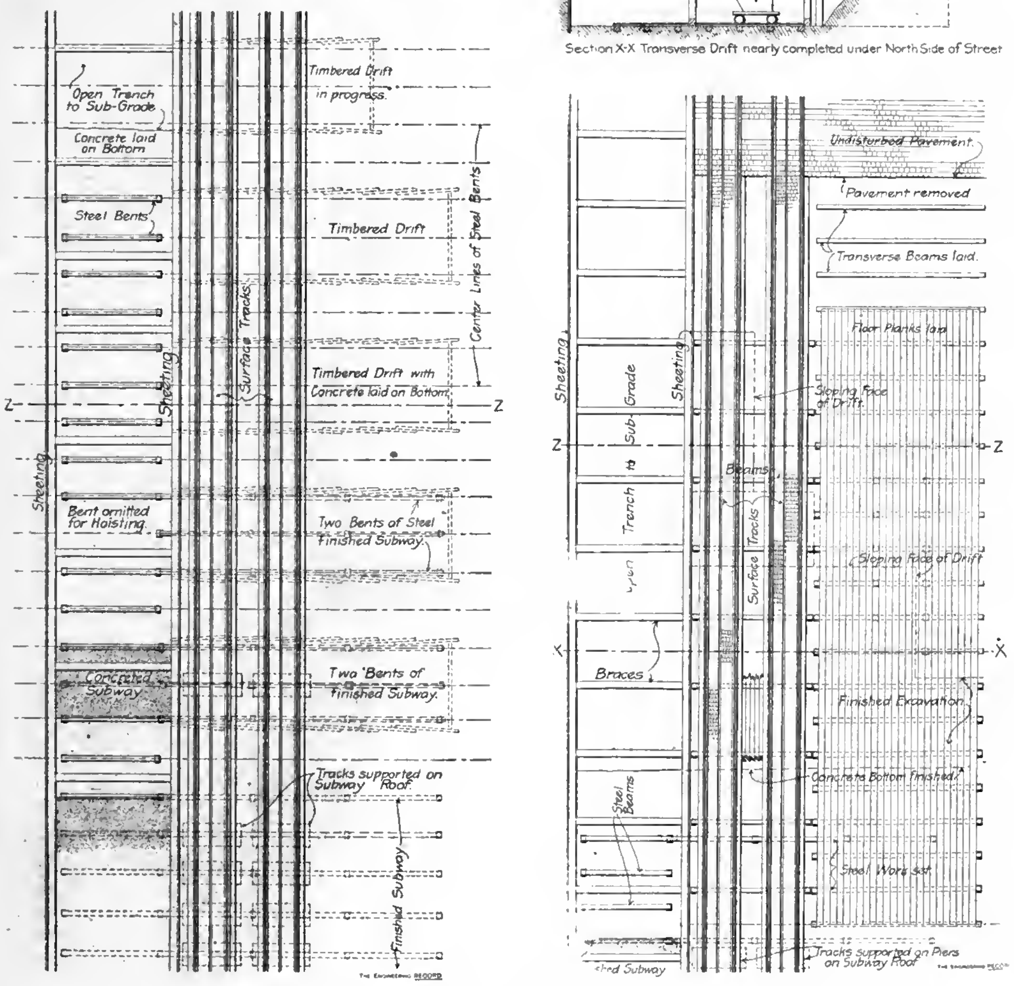




Section Z-Z. Transverse Drift commenced under Surface Tracks.



Section X-X Transverse Drift nearly completed under North Side of Street



SUBWAY EXCAVATION ON FORTY-SECOND STREET; SIXTH AVENUE TO BROADWAY.

The part of the structure in 42nd Street in the middle of the block between Sixth Avenue and Broadway was built almost wholly in earth excavation, which was made with one continuous side trench and alternate transverse short tunnels. A 20-foot open trench was dug to subgrade between the south surface track and the south building line, the sides were braced and sheeted and sidewalk bridges were built over it to give access to the houses. Some of the sidewalk vaults intercepted the line of the subway and were partly removed. The concrete floor was laid the full length of the trench and on it the steelwork for the south track of the subway was erected and the concrete walls and roof completed except in occasional panels where the roof was left open to allow space for hoisting. Spoil buckets and materials were handled by a 300-foot cableway over the center of the trench and by occasional stiff-leg boom-derricks set on the trench timbering and all operated with compressed air from the contractor's plant at 48th Street, near the East River.

Transverse drifts about 12 feet wide and 25 feet apart on centers and high enough to reach from the bottom of the trench to the street surface, were driven from the north side of the trench and extended to the north side of the subway. Each drift was located so as to just receive three bents of the subway steel work, which was erected and the structure completed to its full width in these alternate short lengths. Then similar drifts were run in the spaces between the first set of drifts, giving an opportunity to set the intermediate bents of steel work in them and complete the structure. The surface tracks were supported on brick piers built on the subway roof.

On the ends of the block between Sixth Avenue and Broadway the excavation was 24 feet deep and was generally in earth. It was made with an open longitudinal trench on the south side of the surface tracks, a covered longitudinal trench on the north side of them, and by needling under the tracks and supporting the center of the street intact. A trench 20 feet wide was sheeted down to subgrade between the south surface track and the building line. On the north side of this trench drifts were started under the surface tracks about 10 feet apart, and in them short needlebeams were wedged up against the bottoms of the concrete conduits. A transverse excavation was made the full length of the trench, sloping up at a steep angle from the sub-grade to the needlebeams and as the latter were undermined vertical shores were set under their outer ends. As the transverse excavation continued these shores were successively replaced by longer ones until they finally rested on the bottom of the trench at sub-grade. As the excavation extended farther and farther under the tracks the short needlebeams became disengaged at the north ends and the drifts were advanced beyond the face of the slope and longer needlebeams were inserted, and so on until the needlebeams were carried across to support both tracks and were finally supported by vertical shores from sub-grade at both ends.

Meantime the pavement north of the tracks was removed in short sections, and timbers about 5 feet apart were laid in shallow trenches, and covered with a solid floor of 3-inch planks flush with the pavement. The sloping face of the transverse excavation was worked under this plank platform and the gas and water mains, etc., and the floorbeams above described, were blocked up on needlebeams supported by posts reaching to sub-grade. The floor planks were transverse to the surface tracks and the beams which supported them were longitudinal but are accidentally shown at right angles to their real position in the accompanying plan. The drawings illustrating the excavation methods on Division 2 show the electric conduits under the surface tracks in a conventional manner without attempting to give dimensions or exact form.

In this locality the soil was very loose and soft and was all excavated from sub-grade up to the street level; it was hoisted out of the open south trench by the cableways and derricks and removed in wagons. Movable transverse narrow-gauge tracks were laid on the bottom of the excavation and on them the spoil was transferred in 1-yard steel dump buckets from the foot of the transverse slope to the derrick or trolley hoists. The transverse excavation was made in lengths of 40 to 50 feet and by this method the whole excavation was opened at once and the subway structure was built in full width sections and completed at one operation. After the subway was finished brick piers about 1½ feet wide and 5 feet long were built over alternate roof beams under each track to support the surface street car lines. Where this method of construction was employed the pipes formed almost a complete roof over the excavation near the surface of the ground on the north side of the street; there were fortunately comparatively few on the south side, so that the open trench there and the closed one under the pipes was the most convenient and advantageous way of making the excavations.

Between Fifth and Sixth Avenues the excavation on 42nd Street was from 25 to 39 feet deep and extended from 10 to 27 feet into the rock. A trench 20 feet wide was excavated to sub-grade on the south side of the surface tracks and two 300-foot cableways were installed over its center line to handle spoil and materials. The trench was along the edge of the Bryant Park and the old reservoir site and occupied all the sidewalk, which was entirely given up to it, the pedestrian traffic being transferred wholly to the opposite side of 42nd Street. The bottom of the trench was concreted, the steel work erected and the subway completed for the southern track except that the roof concrete was omitted in occasional panels to provide openings to hoist out the spoil and deliver material through.

A pair of 10x10-inch wooden stringers were laid side by side on the north edge of the completed longitudinal section of the roof, and opposite the middle of them a transverse drift 12 feet wide in the clear and about 20 feet long was excavated with ordinary timbering and poling boards from the north side of the trench to 10 feet beyond the center line of the subway. The roof of the drift was about 3 feet clear above the level of the subway roof, and at a maximum depth of about 15 feet below street level. The bottom of the drift was on the surface of the rock, from 10 to 15 feet above sub-grade. Three 24-inch 100-pound I-beams, 24 feet long, were set transversely with their south ends supported across the pair of 10x10-inch timbers, directly over the subway roof beams and their north ends reaching to the north end of the drifts, one on each side and one in the middle, and were supported by vertical shores as shown in the plan and section of the trench and first drift. The I-beams were wedged up to support the roof timbers and the vertical timbering of the drift was removed.

Excavations were commenced on each side of the drift and carried east and west. Roof poling boards were driven over the top flanges of the 24-inch I-beams, and, when the excavation permitted, another similar I-beam was set parallel to the first one on each side of the drift, a second set of poling boards were driven over it and the excavation continued, and so on as far as the set of I-beams would permit. The north ends of all the I-beams were supported on vertical shores set on the surface of the rock about 8 feet beyond the line of the center columns of the subway. When the upper part of the drift was well advanced, the rock bottom was drilled and blasted out to sub-grade and a second longitudinal section of the subway including the center row of columns, was built in extension of that already made in the trench. The north side of the drift was protected by a bulkhead of braced vertical sheeting boards.

A second 12-foot transverse drift about 13 feet long, similar to the initial one and on its center line was excavated with poling boards from the north side of the first drift to a point 10 feet beyond the third row of columns. Timbers were placed parallel and close to the first three I-beams under the supports of the roof poling boards in the first drift and jacked up on vertical shores until they released the pressure on the I-beams. The latter were then slid north and their north ends supported on vertical shores in the north end of the drift, their south ends being supported across a second pair of 10x10-inch longitudinal timbers set on the subway roof nearly over the middle row of columns. The I-beams were jacked up to support the roof timbers of the drift, the vertical timbers were removed and the excavation continued simultaneously east and west from the sides of the drift as previously.

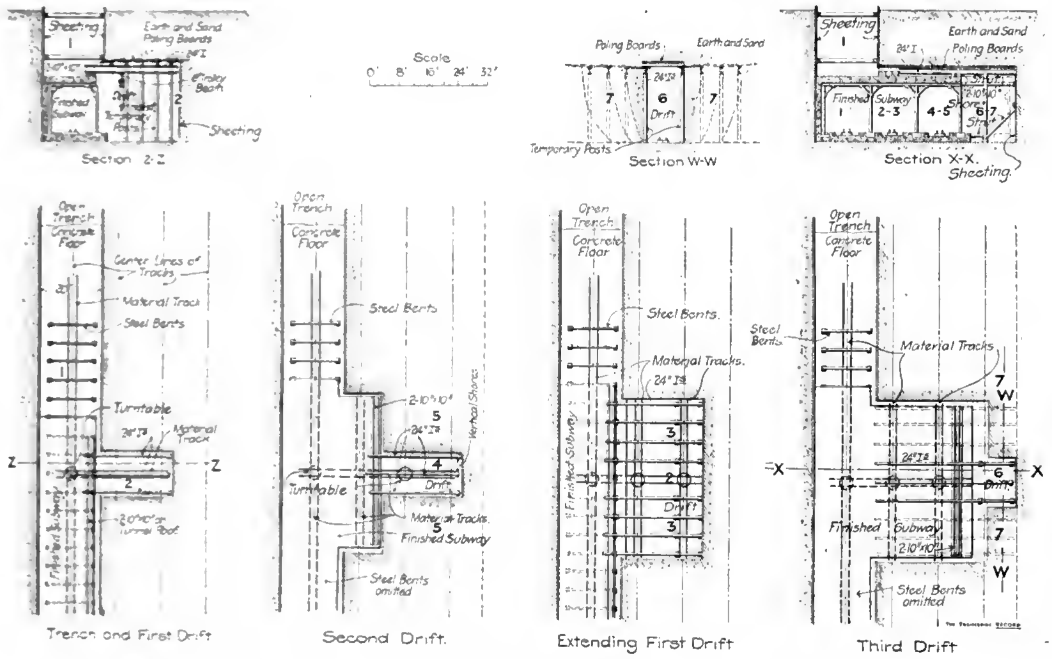
The excavation was completed and the structure for the third subway track up to and including the fourth row of subway columns was built as already described. The excavation required to be extended only about 6 feet farther north beyond the ends of the 24-inch I-beams for the construction of the remainder of the subway, and the same process of extending the initial drift, sliding forward the I-beams in it and then drifting longitudinally from its sides was repeated. It was, however, at first intended to modify this method slightly on account of the short width of the excavation, by allowing the 24-inch I-beams to act as cantilevers and support them only from the last row of vertical posts set for the third track excavation, thus avoiding the use of timbering outside the net limits of the subway. This method is indicated in the diagrams at 6-7 but was finally superseded and the work done as shown at 4-5.

In the plans and sections the successive operations of the excavation are consecutively numbered from 1 to 7. The open trench is 1, 2 is the first transverse drift to beyond the center row of columns, 3 3 are the longitudinal drifts extended east and west from drift 2 and are really carried much farther than is indicated on the diagrams, which are all compressed longitudinally. The second transverse drift, or the extension of drift 2 to just beyond the fourth row of columns is marked 4; 5 5 are the locations in which the second set of longitudinal drifts are to be excavated east and west from 4; 6 is the third transverse drift or the extension of 4 to the north edge of the subway and 7 7 are the third longitudinal drifts proposed to be carried east and west from 6 under the cantilever ends of the I-beams.

The spoil was loaded into 1-yard steel buckets which were suspended from differential hoists carried by trolleys which traveled on the lower flanges of 6-inch I-beams bolted across the lower flanges of the 24-inch beams over the center lines of the subway tracks. These trolleys delivered the buckets to cars on transverse tracks which delivered to the cableway hoists in the open trench, but later the trolleys were replaced by narrow gauge tracks and turntables on the subway floor as shown in the plans and sections.

Near Fifth Avenue, the surface of the rock was so much higher that the height of the earth drift had to be increased to secure working headroom, and the 24-inch I-beams were raised 4 feet. They were carried on a second set of two 10x10-inch longitudinal timbers in the vertical plane of those laid on the north edge of the subway roof, and supported from them by pairs of 10x10-inch vertical posts under each I-beam, both vertical posts and I-beams being securely braced transversely by inclined braces. Rubble masonry walls or continuous transverse piers were built on top of the finished subway roof between the I-beams, and the poling boards were wedged up tight on them before the I-beams were moved. After the subway was completed and the I-beams removed the spaces between these piers and the poling boards were packed full of dry rubble masonry and the poling boards were left permanently enclosed there.

(To be continued.)



Methods of Excavation on Forty-second Street between Fifth and Sixth Avenues.

A Concrete Culvert was built last fall for the Western & Atlantic Railroad near Bartow, Ga., which presents some interesting features, described by Mr. C. B. Wilson in the "Proceedings" of the Engineering Association of the South. The stone box structure which it replaced was being crushed by the weight of the 66 feet of embankment above it, and it was decided to build the new culvert about 30 feet to the north. The latter is 5 feet wide, with full-centered arch; height from bottom of curved invert to springing line of the arch, 5½ feet; thickness of invert and arch crown, 12 inches; and thickness of side walls, 3 feet 1 inch. On account of the great depth, a tunnel 150 feet long was driven from both ends, the open cut being about 38 feet at each end. The headings, from which the earth was removed by wheelbarrows, could only be about 3 feet in length before being timbered up. After the work of laying the invert had begun, the tunnel timbering was found to be settling directly under the track but not at the ends. This was allowed for by increasing the thickness of the invert at the center. After the invert had all been laid, a wooden track was constructed in the upper part of the tunnel, leaving about 4 feet headroom, and a small car from which the concrete for the walls could be easily dumped into the molds was built. For the delivery of sand and cement from the track above, a wire rope was stretched from top to bottom of the slope, and two boxes with drop bottoms were hung from it by small snatch blocks. The 20x30-foot mixing board was built near the lower end of the culvert. The costs of concrete placed, including building of platforms, molds, car, etc., were: In invert $4.76 per cubic yard, in side walls $4.82, and in arch $6.02.

The History of the Institution of Civil Engineers.

Extracts from the Presidential Address of Charles Hawksley.

The early history of the Institution is so well related in the report of the Council for the Session 1885-86, just 50 years after its existence was first announced to the world by the publication of its proceedings, that the following extract from that report may be of interest to at least the younger members of the profession:

"The honor of having originated the Institution is often assigned to Smeaton, or to Telford, but the idea is erroneous in both cases. Smeaton died many years before it was thought of, and Telford only joined it after its establishment. A Society of Engineers, still existing, was founded by Smeaton in 1771; it includes many of the most eminent members of the profession, but it is rather of the nature of a social club than of a scientific association, and has no connection with this Institution. It was, indeed, of too exclusive a nature to meet the wants of so large and mixed a body as soon became engaged in engineering; and early in the present [nineteenth] century a feeling began to be entertained that an Institution on a larger scale, having for its object the furtherance of professional knowledge, might be made eminently useful.

"The persons who took the initiative in the matter were six young men, then beginning their engineering life, William Maudsley, Joshua Field, Henry Robinson Palmer, James Jones, Charles Collinge and James Ashwell. Towards the end of the year 1817, they, impressed with the difficulties of gaining the knowledge necessary for the diversified practice of engineering, resolved to form a society for promoting regular intercourse between persons engaged in the profession, to the end that such persons might mutually benefit by the interchange of individual observation and experience.

"The first formal meeting was held at the Kendal Coffee House, in Fleet Street, on the 2nd January, 1818. The proposal was favorably received; the society was established; other engineers joined, and rules were framed for its government. During two years it continued to meet, and the result of its experience of the value of the meetings was such as to warrant an effort being made to extend the limits of the society. It was perceived that a principal step towards this extension would be to obtain the direct patronage of some eminent and popular professional man. Accordingly, on the 23rd January, 1820, the following resolution was passed:

"'That in order to give effect to the principle of the Institute, and to render its advantages more general both to the members and the country at large, it is expedient to extend its provisions by the election of a President whose extensive practice as a Civil Engineer has gained him the first-rate celebrity; . . . and that a respectful communication be made to Thomas Telford, Esq., Civil Engineer, requesting him to patronize this Institution by taking upon himself the office of President.'

"So little was the society known up to this time, that Telford had never heard of it when the foregoing resolution was announced to him; but appreciating, with characteristic judgment, the value of such an Institution, and the useful results it was capable of yielding, he accepted the proffered chair without hesitation, and was formally installed on the 21st March following.

"Telford's name gave an impulse to the progress of the society, which grew rapidly in importance under his fostering care, until, on the 3d June, 1828, it received a charter of incorporation under the Great Seal, by the title of The Institution of Civil Engineers. Telford died on the 2d September, 1834. A few years before his death he had begun to contract his engagements, and as he gradually withdrew from the toils of business, his attention became more and more concentrated on this society. It was, indeed, the last object of his solicitude, and gave employment to his mind in the evening of his days. Its collections were enriched by his bounty, and when, full of years and of honors, he felt the close of life approaching, he endowed the Institution with the munificent bequest which has since done so much to encourage the production of Original Communications, for reading at the meetings and for publication in the 'Minutes of Proceedings.'"

Thomas Telford was in 1835 succeeded as President by James Walker, another engineer of acknowledged eminence, who occupied the chair until January, 1845.

In 1836 the first volume of the "Transactions" was published; it was in quarto size and contained selected communications, written by men of considerable eminence, together with a short history of early engineering in Great Britain and of the Institution. The publication of the "Minutes of Proceedings," in octavo size, was commenced in 1837, in which year the first published report of the Council appeared. It was then intended to give in the octavo volumes only abstracts of the papers and discussions, certain selected papers being published in full in the quarto form.

In 1842 the third and last volume of the quarto "Transactions" was published, and after the 12th of March, 1844, the papers were published in the octavo "Minutes of Proceedings" in full, or with but slight curtailment. In this form the proceedings have continued to appear, and at the close of the Session 1899-1900 they occupied no less than 142 octavo volumes.

At the end of the year 1844, Mr. James Walker, who had occupied the chair since the death of Telford, a period of ten years, desired that he should not be again nominated, but notwithstanding this he was chosen at the Annual Meeting in January, 1845, and on his declining to serve, Sir John Rennie was elected President.

In 1846 it was enacted that in future no members should be nominated for the office of president more than two years consecutively, and that at the expiration of such two years he should not be eligible for re-election for three years. It was also virtually decided to allow the class of graduates to become extinct, and no elections into it subsequently took place. At the same time it was arranged to admit young engineers as Associates.

The number of the Council was increased in the year 1871 to twenty, and in 1874 there first appeared in the "Minutes of Proceedings," under the title of "Other Selected Papers," certain papers which had not been read at the meetings, and at the same time there were also added "Abstracts of Papers in Foreign Transactions and Periodicals."

An important change in the constitution of the Society was made in December, 1878. Under the Constitution as then amended, the Institution has since consisted of Members, Associate Members, and Honorary Members, all entitled to the privileges of corporate membership, and of Associates (not civil engineers by profession) who are not entitled to those privileges, with the exception of those who were on the Register of the Institution prior to the 2nd December, 1878.

In their report for 1880, the Council alluded to the existence of a general feeling that it would be desirable for a president in future to hold office for one year only. In consequence, the then president, Mr. William Henry Barlow, F.R.S., intimated that he did not wish to be proposed as President a second time. Since that date the former practice of nominating the same person for two years consecutively has not usually been followed, although no change has been made in the By-Laws on the subject.

In the report of the Council presented to the annual general meeting of the Institution in May, 1892, attention was directed to the dearth of professional men in the volunteer regiments of the Royal Engineers, and the hope was expressed that young civil engineers, whose education rendered them peculiarly fitted to fill the vacancies and to be of service to their country, would, in larger numbers than was then the case, prepare themselves by military training to give aid in any national emergency. Recent events add force to the hope then expressed, and the valuable assistance which has been lately afforded by those engineers who volunteered for service in the South African war should be an inducement to young engineers of the present day to go through the training needful to enable them to render efficient aid to the military authorities in defense of their country, should the necessity unhappily arise for calling on them to do so.

The contemplated reconstruction and enlargement of the premises of the Institution having been deferred for several years, in consequence of Parliament having sanctioned the acquirement of the house of the Institution for certain projected street improvements, which were eventually abandoned by their promoters, the Council considered that further delay was, in the interests of the Institution, undesirable, and determined, in the autumn of 1893, to utilize the sites of Nos. 24, 25 and 26 Great George Street, by the erection thereon of the present building from the designs of Mr. Charles Barry. In the month of March, 1896, the temporary premises were vacated, and the offices were opened in the new house, to which the principal portion of the library books was also transferred.

Having now had the use of the new premises for five years, the experience acquired has confirmed the favorable opinion at first formed as to their suitability for the intended purposes; but extensive as they are, it has already been found that one or two additional rooms would be very useful, in view of the increasing number of committee and other meetings held in the building and the augmented office business.

It may be here mentioned that during the year 1895 a new catalogue of the books in the library of the Institution, comprised in three volumes, was issued.

The year 1896 was not only rendered memorable by the completion of the new house of the Institution, but was also notable as having been the year in which important alterations were effected in the charter and by-laws of our Society. The Council were of opinion that the then existing circumstances were such as to render changes in the constitution and the mode of election of the Council desirable in the interests of the Institution; and that view having been concurred in by the members generally, the Council recommended that a supplemental charter should be applied for in order that the desired alterations might be effected. This recommendation was adopted at a special general meeting held on the 6th February, 1896; and on the 20th March, 1896, a new supplemental charter was granted, with reference to which the Council, in their report for the session 1895-96, observed as follows: "Under the new charter the members of the

Institution are at liberty to fix the number of the Council by the by-laws from time to time, thus admitting of the full and proper representation of all engineering interests both at home and in the Colonies and India. The broad principle thus embodied in the constitution has aroused interest and attention in many quarters. The Right Hon. James Bryce, M. P., late President of the Board of Trade, on a recent occasion remarked in this connection: 'It is with the heartiest sympathy that those of us who watch the efforts that are being made in the political sphere to bring the Colonies closer to their mother-country welcome such a step as you are taking, which will unquestionably give you a firmer hold on the members of your profession beyond the seas.' Further, the corporate members are given the power of voting for the election of the Council without the necessity of attending the annual general meetings—a condition which before practically debarred the vast majority of the members from exercising their privileges in the foregoing respect."

On the 15th April, 1896, at a special general meeting, the by-laws were altered so as to bring them into conformity with the powers conferred by the new supplemental charter. The by-laws as then altered provide that "the number of the Council shall be such as the Council in any year may fix for the ensuing year, provided that such number shall not be less than twenty-three or more than thirty-one, inclusive in both cases of the Presidents and Vice-Presidents, but exclusive of such of the Past-Presidents, if any, as may be appointed by the Council," and that "the Council, when elected for the year, may appoint any number of Past-Presidents, not exceeding four, to be members of the Council for the same year." The altered by-laws also prescribed that the balloting list for the council "shall include the names of not less than seven corporate members who have not served on the Council during the current or the preceding year, and the number of names in all shall be at least two in excess of the number of the Council to be elected." Provision was made to enable members to vote for the election of the Council without the necessity of attending personally at the annual general meetings, and the session was fixed to commence annually on the first Tuesday in November and to continue until the end of April, unless it should appear to the Council advisable to protract it. Other minor alterations were also made.

Under the by-laws as so altered, the number of members on the Council has been gradually increased from twenty to the maximum allowed, namely, thirty-one.

On the 9th June, 1896, in consequence of failing health, Mr. James Forrest retired from the post of Secretary, after having been connected with the Institution for no less than 54 years, during which period he had been for 4 years Assistant-Secretary and for 36 years Secretary. In November, 1896, Sir John Wolfe Barry remarked in his inaugural Address as President with reference to Mr. Forrest, that "It may truly be said of him that he has not only watched over the interests of the Institution with the greatest assiduity and with complete success, but that his office has been to him a labor of love. Certainly no man ever devoted himself more thoroughly heart and soul to his work than has Mr. Forrest from first to last during his long tenure of office," an expression of appreciation which I am sure all of you who have had the pleasure of knowing Mr. Forrest or are acquainted with the results of his exertions on behalf of our Institution will agree with me was fully deserved. On his retirement, Mr. Forrest, who to the present day continues to take a keen interest in everything connected with the Institution, was appointed Honorary Secretary in succession to Dr. Pole, F.R.S., who was elected an Honorary Member of the Institution, and whose death during the present year we have had to regret. Dr. J. H. T. Tudsbery (M. Inst. C. E.), who had for four years acted as Assistant-Secretary, succeeded Mr. Forrest as Secretary, and fills the position with an ability and courtesy known to us all.

At a special general meeting held on the 30th March, 1897, further alterations were made in the by-laws, the most important being the introduction of a test, by examination, of the general and scientific knowledge of candidates for election into the class of associate members, with a view to insure that those who are admitted into that class shall, in addition to the qualifications previously demanded, give satisfactory evidence of their acquaintance with those branches of science which form the basis of engineering. Advantage was taken of the revision of the by-laws to define more concisely the several classes attached to the Institution, and to give official recognition to the term "Associate Member," which had been in use since the foundation of that class in 1878.

Membership in the Institution of Civil Engineers.

Date.	Honorary members.	Members.	Associate members.	Associates.	Graduates.	Students.	Totals of all classes.
1824......	13	80	.....	...	..	.....	93
1830......	14	96	.....	60	..	.....	170
1841......	26	176	.....	205	68	.....	475
1850......	34	244	.....	371	32	.....	681
1860......	24	355	.....	537	14	.....	930
1870......	16	699	.....	988	..	173	1,876
1880......	18	1,209	1,287	568	..	613	3,695
1890......	19	1,684	2,768	432	..	969	5,872
1900......	19	2,033	3,989	311	..	1,007	7,359

With the object of promoting union amongst the members of the Institution, and facilitating the interchange of professional views in the case of those whose residence at a distance from London precludes them from regular attendance at the weekly sessional meeting of the Institute, the Council arranged for a general conference of members in May, 1897, at which the large attendance and the interest manifested in its proceedings were so satisfactory as to induce the Council to arrange for similar meetings to be held biennially. The second of the conferences was held in London in June, 1899, and the third was merged in the International Engineering Congress held at Glasgow in September, 1901, in connection with the Glasgow Exhibition.

In April, 1899, the Council nominated Mr. (now Sir) W. H. Preece, then President of the Institution, and Sir John Wolfe Barry, Past-President, to be the first representatives of the Institution on the General Board of the National Physical Laboratory, which has now acquired a home at Bushy, near Kew, where it is confidently anticipated that scientific researches of considerable practical value to civil engineers will be conducted.

The Council, in their report for the Session 1899-1900, call attention to the condition under which admission to the Institution as a corporate member is granted, viz., that the applicant shall be "regularly educated as a civil engineer" in some branch of the profession, and they set out the regulations which they had framed with the object of indicating more definitely the regular education contemplated by the by-laws apart from the examination or other tests in force. It cannot, in my opinion, be too strongly insisted on that these examinations and tests are only to be regarded as supplementing, and not in any sense as superseding, that practical training in actual work which is essential to the education of a civil engineer.

The progress of the Institution, as indicated by the number of members and others associated with it at various dates in the Nineteenth Century, is shown in the accompanying table, and it is worthy of note that in 1860, 42 years after the Institution was established, the total number of all classes on its books was only 930, yet 40 years later, namely, in 1900, the total number had become no less than 7,359, being an increase in that period of 6,429, thus making the total number in 1900 nearly eight times as great as in 1860.

It may not be out of place to put on record that the accounts for the financial year ended the 31st March, 1900, show that the income of the Institution during that year amounted to £22,735 1s. 8d., in addition to which £2,470 13s. was received on capital account and £470 8s. 11d. from trust funds, making a total of £25,676 3s. 7d. The expenditure during the same period was on income account £21,465 17s. 2d. and on account of trust funds £517 5s. 7d. At the end of the financial year the Institution held investments in railway and other securities valued at nearly £55,000, in addition to the freehold premises in Great George Street with their contents. The financial position of the Institution at the close of the nineteenth century may therefore be regarded as highly satisfactory.

A Test of the Safe Load for Piles was made a few years ago at New Quay, Royal Victoria Dock, London, which has been described in "Engineering." The piles driven in some of the work at that place when 36 to 38 feet in the ground were found to respond to the blows of the hammer more than had been expected. A test was accordingly made of one which had been going at the rate of 2¼ inches to four 8-foot blows of an 1,800-pound monkey. The pile was of pitch pine 36 feet in length below the cut-off and 12½x11½ inches in cross section. The head of the pile was loaded with steel joists weighing 56.8 pounds per foot. A small indicator was arranged just above the level of the ground to record the deflection, which was as follows:

At 10 tons.	No deflection.	Remained thus	24 hours.
" 20 "	1/16 in.	"	48 "
" 30 "	1/16 in.	"	0 "
" 37.5 "	3/16 in.	"	7 days.
" 56.9 "	1/4 in.	"	4 weeks.

At the end of this time there was no further deflection. On the load being removed the pile rose 3/16 inch, showing that a great deal of the deflection was due to the fibers of the timber being put in compression.

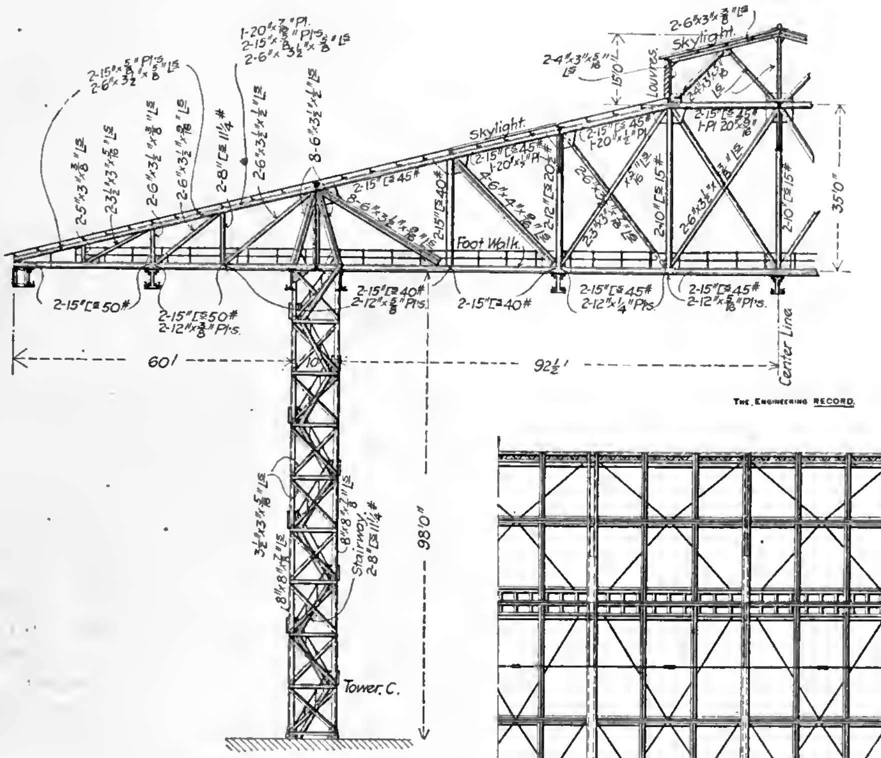
Liquid Fuel Burning Without the Steam Jet is accomplished by Mr. R. A. Meyer, superintendent engineer of a Dutch steamboat line sailing between Batavia and Singapore, in the following manner. The oil is forced into the furnace by means of a donkey pump, the oil coming from a storage tank through a small heater in which it is warmed slightly by the exhaust from the pump, the exhaust after passing from the heater going to the ship's condenser, as the apparatus is designed to save the fresh water which would have to be supplied if the steam jet were used. The oil is discharged by the pump through another heater, through which live steam for the donkey pump is passed, and is heated to 200 degrees Fahrenheit. The front end of the furnace is closed with a cap of steel, and an annular space is formed around this into the furnace, with spiral air guides to cause the inflowing air to take up heat before entering the interior where the coil is burning. Part of the air is allowed to ignite with the oil as it sprays from the injector, but the bulk of combustion is completed further on. No air blast is used, the design being simply to heat the air by the radiation from the oil flame.

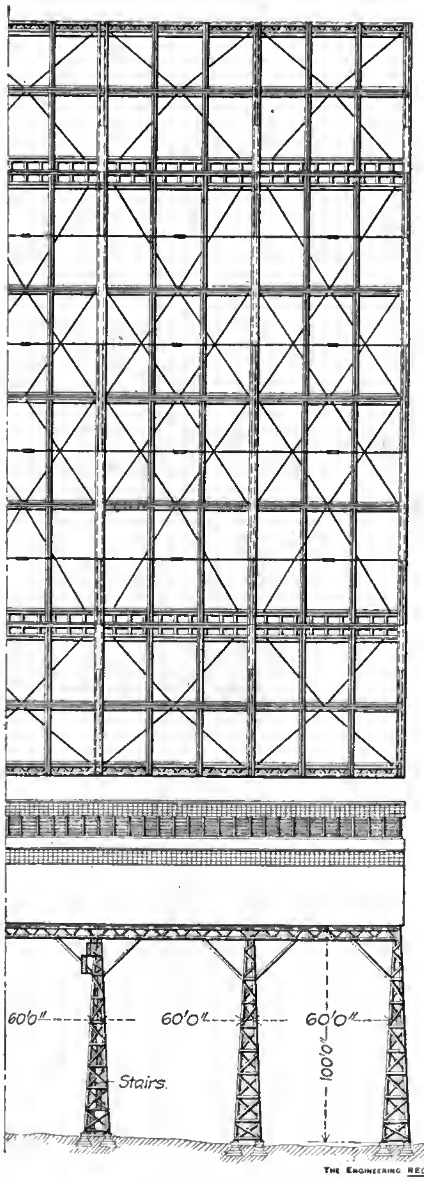
The Fore River Ship Building Shed.

A large steel shed of a special type has been recently designed for the ship building berths of the Fore River Ship & Engine Company, at Quincy, Mass. It will shelter four large ships under simultaneous construction and afford all desirable facilities for handling and transporting the structural materials and machinery and for assembling the frameworks. Multiple systems of independent overhead girder cranes are provided, which command the whole area of that portion of the shipyard which is under cover and handle all materials and tools quickly without having the service for any one of the four vessels obstructed by that for the other three and without any fixed or movable tracks or apparatus on the ground and only two longitudinal rows of vertical members to carry the building and the crane service. This system obviates the use of gantries, derricks and fixed crane service, reduces the obstructions in the yard, economizes spaces, provides shelter for the vessels under construction and, being equipped with specially quick-acting separate electric motors for hoisting and traversing the different cranes, provides means for rapid work.

The shed is 480 feet long and 325 feet wide, and has a roof which is over 150 feet high to the top of the lantern and 100 feet clear above the ground. There are nine main roof trusses, 35 feet deep in the center, which are supported on two longitudinal rows of towers 195 feet apart on centers. The roof trusses overhang the towers 60 feet in the clear on each side, and are intended to have ways under them which will accommodate two large battle ships in the center span and a large merchant ship under each cantilever.

The towers are 10 feet square at the base, with four columns in each. The columns are battered about 4:100 in vertical longitudinal planes, so that the tower is wedge-shaped with a longitudinal length of about 2 feet at the top and a uniform transverse width of 10 feet from top to bottom. Each column is made with a single 8x8-inch angle with the flanges turned in and is seated on a separate offset masonry pier with its cap stone just above the surface of the ground. There are horizontal angles riveted across all faces of the tower dividing it into vertical panels about 11 feet high, which are X-braced with single angles riveted across opposite sides of the column flanges in the same panel, so that their outstanding flanges will clear at intersections. The width of the column angles allows the bracing angles to be riveted directly to their flanges and dispenses with connection plates. Gusset plates and horizontal connection angles are riveted to the ends of the columns for the cap and base plates, and in two of the towers in each row there are zigzag inside stairs giving access to the girder cranes at the level of their tops. At the shore end of the shed the towers are 100 feet high, with their bases carried down below high-water line, but as the ground slopes up away from the shore and the roof line is level, the heights of the towers decrease to 87 feet at the opposite end, where the foundations are at a correspondingly higher level.





Steelwork of Ship Berth Sheds.

Longitudinal cap plates unite the tops of the pairs of tower columns and receive the bearings of the lower chords of the roof trusses, which are continuous over the tops of the towers. The reactions from the trusses are transmitted to the towers through a pair of very heavy inclined braces intersecting at the top chord and seated on the bottom chord over the tops of the columns. The top and bottom chords of the trusses have rectangular cross-sections made up of 12-inch cover plates and pairs of 15-inch side channels, with gusset plate connections for the vertical and inclined web members. The vertical members are made with pairs of channels, latticed, and the inclined ones with angles, of which there are eight in the heaviest ones and two in the lightest ones in the center and end panels.

The trusses are connected by five lines of longitudinal lattice girders with their flanges flush with the top chords of the trusses and web connected to the vertical members of the trusses. One line over the center of each row of towers is 17¾ feet deep, the line in the centers of the trusses and the two intermediate lines are 10 feet deep, with six panels each. The tower lines are as deep as the trusses at those points, and are connected to both top and bottom chords and to the tower caps. At points one-third of their lengths from the towers they are braced by 45-degree struts about 27 feet long, reaching from the lower flanges in vertical planes to the sides of the towers at the second panel point from the top.

The longitudinal girders support jack rafters 20 feet apart, which carry horizontal purlin angles about 6 feet apart. In the main span of the roof trusses there are four lines of ¾-inch adjustable longitudinal rods continuous from end to end of the building, and every panel of the roof is X-braced by rods in the plane of the rafters, as shown in the general plan. The roof trusses which are supported on the stairway towers carry footwalks and railings on their lower chords to give access to the different girder cranes.

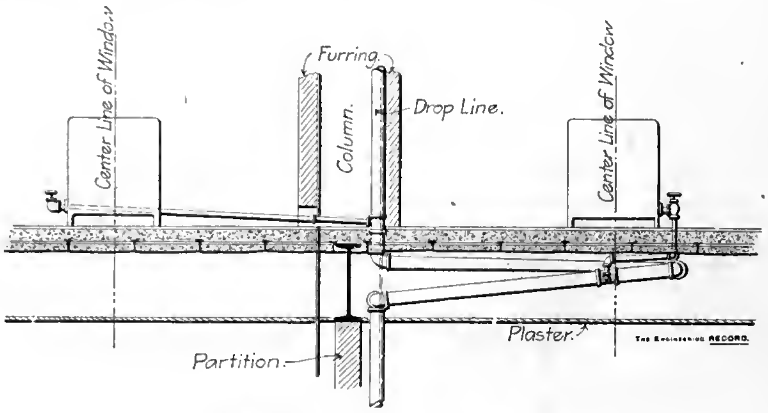
The lower chords of the roof trusses are connected by eleven lines of longitudinal crane girders suspended from them, and by two lines of light fascia girders at the eaves. The center three lines and the lines in the centers of the cantilever ends of the trusses have double webs, the other lines, one on each face of each tower and one near the end of each cantilever, have single webs and all of them have T-rails for the crane tracks set on the upper side of their lower flange angles. This arrangement provides separate parallel tracks for eight sets of independent girder cranes, two sets of one or more cranes over each ship. All are of 5 tons nominal capacity and are from 25 to 45 feet spans.

The roof is covered with No. 18 galvanized corrugated iron, and has a skylight 20 feet wide reaching from end to end on each side of the lantern. The lantern is 45 feet wide and 15 feet high and has iron ventilating louvres on the sides and skylights in the roof. The roof trusses are proportioned for dead load and 40 pounds uniform distributed load per square foot of roof surface and for the crane loads and for an assumed wind pressure of 20 pounds per square foot of roof surface. Medium steel is used throughout and is proportioned for unit strains of 18,000 pounds bearing, 10,000 pounds shear, 15,000 pounds tension and 12,500 pounds properly reduced for compression. Unit strains in field rivets and bolts are 15 per cent. less than for shop rivets and bolts.

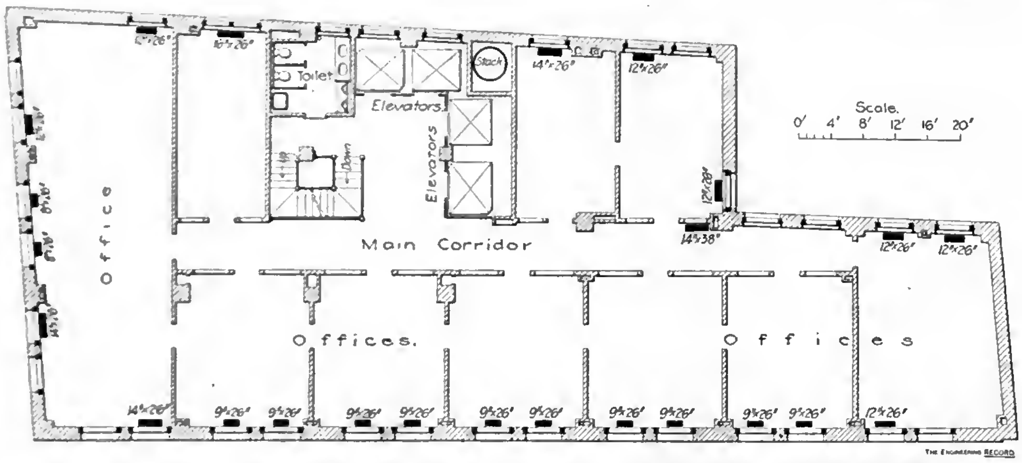
The shed and cranes and a special 75-ton folding jib gantry crane were designed, built and installed by the Wellman-Seaver-Morgan Engineering Company, Cleveland.

The Mechanical Plant of a New York Office Building.

In a new 15-story office building at the corner of Cedar and William Streets, New York, there has been installed a mechanical plant which is of interest in many respects. One of the features of the installation is the use of two internally fired Scotch marine boilers, which were adopted in this instance on account of lack of room in the basement and because they could be covered and insulated in such a manner as to prevent in the greatest degree any heat being felt on the main floor above the boiler room. Another interesting feature in connection with the plant is that steam is circulated throughout the heating system at atmospheric pressure without special devices. Two electric light units furnish current to 1,800 incandescent lamps throughout the structure, four hydraulic elevators have been installed, and there is a one-pipe heating layout fed from overhead mains. Special provision has been made in the building against fire and the floors are of concrete construction. Most of the piping has been concealed, and that which is exposed is arranged so as not to be unsightly. The good appearance of the engine room is enhanced by covering the walls with white tile.



Method of Making Connections with Radiators.



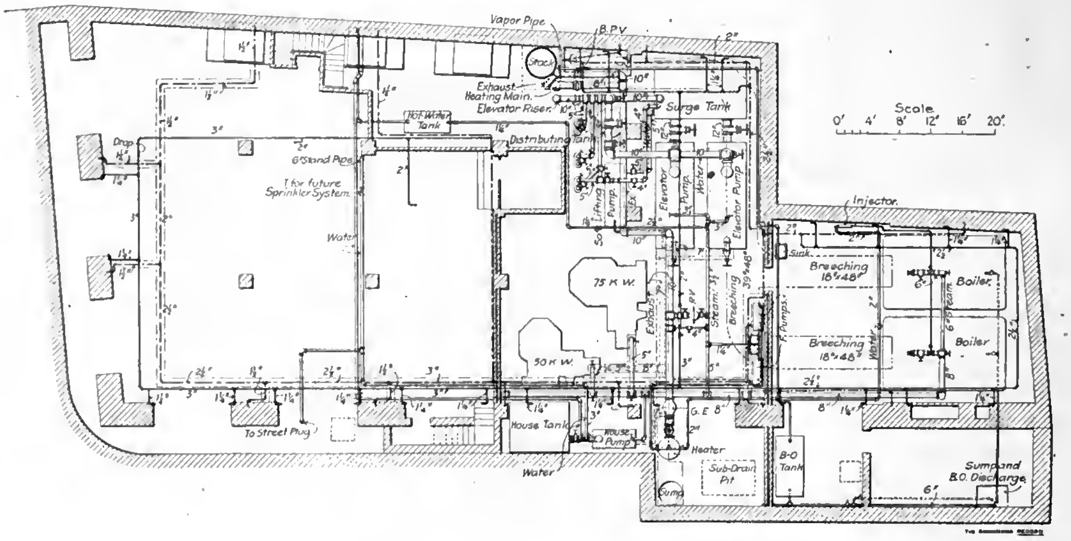
Typical Floor Plan, showing Direct Radiation.

The building is of steel skeleton construction and covers a rectangular area of about 4,800 square feet, the main entrance being on William Street, where there is a 60-foot front. The total depth of the structure is 124 feet. A typical floor plan is given in one of the accompanying illustrations. The boiler plant occupies a portion of the basement on the Cedar Street side, while to the front of it is the engine room. Two elevator pumps are located in the engine room on the left, connected to a surge tank, while a house tank with its pump, a feed-water heater, etc., are on the right. The electric light units are centrally located.

The boilers which are before mentioned are of the internally fired Scotch type, two in number, each being of 200-horse-power capacity, rest individually on saddles and very little setting has been necessary. They are about 15 feet in length and 9 feet 6 inches in diamater, fitted with Morison corrugated furnaces each delivering steam from 6-inch outlets on the top of the boilers to an 8-inch header extending along one side of the engine room. It is suspended from the ceiling and is run to a point near the house tank where it drops below the flooring and is fitted with a blind outlet so as to form a water leg. A 2-inch drip is carried from the bottom of the latter to an Anderson trap. The main exhausts from the engines are shown leading to a Ford grease extractor and into the heating main.

The engines are of the Harrisburg single expansion, horizontal high speed type, one is a 14x12-inch engine and the other a 10x12-inch, the former being direct-connected to a 75 kilowatt Westinghouse multipolar compound wound 120-volt generator and the latter to a 50-kilowatt machine of the same type and manufacture. A 4-inch steam line from the main header serves the smaller one and a 5-inch line supplies the larger engine. The main exhaust line from engines and pumps is 10 inches in diameter and is run from the grease extractor mentioned to a point near the smokestack where it rises to the attic, serving downward heating lines. To the rear of the engines are two 6x4x6-inch boiler feed pumps made by the Buffalo Steam Pump Works, fitted with brass lined cylinders, which pump the water of condensation from the heating system back through a 200-horse-power Berryman feed-water heater into the boiler. A 10x6x8-inch house pump, also made by the Buffalo Steam Pump Works, is supplied with steam through a 2-inch connection and exhausts through a 2½-inch line; it draws from a house tank 6½ feet by 8 feet in plan and 6 feet deep, divided into two sections, one for flushing the toilets and the other for drinking purposes. Water connections to and from this tank are shown, the latter running across to the opposite side of the building where it rises to a roof tank in a pent house. The roof tank is capable of holding about 2,000 gallons, and the water level is automatically regulated by a ball float operating in connection with the admission valve on the supply pipe.

Other apparatus belonging to the steam plant proper is a blow-off tank 8 feet long and 3½ feet in diameter, the boiler connections for which are shown. Also a hot-water tank, 3 feet in diameter by 6 feet in length, which is suspended from the ceiling by means of wrought iron straps and hangers. The temperature of the water in this tank is kept at a desirable point by a Davis & Roesch thermostat. All steam piping, tanks, etc., have been covered with magnesia insulation made by the H. W. Johns-Manville Company of New York.



Plan of Mechanical Plant in Basement.

The electrical equipment includes the two 120-volt multipolar generators mentioned which supply current to a two and three-wire lighting current supplying incandescent lamps in various parts of the building. There are four general centers of distribution as follows: One circuit to the second floor supplies the first, second and third floors; a line to the fifth floor furnishes current to the fourth, fifth, sixth and seventh stories; another to the ninth takes care of the eighth, ninth, tenth and eleventh; while the last, running to the thirteenth floor, connects the twelfth, thirteenth, fourteenth and fifteenth. A panel box is provided for each floor, from which taps are taken to outlets. In several places flexible conduits are used, generator feeders being run under the engine-room floor to the switchboard in loricated conduits.

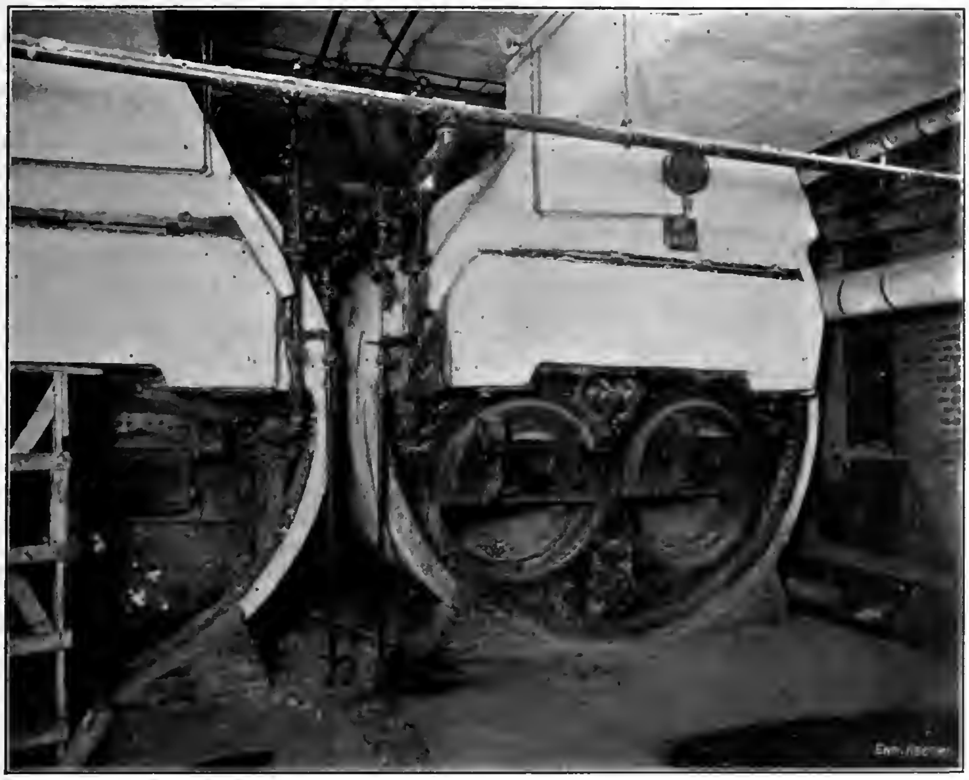
The switchboard consists of two panels of white Italian marble and is located at one corner of the engine room. On it are placed two ammeters and two voltmeters of the Weston type, a ground detector, two pilot lamps for the generators and two Carpenter rheostats. There are also contained on the board two large generator switches, a break-down switch and switches for the control of the four centers of electrical distribution mentioned.

The elevator equipment was installed by the Otis Elevator Company, of New York, and includes four hydraulic elevators and a safe lift. The two compound tandem pumps are of the Worthington type and are duplicate machines, each being 14x20x11x15 inches in size. Either or both may be used for obtaining the necessary pressure in the elevator tank, 4 feet in diameter and 16 feet long, which is set on steel girders. A surge tank to which the pumps are connected in the usual way is 7½ feet by 12 feet in plan and 6 feet in height, holding about 15,000 gallons. The customary automatic cut-off valve operating when the cars have reached the end of their transit is provided and Cruikshank safety devices are installed on the cars. The safe lift pump, connected to the surge tank and also of the Worthington type, is 10x4½x10 inches. Each elevator has a carrying capacity of about two tons and a speed of approximately 500 feet per minute, traversing a vertical distance of 200 feet.

Exhaust steam is used for the heating system, which is of the one-pipe overhead type, direct radiation being installed throughout. The 10-inch heating line already mentioned serves individual attic mains which in turn supply thirteen different drop lines. The radiators are those manufactured by the United States Radiator Company connections for which have been made according to the detail sketch, and expansion joints have been provided at an intermediate floor. Live steam passed through an 8-inch Ford reducing valve located at the junction of the exhaust heating main in the basement and a branch steam line from the main header may be used in addition to the usual heating supply should severe weather warrant such. In connection with the drop lines ½-inch air lines are run, which extend from the top of the building to the basement, there connecting with a small air pump.

The engine room is ventilated by means of a 36-inch Seymour disc fan located in one of the walls and driven by a small motor. No ventilation except through window openings is provided on the floors above. A pneumatic tube system is also installed.

The building was erected from the plans of Mr. Goldwin Starrett, of the Thompson, Starrett Company, of New York, and the mechanical plant was designed by Mr. McGonagal of the same company, who were also the contractors for the installation.



The Scotch Marine-Type Boilers.

An English Municipal Ice and Cold Storage Plant.

The corporation of Wolverhamptom, England, has now in operation a cold storage and ice plant which forms part of a scheme comprising a wholesale market. The latter is now being designed and the total estimated cost, exclusive of site, is about $115,000. At a recent meeting of the Incorporated Association of Municipal and County Engineers, the plant was described by Mr. George Green, borough engineer of Wolverhampton.

The cold stores at the present time comprise five cold storage rooms, having a capacity of 16,650 cubic feet. One of these rooms is intended to be kept at a temperature of about 35 degrees Fahr.; the other four at 22 degrees. In addition to this there is an ice cellar with a cubic capacity of 3,750 feet. The motive power for working the air-cooling apparatus and for manufacturing the ice is electricity, supplied from the corporation mains at about 2 cents per kilowatt hour. The ice machinery has a capacity of 10 tons of can ice per day of 24 hours and the cellar will store 90 tons.

The plant has been supplied by the Linde British Refrigeration Company, and consists of two compressors; one surface evaporating ammonia condenser; one ice tank, complete with necessary moulds; one filling tank; one thawing-off tank; one overhead electric travelling crane; and one air-cooler, with fan, and the necessary motors. The compressors are horizontal, double-acting and belt-driven, the larger one being generally used for ice making and the other for the cold stores.

The air-cooler consists of a series of coils of special lap-welded wrought-iron tube. The evaporation of the ammonia in the coils is utilized for cooling the air, the surface of the coils being kept free from snow by means of a drip of uncongealable brine, the brine being circulated by a brass-fitted pump, worked by a separate motor. The fan, provided for circulating the air over the coils, is placed in a duct, and the air is drawn in by the fan at one end and passed out at the other end, after being cooled, shutters being fixed in each store at convenient places to let in the cold air in such quantities as may be required from time to time.

The ice tank contains 140 moulds or cans of turned steel, in frames, each block of ice weighing 140 pounds, and measuring 42x20x6 inches. The tank is fitted with a propeller for circulating the cold brine over the coils and round the ice moulds. The ice is made from the ordinary water supplied from the corporation mains. Hydraulic agitating gear is also provided for rendering the ice clear to within something like 7 per cent. of the total capacity of the block.

The insulation of floors, walls and ceilings cost approximately 24 cents per cube foot of storage. The floors of the stores were, in the first instance, constructed of 6 inches of cement concrete, upon which, in the case of the ice cellar, was laid ¾ inch of rock asphalt; this was continued up to the damp-course and joined to that by means of a hot seam.

The ordinary method of floor insulation was deviated from in this case, and consists of three slabs, laid one above the other, of a patent material, consisting of granulated cork cemented together and forming a solid slab or brick. Upon the top of these were placed two layers of rock asphalt 1¼ inches thick. This floor has been found an excellent insulator, and at the same time has the advantage of being solid. The author considers it an improvement on the wooden floor, inasmuch as it can be thoroughly cleansed, and should any liquids be spilt upon it no damage can be done to the insulation.

The walls and the ceilings are insulated with timber and slag wool. In the first instance, 2x2-inch red deal studs, 18 inches center to center, are secured to the brick walls with plugs. They are afterwards covered and the spaces between them, with one layer of Giant insulating paper, secured to the studs with tacks and marine glue. Immediately upon this are placed two layers of 1-inch red deal grooved and tongued boarding, the first laid horizontally and the second vertically, with one layer of similar waterproof paper between; 2x9-inch red deal uprights at 18-inch centers are then fixed, to which are attached again two layers of 1-inch grooved and tongued boarding, with waterproof paper between, as previously described. The 9-inch space is carefully and firmly filled with slag wool. The ceiling is treated in a similar manner, slag wool, of course, being put in from the top before the upper boarding is laid.

In the case of the ice cellar, the walls are covered with asphalt up to the top, and after the insulation has been fixed in a similar manner to that in the stores the inside walls are then fitted with 2x1-inch dunnage or cargo battens at 15-inch centers, to prevent the blocks of ice adhering to the walls, and to admit of a free circulation of air around the materials stored. The ceiling of the ice cellar is largely formed by the bottom of the ice tank, and has no means of being kept cool otherwise than by the tank.

Each doorway also has a canvas Willesden curtain to prevent unnecessary escape of cold air. The whole of the inside of the stores is painted in white and finished in white enamel, so as to make the same as light, clean and sanitary as possible. The entire building is lighted by electric light.

New Books.

Although only six years have elapsed since the publication of the first edition of Prof. William P. Mason's "Water Supply," so much material has since been added to the stock of general knowledge on the subject that no inconsiderable portion of the text had to be rewritten for the third edition, which has just appeared. As the work now stands it is a digest of all the important information the author could collect on the subject, considered from a sanitary standpoint. The relations between drinking water and disease, water purification, the quality of supplies from various sources, the effect of storage, the pollution of supplies, and the action of water on metals are the general features of the book, which is profusely illustrated. It is published at $4 by John Wiley & Sons, New York.

The Association of Civil Engineers of Cornell University publishes every year a volume of "Transactions" which includes addresses by non-resident lecturers and other papers of permanent value. The volume for 1901-2 is a book of 136 pages and contains nine good articles. The introductory paper is on "Bridge and Concrete-Steel Construction" and was written by Mr. Edwin Thacher. It is mainly a compilation of experimental data useful to designers of concrete-steel structures and a statement of a theory of the ultimate strength of such construction which Mr. Thacher has found to agree well with tests. The other papers are as follows: "Railway Management and the Civil Engineer," by Mr. Theodore Voorhees; "Heavy Sewer Construction in Concrete," by Mr. E. J. McCaustland; "Hook Mountain Tunnel," by Mr. Wager Fisher; "New York, Chicago & St. Louis R. R. Bridges," by Mr. A. J. Himes; "Problems and Methods of the Isthmian Canal Surveys," by Mr. Boyd Ehle; "Notes on New Orleans Drainage," by I. W. McConnell; "The Engineer in Construction Contracts," by Mr. John C. Wait; "Anti-Friction Bearings," by Mr. Henry R. Lordly. The book is sold at $1 by the Secretary, Prof. C. L. Crandall.

The Committee on Sewerage of the Connecticut Society of Civil Engineers have presented a report giving some valuable data in regard to the methods of sewer construction and maintenance in some 80 odd cities and towns, chiefly in Connecticut and Massachusetts. This report is published in the "Proceedings" of the society, recently issued.

A volume entitled "Alternating Current Machines," by Prof. Samuel Sheldon and Mr. Hobart Mason, though primarily intended as a text-book is such an excellent treatise on the subject of alternating currents that engineers generally will find it helpful in solving many of the problems that arise from time to time in alternating current practice. Of the many attractive features of this book probably the most notable is the attention given to the physical side of the science, so that the student may get a conception of what actually happens in a circuit, and which, if clearly understood, gives a far better grasp of the subject than do the mathematical and graphical sides. An experiment for demonstrating the lap of multiphase current waves is one of several described in the book which are new, and as an example of original treatment the chapter on converters may be taken. It should also be mentioned that the complete derivation of the formula for line inductance is here given and in its simplest form. The book is no proper treatise for the lazy mind. The rapidity with which a subject is caught up, gone into, the meat extracted and then dropped for another requires close attention and an active mind on the part of the reader. The book is published at $2.50 by the D. Van Nostrand Company, New York.

A small book that is full of good and clearly expressed information is Mr. A. A. Atkinson's "Electrical and Magnetic Calculations." In fact there is so much in this little work that it might well have been given a more ambitious title. It covers continuous and alternating currents, wiring and transmission lines, batteries, magnetism and electro-magnets and dynamo design and calculations, including both continuous and alternating machines. Two plates are inserted from which drop, size, current, and other characteristics of distribution systems may be graphically determined. In order that the reader may clearly understand every formula and its use, numerous examples are interspersed throughout the book and they help to make easy the interpretation of the mathematics. It is particularly valuable as a reference book. It is published at $1.50 by the D. Van Nostrand Company, New York.

An elementary book by Alton D. Adams bearing the comprehensive title "Light, Heat and Power in Buildings" has been published at $1 by William T. Comstock, 23 Warren Street, New York. It may prove of interest to those unfamiliar with the generalities of the theory, costs and operation of power plants for buildings, and its arrangement of the discussion of the various points of such plants will be found convenient. The last chapter of the work includes a discussion of the heating power of fuels, together with a compilation of tests and analyses of various classes of fuel.

In these days of many books, with more of them being ground out every day, it is a pleasure to get hold of a work such as the "Electrical Catechism" issued at $2 by the Hill Publishing Company, New York. Electrical works in the question-and-answer form and alleged to contain instruction in the elementary principles of the art there are in plenty, but they are generally wandering, tiresome and compiled from electrical catalogues by persons who know but little more than the pupils they propose to instruct. The book under review, however, is a departure from the usual type. It is a smart, clean cut work in which the information is correct, well explained and up to date. In short it is good enough for an engineer's library and simple enough for the beginner. The subjects treated are such as logically find their place in such a book, the general theories of electricity and magnetism, distribution, control and design.

The steady increase in the percentage of the total population of the country which dwells in cities and towns makes the study of municipal affairs an obligation of growing importance to all citizens. There is a small number who understand the magnitude of these problems and are endeavoring to solve them, but the mental attitude of the majority of that body of citizens proud to call itself the intelligent class is simply one of befogged conceit. They are the first to assert the intricacy and detail of their own particular calling and the time it takes to master it, yet few of them will fail to give, on the slightest provocation, an opinion on the management of public affairs marked by such a lack of knowledge of legal restrictions, historical precedent and technical information that the decently informed hearer is at a loss whether to laugh or swear. The Macmillan Company, New York, has recognized this condition and has published at $1.25 each a series of books on different subjects of interest to citizens desirous of fulfilling their obligations to the city, State and nation. The last of the series is "Municipal Engineering and Sanitation," by M. N. Baker. The author has had exceptional opportunities for acquiring definite information on the subjects covered by the title of the volume, which he has set forth with the accurate sense of proportion that only comes from a long practical association with municipal affairs. The contents of the book are divided into five parts, ways and means of communication; municipal supplies; collection and disposal of wastes; protection of life, health and property; administration, finance and public policy. No claim is made to review any of these branches exhaustively, as the book is intended for people without technical training who are striving as officials or citizens to improve municipal conditions. It can be heartily recommended for this purpose and deserves a wide circulation and careful study.

A book of vest-pocket size by Mr. H. B. Andrews entitled "Handbook for Street Railway Engineers," contains much useful information concerning mensuration, laying out of curves, track construction, earthwork, copper calculations and the usual trigonometrical tables. While there is little new either in the matter or its treatment, the book forms a handy reference for general use and is based on such excellent models as are found in the Boston street railways. It is published at $1.25 by John Wiley & Sons, New York.

The So-Called Flint Pavements of Lafayette, Ind., which are now attracting considerable attention in that State, are made from a silicious limestone which is found on the Wabash River about 14 miles southwest of the city. Mr. G. H. Stevenson, city engineer, states that the exposed layers of the ledge have the appearance of compact stone, but a light blow with a hammer will break it into small pieces. This ledge, after exposure to the air, can be loosened with an ordinary plow and is very easily handled; the loosened stones range in size from 3 inches down to less than ½ inch. This stone has been used on the streets of Lafayette for a great many years. Formerly it was spread on the street the same as pit gravel and left for the traffic to compact, which took some time, as this stone has very little cementing qualities of its own. Of late years the city has used an 18-ton steam roller in making flint streets. The stone is put on in 3-inch layers and rolled dry until there is no creeping of the pieces under the roller. Then about an inch of clean coarse sand is spread over the layer and washed into the interstices with water from a sprinkling wagon, care being taken not to drench the roadway; the amount of water used is left to judgment of the inspector or engineer. After sprinkling the layer is again thoroughly rolled before the next layer is put on. This operation is repeated with each layer, the total depth of stone used depending on the traffic of the street, and varying from 6 to 12 inches on different streets. Lafayette is partly underlaid with gravel and sand and partly with clay. When flint is used on a street where there is gravel subsoil no special foundation is made beyond shaping and rolling the subgrade, but where the subsoil is clay either an 8-inch telford foundation or a rough stone foundation is made. Where these foundations are used the depth of flint is 3 inches at the sides and 6 inches at the center. This stone makes a very hard and clean roadway, free from dust, which is uninjured by hand sweeping.

Personal Notes.

Mr. R. M. Phelps has been re-elected city engineer of Berkley, Va.

Mr. E. Lacey Chinn has been elected engineer and surveyor of Annapolis, Md.

Capt. A. H. West, of Rosedale, Miss., has been elected chief engineer of the Mississippi River levee commission and Mr. Robert Somerville, of Greenville, Miss., chief assistant engineer.

Mr. Charles H. Ewing has resigned his position as chief engineer of the Central New England Railway to accept a position as division engineer on the Philadelphia & Reading Railroad, with headquarters at Reading, Pa.

Mr. H. C. Brubaker, Jr., has withdrawn from the firm of Samuel H. Brubaker & Co., and has opened offices for engineering and architectural work in the Aetna Building, Indianapolis, in association with Mr. W. K. Eldridge, lately with the same firm.

Mr. W. S. Jones has been appointed general manager and assistant to the president of the Arkansas & Choctaw Railway and the Choctaw Construction Co., with headquarters at Hugo, I. T. He was recently general superintendent of the Rutland Railway in Vermont.

Mr. H. A. Sumner, M. Am. Soc. C. E., has resigned his position as chief engineer of the New Mexico Railway & Coal Co., owners of lines embraced in the El Paso-Rock Island Route, to accept a similar position with the Denver, Northwestern & Pacific Railroad Co., which has been incorporated to build a road between Denver and San Francisco by way of Salt Lake City.

A 30-inch Riveted Steel Force Main, laid last summer to supplement the water supply of Atlantic City, N. J., is described in the 1901 report of Superintendent W. C. Hawley. The method of coating the pipe is of special interest on account of the corrosive action of the meadow mud in which part of it was to be laid. Each length was made up of five alternate inside and outside rings of ¼-inch open-hearth steel, the diameter of the inside rings being 30 inches and the total length of the section being 28 feet center to center of rivet holes. After riveting and calking the seams inside and out the pipe was heated by a jet of natural gas burned inside to a temperature of about 400 degrees Fahrenheit and then coated by dipping it into a bath of mineral rubber heated to the same temperature. The pipe was lifted out of the bath slowly so that the surplus coating material would run off, and it was then placed on end inside a frame scaffold and two strips of 10-ounce burlap wide enough to encircle the pipe and lap a few inches were applied immediately by a gang of paper hangers and brushed into the hot coating. In laying the pipe across the meadows branches were inserted at six points to connect to the two old mains, allowance being made for expansion and contraction by slip joints inserted on either side. A 30-inch Venturi meter was set near the pumping station in order to give a more accurate record of the amount of water pumped than can be obtained from the revolution counters on the pumps, as was done in the past. A 20-inch Venturi meter at the other end of the main will give a check on any leakage. The valves on the three mains are so placed that any one can be repaired without shutting off more than one section of one of the mains. Mr. Emil Kuichling, M. Am. Soc. C. E., was consulting engineer for the work. The T. A. Gillespie Company, of New York, were contractors for the construction of the main.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xvi, xviii and xxvii.

WATER.

Golden, Colo.—City Attorney W. H. Whitehead writes that at the election held July 3 bonds to the amount of $100,000 were voted for the construction of a municipal system of gravity water works.

Seguin, Tex.—Chas. Troell writes that he and Hugo Troell, both of Seguin, propose to construct an irrigation system and will receive bids Dec. 1 for pumps.

Cheyenne, Wyo.—City Engr. W. D. Pease writes that bids have not yet been asked for the proposed water works improvements to cost $85,000. A. J. Wiley, of Boise, Idaho, Engr. in Charge.

Wilmont, Minn.—It is stated that the Council will receive bids Aug. 5 for the construction of water works from plans prepared by M. B. Haynes, of Mankato. S. L. Long, Village Recorder.

Grand Ropids, Minn.—Bids are wanted July 28 for rebuilding the water works pumping station. Fred. A. King, Village Recorder.

Tell City, Ind.—Bids are wanted Aug. 12 for furnishing and laying a 4-in. cast iron water pipe in Mozart St. H. J. Stuebrk, City Clk.

Dayton, O.—Bids are wanted Aug. 1 for the erection and completion of an extension of the boiler house and pumping station at the water works. Chas. E. Rowe, Secy. Bd. of Trus.

Mt. Pleasant, Mich.—Consulting Engr. W. F. Brown, of Toledo, O., has recommended the boring of additional wells as the best method of obtaining a sufficient supply of pure water for this place.

Chicago, Ill.—Frank Murphy, Contract Clk. of the Dept. of Pub. Wks., writes that the following bids were opened July 11 for constructing one electric traveling crane, capacity 20 tons, at the Chicago Ave. pumping station: Pawling & Harnischfeger, Milwaukee, Wis., $16,500; Whiting Fdy. Equipment Co., Chicago, $11,980 (awarded).

Charleston, S. C.—The plans of the American Pipe Mfg. Co., Philadelphia, which has the contract for designing and building the new works, provide for a timber and earth dam on Goose Creek 11 miles northwest of the city; a pumping station there with a 100-ft. brick stack; one 3,000,000 and two 5,000,000-gal. high-duty pumps; one 5,000,000 and two 3,000,000-gal. low-duty pumps: 600 H.-P. in boilers; a 5,000,000-gal. mechanical filter plant, with a 10,000,000-gal. sedimentation reservoir and a 2,000,000-gal. clear-water basin; a 24-in. cast iron force main to and through the city, 8 miles of distribution mains, 114 hydrants, and the valves and specials needed in the improvement of the piping now in the city. J. W. Ledoux is Ch. Engr. of company.

Jersey City, N. J.—The contract for special casting work in hydrant connections, plugs, caps, bends, manhole heads and covers is stated to have been awarded to the Fagan Iron Wks. Co., of Hoboken, at 3½ cts. per lb.

Kenmore, N. Y.—Engrs. for the Village, Busch Bros., of Buffalo, write that on July 14 the village of Kenmore closed a contract with the Depew & Lake Erie Water Co. for furnishing the village with water. The village will put in its own distributing system and will soon ask for bids. Plans and specifications are now being prepared.

Bellaire, O.—Supt. M. L. Blackburn writes that a vote will be taken on July 28 on the issue of $50,000 bonds for a water works pumping system.

Brookfield, Mo.—City Clk. Chas. K. Hart writes that the contract for constructing water works has been awarded to Jos. Bowers, of Lincoln, Neb., for $6,000. Guaranteed supply, 500,000 gal. per day.

Genesco, Ill.—Bids are wanted Aug. 1 for furnishing 9,000 ft. of 4-in. water main. Henry F. Horft, City Clk.

Lowell, Mass.—A Special Com. of the City Council has under consideration the proposition to supply city water to Dracut and Chelmsford. The estimated cost of mains, etc., is between $20,000 and $50,000.

Lawrence, Mass.—Local press reports state that the Water Bd. will soon let the contract for constructing the dividing walls at the filter gallery. Amount available for this purpose, $5,000.

Ardsley, N. Y.—The Ardsley Heights Water Co. has been incorporated, with a capital of $50,000. Directors: Henry De F. Baldwin, New Rochelle: C. J. Fay, New York, and Wm. Bradley, Philadelphia.

St. Louis, Mo.—Dir. of Works Taylor writes that it is proposed to build, on the World's Fair site, a reservoir having a capacity of 4,500,000 gal. for fire protection and sports.

The House of Delegates has passed the Council bills appropriating $250,000 for a covered reservoir at Baden; authorizing construction of an office, warehouse and stable in the water works pipe storage yard on Eager Road; appropriating $120,000 for work on the new City Hospital pavilions, and authorizing installation of 3 boilers in the Insane Asylum.

Pittsburg, Pa.—Bids are wanted July 31 for installing foundations for 2 15,000,000-gal. pumping engines at the Brilliant Pumping Station. J. O. Brown, City Recorder.

Ithaca, N. Y.—Bids are wanted Aug. 20 for supplying the city with water by hydrants for fire purposes for a period of 5 and 10 years from Dec. 1, 1902. A. G. Marion, City Clk.

Cincinnati, O.—The United States Const. Co. has received the contract for building a brick chimney at the Eastern Pumping Station, for $14,950.

Pomeroy, Wash.—The Council has voted to construct a system of water works to cost $26,500.

Pauls Valley, Ind. Ter.—Bonds to the amount of $25,000 have been voted for water works by a large majority.

Wilmington, O.—City Clk. Lee Baker writes that at the election held July 22 a vote was taken approving the contract between the Council and J. R. Poindexter, of Cynthiana, Ky., for the construction, maintenance and operation of a water works system.

Dickson, Tenn.—The question of constructing water works at a probable cost of $25,000, is under consideration.

Harrisburg, Pa.—Chas. A. Miller, City Clk., writes that the Sinking Fund Comrs. have decided to receive bids about Sept. 1 for $362,000 bonds, which are part of the $1,090,000 improvement loan authorized at the Feb. election. The Bd. of Pub. Wks. is working upon a revised sewer system, a filtration plant, and a dam in the Susquehanna River.

St. Cloud, Minn.—The Industrial Trust Co., of Providence, has declined the offer of the city to purchase the water works plant for $65,000. The company is said to contemplate the installation of a filtering system.

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until Aug. 8 for steam and feed-water piping and filters, galleries and platforms, H. S. Station No. 1. Hiram Phillips, Pres.

Elyria, O.—Bids will be received by the Bd. of Water Wks. Trus. until Aug. 7 for the following work: 4,605 tons of 6 to 20-in. pipe; 25 tons special castings; stand pipe foundation, and stand pipe 30x120 ft. erected; 2 pumping engines, each of 2,000,000-gal. daily capacity, and 2 boilers complete; a submerged crib in Lake Erie, and 1,500 ft. of 24-in. intake pipe and a pump well; for a complete filter plant with a daily capacity of 2,000,000 gal. of filtered water; hydrants, valves, etc., and for laying 40,500 ft. of force main and about 4 miles of distributing pipes. Geo. E. Crisp, Secy.; L. E. Chapin, Consult. Engr., Canton.

Fowler, Colo.—The Town Council has granted to the Crystal Springs Pipe & Water Co. a 20-year franchise to supply the town with water.

Carnegie, Pa.—A Com. of the Council is considering the matter of constructing municipal water works.

Boyne, Mich.—The City Authorities have under consideration the proposition to pipe a water supply from the North Boyne, 3½ miles above the city, at a probable cost of $20,000.

Springfield, Ill.—City Engr. Frank H. Hamilton and Isaac Withrow estimate that an adequate supply of pure water can be secured for this city at a cost of $25,000.

Colerain, Mass.—Press reports state that bids are being received for the construction of water works estimated to cost $5,000.

Dyer, Tenn.—The citizens are said to be considering the construction of a system of water works.

Kenosha, Wis.—The Bd. of Water Comrs., of this city, is said to be considering plans for the building of a large iron standpipe.

Decatur, Ind.—The City Council has passed an ordinance providing for the general installation of meters.

Middleport, N. Y.—The Village Council has granted Dudley & Johnson a franchise to construct, maintain and operate a complete water works system.

Tuscumbia, Ala.—J. W. Northington, of Sheffield, is reported to have received from the City Council a concession for an electric light plant and water works.

Oakland, Cal.—City Engr. Turner estimates the cost of constructing 12th St. dam at $38,000.

Animas, Colo.—It is proposed to construct water works at a cost of $15,000.

Questa, N. Mex.—The Taos Irrigation & Development Co. has been incorporated with a capital of $1,000,000. Headquarters at Questa.

Victoria, Tex.—The question of issuing $7,500 bonds for laying a 12-in. main from the pump house to the standpipe, received a favorable vote at the election held July 15.

Leadville, Colo.—The Colorado Fuel & Iron Co. has purchased 2,000 acres of land in Lake Park, about 7 miles west of Leadville, upon which it is stated the company proposes to construct a storage reservoir for a reserve supply of water for its plant at Pueblo. Proposed dam to be 40 ft. high and 1,000 ft. across.

Kokomo, Ind.—The City Council has given the Kokomo Water Co. a 12-years' extension of franchise.

Elgin, Ill.—Supt. R. R. Parkin writes that the following bids were opened by the Bd. of Water Comrs. on June 25:

For pumping engine, guaranteed duty 115,000,000 ft.-lbs.: Holly Mfg. Co., $11,550 for 2,000,000-gal.; $13,125 for 3,000,000-gal.; $15,540 for 4,000,000-gal.; $18,375 for 5,000,000-gal.; $21,000 for 6,000,000-gal.; $26,250 for two 3,000,000-gal.; $27,090 for one 4,000,000-gal. and one 2,000,000-gal.

A. E. Rutledge & Co. bid for shaft and tunnel complete, including 2,000,000-gal. pumps with pumping engine, all connections to suction from 4 wells, and water and steam connections complete ready for operation, $55,000; for 2 4,000,000-gal. pumps to be driven by 2 compound condensing high-speed engines, $18,000 (awarded). Shaft and tunnel to be readvertised.

Henry R. Worthington bid as follows for pumps driven by Western Elec. motors: A, 6,000,000-gal., 33 H.-P., $7,700; B, 5,000,000-gal., 33 H.-P., $7,450; C, 4,000,000-gal., 36 H.-P., $6,375; D, 3,000,000-gal., 40 H.-P., $5,575; E, 2,000,000 gal., 40 H.-P., $4,800. If General Elec. motors are adopted, the following amounts are to be added: A, $300; B, $250; C, $200; D, $150; E, $150. For generating units, the bids were as follows: Two 11 and 19x16-in. Buckeye tandem comp. engines, $5,700; two 100-Kw. Westinghouse generators, $5,800; total, including condenser, $13,500; two 12 and 24x30-in. cross comp. Allis-Chalmers engines, $7,500; two 100-Kw. Westinghouse generators, $6,400; total, including condenser, $15,900.

Seattle, Wash.—The City Council has been petitioned for water main extensions in the Denny-Fuhrman addition. Estimated cost, $17,000.

Philadelphia, Pa.—Local press reports state that the Dept. of Pub. Wks. is about to receive bids for building according to revised plans, the Lardner's Point pumping station at the Torresdale filtration plant. The lowest bid received last Feb. for this work on the original plans amounted to $1,440,000. The revised plans are said to provide for a plant estimated to cost $7,000,000.

Sterling, Colo.—F. H. Newell, Ch. Hydrographer, Washington, D. C., is said to be in Sterling for the purpose of considering the advisability of recommending to the Government the construction of a reservoir at this point, to irrigate 285,000 acres of Government land in Colorado and Nebraska.

SEWERAGE AND SEWAGE DISPOSAL.

New Albany, Ind.—The Special Com. of the Council appointed to consider the question of sewerage for the city favors a plan for a general system of sewerage. Councilman McQuiddy and City Engr. Coolman are members of the Com.

Syracuse, N. Y.—Bids are wanted July 28 for constructing a 12 and 15-in. pipe sewer in University Ave. and a 12-in. pipe sewer in Butternut St. Geo. J. Metz, City Clk.

Columbus, Miss.—Press reports state that $50,000 bonds have been voted to complete the present sewerage system, build a standpipe, city hall and public school.

Rapid City, S. D.—Citizens are said to be considering the construction of a sewerage system. Jas. Hartgering, Chmn. of Com.

Tacoma, Wash.—An appropriation of $11,000 has been made for the construction of the Edison trunk line sewer.

Elizabeth, Pa.—The Town Council has passed an ordinance for the construction of an 18-in. pipe sewer on Market St. W. F. Taylor, Burgess.

Pittsfield, Mass.—The Common Council has voted against the order adopted by the Aldermen appropriating $8,500 for surface drainage.

McDonald, Pa.—Local press reports state that this Boro. has engaged Trimble & Miller Co., of Pittsburg, to prepare plans and estimates for a sewer system to cost about $50,000.

Brainerd, Minn.—In a recent communication to the Council, Mayor Halsted recommended that the City Engr. be instructed to prepare plans for a complete system of sewerage, and that provision be made at once for putting in sewers.

Duquesne, Pa.—Bids are wanted Aug. 4 for improving 3 streets; also for constructing sewers in 6 streets. S. A. Taylor, Boro. Engr., Pittsburg.
The Boro. is stated to have sold $70,000 bonds, of which $50,000 is for street work and $20,000 for sewer construction.

Glenville, O.—The City Council has passed a resolution for a storm water sewer for streets west of Doan.

Niagara Falls, N. Y.—City Engr. McCulloh estimates the cost of extending the Chasm Ave. trunk sewer at $17,500 to $19,151.

Des Moines, Ia.—According to local press reports the State Bd. of Control has recommended that contracts for sewage disposal plants at 3 State institutions be awarded to the Cameron Septic Tank Co., of Chicago, Ill., as follows: Orphans' Home, Davenport, for $4,450; Mt. Pleasant Insane Hospital, for $7,250; and Industrial School at Mitchellville, for $2,625.

Bluefield, W. Va.—Bids are wanted Aug. 1 for constructing a sewerage system. F. E. Carter, Chmn. Com.

York, Pa.—Bids will be received by John R. Lafean, Chmn. Highway Com., until July 31 for furnishing material for improving the highway with about 10,350 ft. of 20, 24 and 30-in. terra cotta pipe sewer and about 2,090 ft. of 3 and 4-ft. brick sewer. Bids will also be received for furnishing material for paving Highway with about 12,875 sq. yds. vitrified brick paving, 12,000 sq. yds. sheet asphalt, 19,500 lin. ft. of macadamizing and 20,000 lin. ft. of grading.

Swissvale, Pa.—Bids will be received by the Boro. of Swissvale until July 28 for the purchase of $20,000 sewer bonds. R. W. Cummins, Chmn. Finance Com.

Harrisburg, Pa.—Bids are wanted July 31 for constructing a sewer in Pine St. M. B. Cowden, City Engr.

Jamestown, N. Y.—City Clk. Clement B. Jones writes that the contract for extending the sewer system has been awarded to Mahoney Bros. & Gardner. Local press reports gave the estimated cost of this work as about $35,000.

Villisca, Ia.—J. J. Dunnegan, of Shenandoah, Ia., is stated to have received the contract for constructing a sewer system for $6,000.

Stevens Point, Wis.—About 1½ miles of sanitary sewer is about to be built by this city at an estimated cost of $11,000.

Ames, Ia.—The City Council has engaged Prof. A. Marston, of Ames, to draft plans for a complete system of sewers for Ames.

Franklin Falls, N. Y.—The question of extending the sewer system, at a cost of $25,000, is under consideration.

Grinnell, Ia.—Mayor H. W. Spaulding writes that bids will be opened Aug 5 for the construction of a septic tank for sewage disposal; capacity, 250,000 gal. Prof. A. Marston, of Ames, Ia., Engr. in Charge.

Dunkirk, N. Y.—The Council has ordered a sewer in Roberts road, tile, 20-in., about 1 mile long, with earth excavation; also a sewer in Doughty and King Sts., 1,050 ft. long, 15-in. tile, and bids for same will be opened July 29. Plans and profiles on file in office of City Engr.

Jefferson, Ia.—Local press reports state that probably a complete drainage and sewer system will be built in the near future.

Brockport, N. Y.—Thos. Holahan, of Rochester, is stated to have received the contract for constructing the sewerage system. Appropriation, $75,000.

Dike, Ia.—Local press reports state that a sewerage system is to be put in for this place.

Cleveland, O.—Bids are wanted Aug. 5 for constructing sewers in portions of 4 streets. Chas. P. Salen, Dir. of Pub. Wks.

Wyoming, O.—Bids are wanted Aug. 1 for the purchase of $10,000 sewer bonds. W. A. Clark, Village Clk.

West Carthage, N. Y.—Bids are wanted July 31, for constructing a sewer system. W. M. Vincent, Clk. acting Bd. Sewer Comrs.

Beloit, Wis.—Robt. Caldwell, C. E., writes that all bids opened July 7 for 2,700 ft. of 20-in. and 900 ft. 8-in. pipe sewers have been rejected; also that bids will be opened Aug. 8 for 9,000 ft. of 8 to 12-in. pipe sewers.

Cheyenne, Wyo.—City Engr. W. D. Pease writes that it is proposed to build 5,000 ft. of 24-in. pipe sewers, but bids for same have not yet been asked. Probable cost, $15,000.

Wilmont, Minn.—Local press reports state that bids are wanted Aug. 5 for the construction of sewers. S. L. Long, Village Recorder.

Elkhart, Ind.—Bids are wanted Aug. 6 for constructing a 12-in. sewer. Kit McKean, City Clk.

Trenton, N. J.—Bids are wanted Aug. 5 for the construction of sewers in Fall and Warren Sts. C. Edw. Murray, City Clk.

Tecumseh, Mich.—The question of constructing a sewerage system is being agitated.

Mt. Pleasant, Mich.—Willis F. Brown, 55 Law Bldg., Toledo, has completed plans for a main sewer in Dist. No. 7, about 4,000 ft. in length; also plans for dividing the city into sewer districts.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that W. J. Stevenson & Co. received the contract for constructing a sewer in Sewer Dis. No. 148, for $3,199.

Galveston, Tex.—The Bd. of City Comrs. has decided to lay pipe sewers along Tremont St., work to be done by the city, by day labor, but bids for furnishing to the city vitrified or cement sewer pipe in the following quantities will be received: Aug. 9, 2,000 ft. 36-in., 1,500 ft. 30-in., 700 ft. 24-in., 600 ft. 18-in. and 2,500 ft. 12-in., with Y branches as follows: 60 36-in.x12-in., 50 30-in.x12-in., 40 24-in.x12-in. and 30 18-in.x12-in. Bidders to state prices f. o. b. cars at point of manufacture and prices f. o. b. cars at Galveston. John D. Kelley, Secy. Bd. of Comrs.; C. G. Wells, City Engr.

Hanover, Pa.—Chauncey Ives, of Chambersburg; Wm. McLean, A. C. Huntzinger and others are said to be making arrangements for the building of a sewerage system, with septic tank sewage disposal plant.

Buffalo, N. Y.—Bids are wanted July 31 for constructing 12-in. tile sewers in Trenton Ave., a 10-in. tile sewer in Gesl St. and 20 to 12-in. tile sewer in Cable St. Francis G. Ward, Comr. of Pub. Wks.

Waterbury, Conn.—The lowest bid received July 15 for the storm water conduits and drainage system on Dublin and several other streets was from Patrick F. Sutton at $8,554. The Bd. of Pub. Wks. voted to reject all bids and to receive new bids for above work on Aug. 5. Local press reports state that bids are wanted until Aug. 12 for the extension of the sewer on Benedict St.

Long Island City, N. Y.—Bids are wanted July 31 for constructing 1,984 lin. ft. of 24-in. pipe sewer in Lincoln Ave. (late village of Jamaica). Jos. Cassidy, Pres. Boro. of Queens.

Brooklyn, N. Y.—Bids are wanted July 30 for constructing several sewer basins. J. Edw. Swanstrom, Pres. Boro. of Brooklyn.

Cincinnati, O.—Bids are wanted Aug. 14 for the improvement of Quebec and Jonte Aves. by constructing a trunk sewer and drains. Robt. Allison, Pres. Bd. of Pub. Service.

Carthage, N. Y.—The State Bd. of Health has approved plans for the West Carthage sewer system.

The proposition to construct a $20,000 sewer system for West Carthage carried at the election held July 12.

Sioux City, Ia.—The City Council has instructed City Engr. Lewis to prepare plans and estimates for storm sewers, to cost about $15,000.

New York, N. Y.—One bid only was received July 18 by Jacob A. Cantor for building sewers in Wicker and Van Corlear Places, that of Wm. E. Welch, which has been recommended for award. In detail it is as follows: 215 ft. 3½x2 1/3-ft. brick sewer at $9; 1,260 ft. of 15-in. vitrified pipe sewer, at $6; 60 ft. of 12-in. pipe sewer, at $4; 2 receiving basins, at $200; 1 gully trap, at $300; 1,925 cu. yds. rock excavation, at $4, and 4 M. ft. timber, at $40; total, $18,295.

BRIDGES.

Oswego, N. Y.—It is stated that a committee has been appointed to estimate the cost of repairing the old bridge and also the cost of a new structure. F. W. Ormsby, City Engr.

Glenolden, Pa.—Press reports state that the Philadelphia, Wilmington & Baltimore R. R. has offered to place a bridge over the tracks at Ashland Ave. W. H. Brown, Chief Engr.

St. Marys, O.—The Toledo & Ohio Central Ry., it is reported, will build a bridge over the canal in St. Marys. C. Buxton, Chief Engr.

Cincinnati, O.—Press reports state that Co. Engr. Krog has submitted to the Co. Comrs. specifications for a $200,000 bridge over the Big Miami River near Elizabethtown. Cost of approaches, $49,385; superstructure and roadway, 586 ft. long, $115,000.

Oshkosh, Wis.—Press reports state that Ericson & Lehman, of Chicago, Ill., are preparing plans for a 50-ft. concrete and steel bridge, to be built in this city at a cost of $10,000.

Rutledge, Tenn.—It is stated that the Co. Court has voted to build an $80,000 bridge across Holston River, and that the contract for construction will probably be let the middle of August.

Harrisburg, Pa.—The Bd. of Viewers appointed to report on the condition of the Millerstown bridge across Juniata River, which was destroyed by fire June 10, report that the bridge, including the abutments and piers has been destroyed, and recommend replacing it with a $92,000 structure.

Pleasanton, Cal.—The Co. Bd. of Supervisors has adopted plans prepared by the Co. Surveyor for the construction of a concrete bridge across Arroyo del Valle Creek, north of Pleasanton, estimated to cost $12,000.

Cayuga, Ind.—The proposition to construct a $12,000 bridge across Wabash River, this city, has, according to reports, carried.

St. Marys, O.—The Massillon Bridge Co., Massillon, O., is reported to have secured the contract to construct a bridge at South St. for $5,200.

Rome, N. Y.—Bids will be received by Chas. S. Boyd, Supt. of Pub. Wks., at his office in the Capitol at Albany, N. Y., until July 30 for constructing a bridge across the Erie Canal at So. James St., Rome.

Tell City, Ind.—Bids are wanted by the Bd. of Co. Comrs. until Aug. 4 for constructing a bridge 101 ft. long and 14 ft. wide. Albert P. Fenn, Co. Aud.

Germania, Wis.—Bids are wanted July 29 for constructing 2 stone abutments for a bridge to cross the south branch of Embarrass River at the Swanke Mill site (section 13), town of Germania. Address H. W. Mueller.

Atlantic City, N. J.—Bids are wanted Aug. 6 for the construction of 3 bridges on the county road near Weekstown. For specifications address John T. Irving, Elwood, N. J.

Boston, Mass.—Ch. Engr. Wm. Jackson writes that the following bids were opened July 17 by the Cambridge Bridge Comn. for building 2 masonry abutments for Cambridge bridge. Bidders all of Boston: Holbrook, Cabot & Rollins, $168,000 (awarded); Patrick McGovern, $170,250; Jones & Meehan, $174,800; Lawler Bros., $176,316. The pile and concrete foundations are, each, 61½x170 ft. long; materials, about 15,000 cu. yds. concrete, 1,000 cu. yds. granite, and 4,200 piles. Work is to be completed by Aug. 1, 1903.

Logansport, Ind.—Bids are wanted Aug. 5 for repairing an iron bridge in Tipton Township and for constructing a stone arch culvert in Miami Township. J. G. Powell, Co. Aud.

Elmira, N. Y.—Bids are wanted July 31 for building abutments for bridges across Hoffman Creek at 1st and 3d Sts. M. H. Murphy, Clk. Bd. of Pub. Wks.

McCook, Neb.—Bids are wanted Aug. 5 for furnishing all material and constructing a bridge across Republican River. E. J. Wilcox, Co. Clk.

Coffeeville, Miss.—Bids are wanted Aug. 4 at the Chancery Clerk's office in Water Valley, for the building of several bridges in Yalobusha County. J. D. Halle, Clk.

Boston, Mass.—Bids are wanted Aug. 4 for building abutments and approaches for Wellington Bridge, Middlesex Fells Parkway, Somerville and Medford. Wm. T. Pierce, Engr. Metropolitan Park Comn.

Glenwood, Ia.—It is reported that the Mills Co. Bd. proposes to build an iron bridge west of the town.

Allegheny, Pa.—Press reports state that an ordinance has been passed by the Select Council for rebuilding and relocating the Superior Ave. viaduct over the R. R. tracks from California Ave. to Pacific Ave., with approaches on Preble Ave. and W. Market St.

Stockton, Cal.—Local press reports state that the contract for the McMullen Lake bridge was awarded to M. B. White for $13,144.

Gallipolis, O.—It is reported that the lower iron bridge has collapsed.

Sullivan, Ill.—Press reports state that an iron bridge will be built across the Okaw east of town by Sept. 1. Main span, 60 ft. Approaches, 50 ft. and 16 ft.

Cedar Falls, Ia.—The Cedar Falls & Waterloo Rapid Transit Co. is reported to have estimated its loss due to floods at $15,000 to $18,000. The bridge crossing Dry Run is the heaviest loss.

Emporia, Kan.—The Lyon Co. Comrs. are being petitioned for two bridges across the Cottonwood, one south of the poor farm and one in the Fowler settlement, 2 miles east of the Columbia Ford bridge. Cost of each, $6,000 or $8,000.

Sault Ste. Marie, Mich.—Press reports state that the Co. Bd. of Superv. has granted the petition of Drummond Township to construct a bridge across Pottaganissing River. It is also reported that Road Comr. Splan is making an estimate of the cost of replacing Co. bridges with steel structures.

Philadelphia, Pa.—The Bureau of Highways is reported to have set aside $65,000 for repairing and building bridges.

Dyersville, Ia.—The Bd. of Superv. is considering the matter of replacing the bridge over the Maquoketa River with a 168-ft. single span steel bridge at a cost of about $5,000.

Greensburg, Pa.—Petitions are being circulated for a joint Co. bridge over the Monongahela between the towns of Donora and Webster.

Hanford, Cal.—The Kings Co. Supervisors are considering building 2 bridges over Kings River and New River.

Fresno, Cal.—Local press reports state that Fresno Co. will construct a road connecting Laton with the road leading north from Hanford, bridge Old Dutch John Cut, and continue the road to connect with the Selma thoroughfare.

Mitchellville, Ia.—The bridge over Skunk River, 3 miles north of town, is reported washed away.

Colesville, N. Y.—The $22,000 issue of bonds of the town of Colesville to pay for a bridge to be built at Nineveh is reported purchased by the Binghamton Savings Bank.

Boone, Ia.—It is reported that several thousand dollars' damage has been done to the Boone viaduct by flood.

Akron, O.—Press reports state that the City Council has under consideration the erection of a viaduct across Mill St.

Omaha, Neb.—Local press reports state that City Engr. Rosewater and Chief Engr. J. B. Berry, of the Union Pacific, have come to an agreement in regard to building two viaducts, one at Martha St. at the intersection of the U. P. and Burlington tracks to cost $50,000, and one crossing the U. P. tracks at Capitol Ave. and 8th St. to cost $30,000. The plan will have to receive the indorsement of Pres. Burt and the City Council before definite preparations are made.

Ann Arbor, Mich.—Press reports state that $25,000 will be needed to rebuild 7 culverts damaged by flood.

Luray, Va.—It is stated that an iron bridge will be constructed across the creek in Luray. Span, 100 ft.; width, 18 ft.

Greenville, Pa.—Press reports state that the Mercer Co. Comrs. will build an iron bridge over the river at Main St. Cost, $12,000.

Somers, Conn.—It is reported that a steel bridge 65 ft. span and 25 ft. wide will be built over the Scantic River by the town.

Columbus, O.—It is reported that the contract for the Hayden Run bridge was not legally let, and will have to be readvertised for.

Syracuse, N. Y.—Local press reports state that the D., L. & W. R. R. has agreed to the building of the Butternut St. bridge across the Oswego Canal and the doing away with the coal sheds at that place. To be an overhead steel girder bridge. Cost of improvement, $12,000; city to pay $5,000.

Ft. Plain, N. Y.—It is reported that State Supt. of Pub. Wks. Boyd has awarded the contract for construction of a bridge over Osaquago Creek to the Owego Bridge Co. for $6,822.

Joliet, Ill.—It is reported that the Highway Comr. proposes to replace the Red Mill bridge with a concrete arch.

Sonyea, N. Y.—See "Public Buildings."

Cleveland, O.—Press reports state that Supt. of Track Elev. Breen considers two more viaducts necessary, one near Hoppie St., Cumminsville, and the other over Wood St. near the entrance of the Grand Central Depot.

PAVING AND ROADMAKING.

Memphis, Tenn.—Of the 14 streets ordered paved by the City Council on May 8, it has been decided to lay asphalt on 10 streets, brick on 2 streets, gravel and block stone on the other 2 streets. Amount available for this work, $225,000. J. J. Williams, Mayor. A. T. Bell, City Engr.

Worcester, Mass.—Both branches of the City Council on July 21 passed, almost unanimously, the order for a loan of $80,000 for the paving of Main St. with granite block.

Boston, Mass.—Jas. Donovan, Supt. of Streets, has placed the estimated cost of repaving a portion of Albany St. with granite block at $56,700.

Buffalo, N. Y.—Bids will be received by the Dept. of Pub. Wks. until Aug. 5 for paving a portion of South St., and for repaving portions of Clinton St.; also for macadamizing a portion of Parkside Ave. Francis G. Ward, Comr. Pub. Wks.

Tyrone, Pa.—Bids will be received by the Boro. Highway Com. until July 29 for block pavement on 10th St., requiring about 3,700 sq. yds. of paving. W. Fisk Courad, Chmn.; J. Luden Henry, Boro. Engr.

New York, N. Y.—Bids are wanted Aug. 4 for repaving with asphalt on present block pavement the roadway of Forest and Park Aves., requiring 41,665 sq. yds. asphalt pavement, including binder course; 41,775 sq. yds. old stone pavement to be relaid as foundation, etc.; 17,550 lin. ft. bluestone curbing, furnished and set, and 5,700 lin. ft. of old curbstone, rejoined and reset; for repaving with asphalt on a concrete foundation the intersections of several streets, requiring about 3,700 sq. yds. of asphalt, including binder course, and for paving with asphalt on a concrete foundation a portion of Washington Ave., requiring 65,300 sq. yds. of asphalt, including binder course; 11,250 cu. yds. concrete, 28,800 lin. ft. of old curbstone, rejoined when necessary and reset. Louis F. Haffen, Pres. Bronx Boro.

Bids are wanted July 29 for regulating and repaving with asphalt pavement on present pavement relaid as foundation the roadways of numerous streets; the engineer's estimates call for 64,830 sq. yds. of asphalt in all. Bids are also wanted at the same time for regulating and repaving with granite block on concrete foundation the roadways of 2 streets, in all 3,570 sq. yds. of paving. Jacob Cantor, Boro. Pres.

Cincinnati, O.—Bids are wanted Aug. 19 for improving a portion of Beekman St. by grading, setting granite curbs and crossings, and paving the roadway with granite block. Geo. F. Holmes, Clk. Bd. Pub. Service.

Cleveland, O.—The County Comrs. have sold bonds to the amount of $91,000 for Kinsman Road improvement.

Erie, Pa.—An ordinance before the Council provides for the issue of $7,700 bonds for the repaving of a portion of 4th St.

Oakland, Md.—Bonds to the amount of $8,000 are said to have been authorized for paving purposes.

Bushnell, Ill.—The Council is said to be preparing to pave several streets.

Arcola, Ill.—Press reports state that Locust St. is to be paved at a cost of $15,000.

St. Paul, Minn.—The Com. on Roads & Bridges of the Bd. of Co. Comrs. estimate $35,000 as the amount required for the current year.

Frederick, Md.—The estimated cost of repaving with brick 2 blocks on E. Church St. is placed at $10,000.

Boise City, Idaho.—Local press reports state that on July 31 bids will be received for furnishing a 12-ton steam roller, a rock crusher, capacity 10 to 20 tons, and a 24-in.x6-ft. revolving screen.

It is proposed to pave S. 8th St., probably with brick.

Mt. Gilead, O.—Plans for paving Marion St. have been approved by the Council.

Louisville, Ky.—The City Engr. has been instructed to prepare plans for macadamizing and paving with granitoid, Mechanic, Graham and Fulton Sts.

Newark, N. J.—The Bd. of Wks. has passed ordinances for the paving of several streets.

Knoxville, Tenn.—The Jefferson Co. Comrs. have decided to build an additional 10 miles of pike road to be located on the Maryville line, extending southwest from Dandridge.

Jersey City, N. J.—The Bd. of Finance has received a petition for the repaving of Grand St. from Hudson St. to Pacific Ave., with granite block. Estimated cost, $97,546.

Beaumont, Tex.—Local press reports state that Calder Ave. is to be paved for its entire length.

Decatur, Ill.—Local press reports state that W. Main St. is to be paved with asphalt to the west end of the University grounds.

Jamestown, N. Y.—City Clk. Clement B. Jones writes that a portion of Forest Ave. is to be paved with brick.

Chester, N. Y.—Street improvement bonds to the amount of $16,800 are stated to have been sold.

Williamsport, Pa.—The Highway and Sewer Committees are about to let a contract for paving Park St., at a cost of $5,700.

Memphis, Tenn.—The sum of $15,000 has been guaranteed by certain citizens toward the paving of Central Ave. with asphalt, for a distance of about 2 miles.

Bloomington, Ill.—City Engr. Elmer Folsom writes that asphalt pavement is to be laid on Monroe and Jefferson Sts., also on Colton and Towanda Aves., in all about 9,000 sq. yds.

St. Marys, O.—Bids are wanted Aug. 9 for furnishing material, grading, curbing with stone and paving with brick or sheet asphalt, portions of Wayne St. J. H. Rowe, Jr., Clk.

York, Pa.—See "Sewers."

Cleveland, O.—Bids are wanted Aug. 13 for grading, draining, curbing and paving portions of Petrie St. with Medina dressed block stone on a 6-in. concrete foundation. Chas. P. Salen, Dir. of Pub. Wks.

West Hoboken, N. J.—Bids will be received by the Town Council until July 30 for paving High Point Ave. John P. McMahon, Town Clk.

Thompson, Conn.—Bids will be received by the Bd. of Selectmen until July 28, for grading and macadamizing a section of road in this town. Oscar Tourtellotte, Chmn. Bd. of Selectmen.

Philadelphia, Pa.—Local press reports state that the following bids were opened July 22 for paving about 5 or 6 miles of streets with asphalt, and for repaving about 10 miles with asphalt: Vulcanite Paving Co., from $2.54 to $2.59 per sq. yd. for new paving, and $2.28 to $2.57 for repaving; Pennsylvania Asphalt Paving Co., $2.52 to $2.61 for new, and $2.43 to $2.59 for repaving.

Little Rock, Ark.—The City Council has passed an ordinance appropriating $30,000 for the paving of W. Markham St. with asphaltum.

Seattle, Wash.—The City Engr. estimates the cost of proposed brick paving on Union St. at $70,000.

Charleston, W. Va.—Street paving bonds to the amount of $70,000 were authorized at the election held July 21.

Duquesne, Pa.—See "Sewerage and Sewage Disposal."

Dorchester, Mass.—Bids will be received by Jas. Donovan, Supt. of Streets, until July 30, for constructing a macadam road on Moultrie St.

Vincennes, Ind.—It is stated that bids are wanted Aug. 15 for constructing about 22 miles of gravel roads in Washington Township. J. D. Williams, Co. Aud.

Fort Sheridan, Ill.—It is stated that bids are wanted Aug. 12, for constructing macadam road at the military reservation. Col. E. B. Atwood, Chmn. Q. M., Chicago.

Newport, Ind.—Bids are wanted Aug. 19 for constructing gravel roads in Clinton Township, in all about 22 miles. Wm. P. Bell, Co. Aud.

Trenton, N. J.—Bids are wanted Aug. 5 for the paving of a portion of East Front St. with sheet asphaltum over Belgian block. C. Edward Murray, City Clk.

Local press reports state that the Common Council proposes to expend $35,000 in repairing and repaving with sheet asphaltum the principal streets in the center of the city.

Indianapolis, Ind.—Bids are wanted Aug. 4 for improving certain alleys by paving with brick. Harold C. Megrew, Chmn. Bd. of Pub Wks.

Verona, Pa.—Bids are wanted July 28 for grading several streets, in all 39,000 cu. yds. Frease & Sperling, Boro. Engrs.

Duluth, Minn.—Bids are wanted by the Town Bd. of Superv. until Aug. 1 for building ½ mile of wagon road in sections 33 and 34, in town 53, range 12. R. S. Postal, Town Clk., Molde, Minn.

Ocean City, N. J.—Bids are wanted July 28 for the purchase of $85,000 street improvement and fire bonds. Ira S. Champion, City Treas.

Ft. Scott, Kan.—City Clk. J. O. Brown writes that in the near future contracts will be let for 25 blocks of vitrified brick paving. U. S. Stoner, City Engr.

Beloit, Wis.—The Bd. of Pub. Wks. is planning to pave portions of School St., Prairie Ave., C, E and Bridge Sts. with brick and macadam. Probable cost about $60,000.

Marshalltown, Ia.—The City Council proposes to pave S. 3d Ave. with 1 course of brick upon old macadam, about 8,600 sq. yds. paving and 5,000 ft. of curbing. Wm. Bremner, City Engr.

Ashland, Wis.—City Engr. M. T. Dozer writes that the Bd. of Pub. Wks. will receive bids Aug. 7 (readvertisement) for macadamizing certain streets, in all 8,970 sq. yds., with 2,250 cu. yds. of excavation and 4,000 lin. ft. of curb.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that asphalt paving contracts, for which bids were opened July 16, have been awarded as follows: To Barber Asphalt Paving Co., Lydia Ave., at $2.15 per sq. yd., also Woodland Ave., at $2.15; to Parker-Washington Co., Illinois Ave., at $2.15 per sq. yd.

East Grand Forks, Minn.—Recorder Henry Harm writes that the bids for paving to have been opened July 15, as stated in The Engineering Record of July 5 have been laid over until Aug. 5, an error in the advertising necessitating this delay. There will be about 33 blocks of paving, material not decided; bidders may bid on any kind of material, but will have to furnish their plans and specifications.

Galveston, Tex.—The Bd. of City Comrs. has decided to pave a portion of Tremont St. with brick, 7,094 sq. yds., work to be done by the city by day labor. Bids for furnishing to the city 500,000 best quality vitrified brick of standard size will be received until Aug. 9, delivery to begin within 30 days from date of contract; bidders to state prices f. o. b. cars at point of manufacture; also prices f. o. b. cars at Galveston. Jno. D. Kelley, Secy. Comrs.; C. G. Wells, City Engr.

Lowell, Mass.—The Common Council has passed an order appropriating $38,390 for the paving of several streets with asphalt.

Atchison, Kan.—On July 14 the Council passed a resolution declaring it necessary to grade, pave with brick and curb with cement Division St. Fred Giddings, City Engr.

Lead, S. D.—City Aud. S. E. Crans writes that in about 60 days bids will be received for 1 mile of brick for stone paving. J. P. Crick, City Engr.

POWER PLANTS, GAS AND ELECTRICITY.

New Castle, Pa.—Regan & Muliock, of Philadelphia, are stated to have received the contract for building the municipal conduit system. The cost to be $40,908; all telephone, telegraph and electric light wires, on the main streets, to be buried.

Livingston, Mont.—E. Goughnour has asked the City Council for a franchise to install an electric light plant, and erect poles on the streets.

Tucson, Ariz.—Press reports state that the Electric Light & Power Co. proposes to add a new gas plant to its works.

Roswell, N. M.—The Roswell Electric Light & Power Co., of Roswell, has been incorporated by Carl Morris Bird, Chas. F. Bode, of Roswell, and others. Capital, $40,000.

Reading, Pa.—The Reading Power Co. is stated to have been organized by Robt. N. Carson, Henry C. Moore and Edw. J. Moore, of Philadelphia, and others, for the purpose of building a $1,000,000 plant, to supply this city and other towns and boroughs in the county, with light and power.

Winnsboro, S. C.—Bonds to the amount of $10,000 have been voted for a municipal electric light plant.

Plainwell, Mich.—The Plainwell Construction Co., capital $50,000, and the Plainwell Power Co., capital $100,000, have been organized to develop water power along the Kalamazoo River, especially at Plainwell and Allegan.

West Seneca, N. Y.—The West Seneca Light, Heat & Power Co. has been incorporated with a capital of $200,000. Directors: E. B. Smith, C. A. Hahl and H. N. Kraft, of Buffalo.

Paducah, Ky.—See "Electric Railways."

York Haven, Pa.—The York Haven Water & Power Co., through Pres. Carter and Judge Stewart, has awarded the contract, for the erection of the transforming station in West Manchester Township, on the northern extremity of Jackson Ave., to Spangler & Bro., of East York, Pa. According to plans prepared by J. A. Dempwolf, of York, the structure will be 90x56 ft., with an annex 34x23 ft., all of fireproof construction.

Natchez, Miss.—The Natchez Light, Heat, Power & Transit Co. has been reorganized, and it is stated that extensive improvements will be made to the plant and its equipment. A. G. Campbell, Pres.; E. H. Ratcliff, Vice-Pres.; Marshall Gaither, Secy.; A. N. Jacobs, Treas. and Gen. Mgr.

Kalamazoo, Mich.—Frederick N. Rowley, of Kalamazoo, and Wm. A. and Jas. B. Foote, of Jackson, are stated to have formed a company, with $50,000 capital stock, to control the water power of southwestern Mich., and furnish electricity for projected interurban roads, and for lighting.

Jackson, Miss.—Local press reports state that the Capitol Comrs. propose soon to let contracts for the erection of the power plant and the wiring of the new Capitol; also for grading and improving the grounds. The two contracts, which will be let separately, will amount to about $80,000.

Lansing, Mich.—The Grand River Electric Co. has been organized at Lansing to build a dam at Delta, 6 miles from Lansing on Grand River, for the purpose of furnishing electricity for heat, lighting and power in Lansing. Capital stock of $50,000. It is expected to generate between 1,000 and 1,500 H.-P. S. E. Jarvis, of Lansing, and Glen D. Smith, of Jackson, are said to be the principal incorporators.

Rockport, Mich.—Articles of association have been filed by the Rogue River Electric Light & Power Co., organized for the purpose of furnishing this village with electricity.

Stromsburg, Neb.—J. B. Buckley and F. E. Holden are reported to have formed a company to build a $15,000 electric light plant.

Decatur, Ind.—The Decatur Oil & Gas Co. has asked for franchise for the purpose of piping gas through the streets.

Marietta, O.—The Union Natural Gas Co. has been formed, with a capitalization of $6,000,000 and an authorized short term bond issue of $2,000,000. The new company has absorbed the gas properties of T. N. Barndall in W. Va. and Ohio. A pipe line will be laid from the Lewis field in W. Va., and other lines will be laid in the Ohio field. The company was organized by R. C. Hall & Co., stock brokers. Mr. Barndall is said to be a heavy stockholder.

Bellefontaine, O.—The City Council has passed a resolution appropriating $15,000 for the improvement of the gas works.

Riverside, Cal.—The City Trustees have under consideration a proposition from Prof. C. G. Baldwin to sell to the city his water right in Mill Creek Canyon, including an extensive raft for $50,000; he estimates that a plant adequate to develop the power from this water supply would cost about $200,000. The proposition to issue $300,000 bonds (the additional $50,000 to be used in extending the present system) may be submitted to a vote of the people.

Gallipolis, O.—City Clk. Geo. F. Bovie writes that a franchise has been granted to Maxon & Eysenbach, of Coshocton, O., for constructing an electric light plant and furnishing the city with light for a period of 10-years, their bid submitted July 15 being as follows: $52.75 per arc lamp per annum, moonlight schedule: 50 16 c.-p. incandescent lamps at $5 per lamp per annum.

Bennettsville, S. C.—Bids are wanted Aug. 15 for the purchase of $12,000 electric light bonds. J. M. Jackson, Chmn. Bd. of Pub. Wks.

Beaver, Utah.—Bids are wanted by the Majestic Co., W. M. White, Engr., until Aug. 1 for the construction of the 3 lower dams, to develop 1,800 H.-P. (approximate cost $50,000), for the power plant in Beaver Canyon. The dimensions of the dams are given as follows: Dams Nos. 1 and 2 will be 290 ft. long, 300 ft. thick at the base, 10 ft. thick at the top and 76 ft. high; dam No. 3 will be 144 ft. thick at the base, 10 ft. at the top and 36 ft. high. Mr. Lewis is Pres. of the Co.

Willows, Cal.—Bids are wanted Aug. 11 for a franchise to supply this town with electric power and light as applied for by the Northern Cal. Power Co.

Elkton, Md.—The Elkton Gaslight Co. proposes to erect, in the near future, a 25,000 ft. holder; also to extend its mains.

Postville, Ia.—Town Clk. Wm. Shepherd writes that on July 14 it was voted to grant a franchise for a gas plant.

Chicago, Ill.—The Chicago, Milwaukee Ave. & Inland Lakes Traction Co., of Chicago, has been incorporated, with a capital of $50,000, to operate street railway, light, heat and power plant. Incorporators: S. A. Walther, J. A. Walther and G. F. Lanaghan.

Cleveland, O.—The Council is stated to have passed the ordinance providing for the placing of all wires in the city underground, within 2 years.

Joliet, Ill.—A trust deed for $1,000,000 is stated to have been filed by the Joliet Gaslight Co. to secure funds for the erection of a new plant in this city and the extension of the present system.

Pontiac, Ill.—Press reports state that the Home Gas Co. has secured a 30-year lease on property on Sanderson Ave., and will at once commence the erection thereon of a gas and electric plant, the company to be capitalized at $100,000.

Norristown, Pa.—The County Comrs. have awarded contracts for work on the court house as follows: Heating and ventilating to Wm. Miller & Sons, their bid being $14,000, with motors, etc., and $13,575 without motors; lighting with electricity, to E. P. Strong & Co., their bid being $7,061, with fixtures, etc., and $4,629 without fixtures.

The Council has passed an ordinance granting to the Norristown Steam Heating Co. the right to lay conduits and pipes for the general heating of houses, etc.

Washington, D. C.—The Walter Motor & Power Co. has been incorporated at Wilmington, Del., with a capital of $1,000,000. Incorporators: Wm. L. Walter, of Port Huron, Mich.; Sam. W. Smith and Edgar Weeks, of Michigan; Burtt H. Rockway and Hopewell H. Darneille, of Washington, and others. Washington office of Co., 313 John Marshall Pl., N. W.

Trinidad, Colo.—The City Council has passed ordinances granting to Seth Hartley a franchise for the construction of an electric railway connecting Trinidad with the towns Starkville and Sopris, and an ordinance granting to him a 5-year franchise for lighting the city with electricity, provided the road is built.

Los Angeles, Cal.—Local press reports state that Pres. John B. Miller, of the Edison Electric Co. confirms the sale by his corporation of $10,000,000 bonds, the money to be used in betterments and general expansion. Of the sum, $3,000,000 will be available at once, and $7,000,000 will be on call for use in the next 5 years.

Baker City, Ore.—A. B. Frame, of Portland, is making surveys for the flumes and building of the proposed power plant; the City Council, of Baker City, some time ago granted Mr. Frame an electric light franchise.

Rushford, Minn.—Bids will be received by C. O. Alm, City Clk., until Aug. 15, for the purchase of $7,000 electric light bonds.

Springfield, Mass.—It is stated that the Springfield Gas Co. has asked permission to increase capital stock by $250,000, to pay for additions to plant and pipe lines.

Romeo, Mich.—Bids will be received by the Bd. of Electric Light Comrs. until Aug. 7 for erecting a brick chimney with a 3-ft. 6-in. flue. Byron N. Seaman, Clk.

Beaumont, Tex.—The Eclipse Power Co., of Beaumont, capital stock $10,000, is reported incorporated by D. O. Lurly, H. R. Decker and others.

Broad Brook, Conn.—The Broad Brook Mill Co. is contemplating the installation of an electric plant to furnish 1,200 lights in the mill.

Columbus, O.—The Citizens' Lighting & Heating Co., of Columbus, is reported incorporated, with $10,000 capital stock, by J. W. Barber, J. D. Karns and others. The purpose is to furnish electric light and hot water heating.

St. Cloud, Minn.—A. G. Whitney, of the Sauk Rapids Power Co., St. Cloud, writes that he proposes to construct a water power dam at Sauk Rapids. Probable cost, $85,000 to $100,000.

Detroit, Mich.—Bids will be received by the Pub. Lighting Comr. until Aug. 29 for furnishing one 900-H.-P. engine, one 600-Kw. alternator, one 60-Kw. exciter and 320,000 pairs carbons.

Bordentown, N. J.—The Bordentown Electric & Motor Co. has filed an amended certificate of incorporation, which enlarges its scope to include the furnishing of power to the Camden & Trenton Ry. for several counties in this and other sections of the State. Dr. J. S. Gilbert is Supt. of both companies.

Chicago, Ill.—The Power House of the Consolidated Traction Co., at Ridgeland Ave. and Lake St., is reported to have been damaged by fire.

Massena, N. Y.—The St. Lawrence River Power Co. has been incorporated with a capital of $7,000,000. The directors are Henry P. Davison, of Englewood, N. J.; Mark T. Cox, of East Orange, N. J.; Samuel E. Porter, of New York, and others.

Tuscumbia, Ala.—See "Water."

York, Pa.—The plan to develop the water powers near McCall's Ferry, on the lower Susquehanna River, is now promised fulfillment by the formation of a syndicate by the Continental Trust Co., of Baltimore, controlling the United El. Lt. & Power Co., of Baltimore, and the Mt. Washington El. Co.

Niagara Falls, N. Y.—The Ontario Power Transmission Co. (directors, Jno. J. Albright, Edmund Hayes and Geo. S. Field, of Buffalo, and J. S. Simmons and S. P. Franchot, of Niagara Falls), has applied for a franchise to distribute current through the city from a water power plant to be developed at the Dufferin Islands, on the Canadian side of the river.

ELECTRIC RAILWAYS.

Nashville, Tenn.—Surveys are being made under the supervision of Prof. C. F. Brown, of Vanderbilt University, for 17 miles of the road, to be in all 53 miles long, which is to be built by the Nashville & Lewisburg El. Ry., from Nashville to Lewisburg.

Kalamazoo, Mich.—See "Power Plants, Gas and Electricity."

Annapolis, Md.—The Washington, Baltimore & Annapolis El. R. R. has asked the City Council for franchises to enter the city by way of Northwest St.

Cincinnati, O.—The Cincinnati, Milford & Goshen St. Ry. Co. has amended its charter so as to enable it to construct lines in Epworth Heights and Madisonville.

Hamilton, O.—The Cincinnati, Hamilton & Indiana Traction Co., through J. C. Hooven, its Pres., made application to the Butler County Com. for a 50-year franchise between here and College Corner, O. The right of way between Darrtown and Oxford, however, is through private property.

Mineola, L. I., N. Y.—A certificate has been filed with the Sec. of State, announcing the consent of the State Bd. of R. R. Comrs. to the building of the Nassau Co. Ry. Co.'s projected road. Local consent has yet to be obtained.

Newburgh, N. Y.—Articles of incorporation have been filed by the Intervale Traction Co., of Newburgh. The company is capitalized at $300,000, and is to construct an electric railroad 28 miles in length from Newburgh to Goshen. The directors are: Hiram B. Odell and J. A. P. Ramsdell, of Newburgh; Chas. W. Griffith, New York, and others.

Watertown, N. Y.—The Black River Traction Co. is said to be planning to make extensions to its line.

Mechanicville, N. Y.—The Hudson Valley Ry. Co. is said to have in contemplation the construction of a dam across the Hudson and the acquisition of sufficient water power to operate the Mechanicville & Stillwater Div. of the road and to transmit power to the other divisions of the road if necessary. J. H. Armstrong, Ch. Engr., Glens Falls, N. Y.

Texarkana, Ark.—The City Council has granted a franchise to Geo. W. Baumoff, of St. Louis, Mo., for the construction of an electric street car line.

Lafayette, Ind.—John P. Smith & Co. have filed with the Co. Aud. a petition asking for a franchise to operate their electric line in this county.

Syracuse, N. Y.—The Rapid Transit Ry. Co. is said to have in contemplation the construction of a 2-mile extension of the South Ave. line through the southwestern part of the city. Estimated cost of said extension $30,000; E. G. Connette, Gen. Mgr.

Hamilton, O.—Falke Bros., of Milwaukee, Wis., are reported to have been given the contract to grade, build and equip an electric road 48 miles in length from Hamilton, O., to Richmond, Ind. Gus N. Hodges, of Dayton, O., is said to be the chief promoter.

Alexandria, La.—B. Willard, Gen. Mgr., and F. S. Hunn, Asst. Mgr. of the Gen. Electric Co. at Atlanta, Ga., are said to be interested in the proposed construction of an electric car line for this city.

Mt. Vernon, N. Y.—The Bd. of Aldermen has given permission to the New York & Port Chester R. R. Co. to construct its rapid transit system through Mt. Vernon.

Morrisville, Pa.—The Council has passed an ordinance granting a franchise to the Phila., Bristol & Trenton St. Ry. Co.

Augusta, Me.—Articles of association have been filed for two new electric railroads—the Augusta & Oakland and the Augusta & Waterville. The former road will extend from this city through the Belgrade lakes region, to Oakland. The other will run from Augusta, on the east side of the river, through Riverside, North Vassalboro and Winslow to Waterville. The incorporators of both companies are: Thos. J. Lynch, Dr. Fred G. Kinsman, of Augusta; Fred S. Thorne, of Gardiner, and others. Each concern has a capital stock of $200,000.

San Jose, Cal.—Lewis A. Sage, of San Jose, is stated to have obtained a 50-year franchise to build and operate an electric railway joining Saratoga, Los Gatos and San Jose, and according to local press reports bids will probably be received Aug. 18.

Middlefield, O.—A. E. Hunt and W. D. Gray, of Orangeville, O., are said to be interested in the proposed construction of an electric railway from Middlefield, O., to Sharon, Pa., via Mesopotamia, Bloomfield, Greene, Gustavus, Kinsman, Orangeville and Byerly's Corners.

Norristown, Pa.—The Council has passed an ordinance granting to the Norristown Passenger Ry. the right to lay its tracks and operate same on certain streets in this Boro.

West Middlesex, Pa.—The East End St. Ry. Co., of Sharon, has been granted a franchise for a street railway through West Middlesex. The Co. will ask for a franchise from the Wheatland Council.

Great Barrington, Mass.—The incorporators of the New York & Berkshire St. Ry. Co. held a meeting at Great Barrington recently and perfected the organization of the company by electing officers, etc. The proposed line is from New York State line in the town of Mount Washington to the Connecticut River at Springfield, a distance of 65 miles. Pres., R. C. Taft, of So. Egremont; treas., W. C. Dalzell, of So. Egremont; sec., O. C. Bidwell, of Great Barrington, Consulting Engr., H. F. Keith, of Mount Washington.

New Orleans, La.—The St. Charles St. R. R. Co. is stated to have sold $75,000 bonds for the contemplated extension of the road to Walnut St. E. B. McKinney, Ch. Engr.

Riverside, Cal.—The San Bernardino Valley Traction Co. has asked the City Trustees for a franchise for an electric car line from the boundary of San Bernardino Co. on Colton Ave. to the city limits. Bids for the purchase of this franchise will be received Aug. 19.

Utica, N. Y.—The Utica & Mohawk Valley Ry. Co. has filed with the Co. Clerk of Oneida and Madison Cos. maps, etc., with notice of extension (9 miles in length) of the proposed line from Oneida to Sylvan Beach.

Vincennes, Ind.—The Southern Indiana Traction Co. was recently incorporated to run a line from Vincennes to Jasper, passing through Petersburg and Otwell. Smiley N. Chambers, Indianapolis, Pres.; Fred E. Chappell, Petersburg, Secy.; E. F. Cox, Worthington, Ch. Engr.

Chicago, Ill.—See "Power Plants, Gas and Electricity."

Trenton, N. J.—A charter has been filed by the People's Traction Co., incorporated with a capital of $175,000. Incorporators: Josiah K. Boughes, of Trenton; Dr. W. C. Parry, of Hainesport, N. J., and I. A. Sweigard, of Atlantic City.

Trinidad, Colo.—See "Power Plants, Gas and Electricity."

Sheffield, Ala.—The City Council has granted to I. T. Crasa, of Chattanooga, a franchise to build and operate an electric street railway in Sheffield.

Atlantic City, N. J.—The Atlantic City & Suburban Traction Co. has been incorporated with a capital of $500,000, to build a trolley line from the Boardwalk in Atlantic City to Florida Ave., Baltic Ave., Atlantic City, and over the Pleasantville turnpike to Pleasantville, with branches from the latter place to Absecon, Linwood and Somers Point, a total distance of 15 miles. The incorporators are Edw. R. Spangler, Harrisburg, Pa.; C. Taylor Leland, Philadelphia, and Albert M. Jordan, Atlantic City.

Roanoke, Va.—Press reports state that the American Asbestos Co., recently formed at Terre Haute, Ind., with a capital stock of $1,000,000, with W. A. Doak as Pres., has secured options on 4,000 acres of land in Bedford County, and expects to build an electric road from the mines to a point on the Norfolk & Western Ry., not far from Roanoke.

Lehigh, Ind. Ter.—Articles of incorporation have been filed by the Lehigh Traction Co., with a capital of $300,000. The corporation will build and operate an electric line from Atoka to Coalgate by way of Lehigh and other mining towns. Among the incorporators are Chas. Copeland, Thomas Carroll and David J. Young, the latter of Fort Smith.

San Bernardino, Cal.—A. C. Denman has applied for an electric street railway franchise on certain streets; bids for said franchise will be received Aug. 14. Legard Allen, City Clk.

Paducah, Ky.—Bids are wanted Aug. 8 for the purchase of a franchise for constructing an electric street railway, distributing electricity for lighting and furnishing power over streets known as the Rowlandtown and Union depot line. Bids are also wanted for the purchase of a franchise for constructing an electric street railway over streets known as the Broadway and La Belle park line. D. A. Yeiser, Mayor.

Lima, O.—An ordinance has been passed granting the Lima, Delphos, Van Wert & Fort Wayne Traction Co. the right to construct and operate street railway route No. 2.

Lima, Peru.—The Lima Street Ry. Co. has been incorporated at Trenton, N. J., with a capital stock of $5,000,000. The charter sets forth that the company will operate street railways in Lima and other cities in Peru. The incorporators are Chas. A. Neville, Henry W. Carter and Chas. Borch, all of Jersey City.

Knoxville, Tenn.—It is reported that a first mortgage for $1,000,000 on the property of the Knoxville, Kimberlin Heights & Sevierville Electric Ry. Co. has been filed, the amount to be used in construction.

Oklahoma, Okla. Ter.—It is stated that the So. Oklahoma City Car Line Co. has been formed to operate a 5-mile line in Oklahoma City. Capital stock, $25,000. Directors: Sam Hooker, T. J. Thompson and others.

Rhinebeck, N. Y.—It is stated that a company, of which L. B. Treadwell is Pres., has secured a franchise for an electric road from here to Rhinecliff.

Fremont, O.—It is stated that right of way has been secured for an electric line from here to Sandusky.

Traverse City, Mich.—A press report states that the Council has granted a street railway franchise to L. K. Gibbs and associates on condition that they incorporate under the general street railway act.

Chicago, Ill.—It is reported that the South Side Elevated R. R. Co. is to build 3 extensions to reach Englewood, the stock yards and the lake. The improvement is estimated to cost $10,000,000, and will involve construction of 10 miles of track.

Lancaster, Pa.—Steps have been taken for building a trolley line from a point near Strasburg, on the Lancaster & Strasburg trolley road, to a point on the Lancaster & Southern R. R. and thence to Quarryville.

Bloomsburg, Pa.—An ordinance has been passed granting the Bloomsburg & Benton Electric Ry. Co. the right of way over certain streets in this town.

Dayton, O.—The Greenville & Union City Traction Co. is reported incorporated with $10,000 capital stock, by J. E. Lowes, John E. Feight and others.

Ensley, Ala.—It is stated that J. W. Minor has been granted a franchise to build a street railway in Ensley.

Berkeley, Cal.—The Town Trus. have granted the Oakland & East Side Ry. a franchise for a railway through the town limits of Berkeley.

Hillsboro, Ore.—It is stated that an electric ry. is proposed between Hillsboro and Portland. Graydon & Son, promoters.

Elkton, Md.—It is stated that the Kent & Cecil Light, Power & Ry. Co. has been organized to construct a trolley line between Elkton and Chestertown and Tolchester Beach. E. A. Tennis, of the Tennis Cons. Co., Philadelphia, is the chief promoter.

Gulfport, Miss.—It is stated that a company is being organized by S. S. Bullis to build an electric railroad between this city and Biloxi.

Black River Falls, Wis.—Surveys are being made for a dam about 3 miles above this city to furnish power for the proposed La Crosse, Black River Falls & Neillsville Electric R. R. Estimated cost of dam and dynamos, $200,000.

Superior, Wis.—It is reported that the Duluth-Superior Traction Co. will extend the Steel Plant line to Billings Park and erect new car barns at Ogden Ave. & 4th St. Estimated cost of improvements to be made this summer in Superior, $100,000.

St. Joseph, Mo.—It is reported that the property of the St. Joseph Ry., Light, Heat & Power Co. has been sold by E. H. Harriman to Seligman & Co. and E. W. Clark & Co. W. T. Van Brunt, Pres.

Bangor, Me.—It is stated that the electric line from Bangor to Hampden is to be extended 7 miles to Winterport.

RAILROADS.

Baltimore, Md.—Press reports state that the Baltimore & Ohio R. R. will expend $25,000,000 in improvements during the next 2 years. Among the contemplated improvements are 3d and 4th tracks to be laid between Washington Junction and Cumberland, and on the Pittsburg & Connellsville line. The Fairport line will be double-tracked and the lake harbors will be enlarged. J. M. Graham, Ch. Engr., Baltimore.

Sheffield, Tenn.—Local press reports state that surveys are being made of the route of the proposed Mobile & Western Ry.

Barbourville, Ky.—The Cumberland R. R. Co., of Knox County, with $30,000 capital stock, filed articles of incorporation. The stockholders are L. R. Freeman, Fred Morck, G. H. Jackson and others, of Warren, Pa. The company will build a railroad from a point on Cumberland Valley Div. of the Louisville & Nashville, near Artemus, in Knox Co., Ky., to a point at Lupsford, Knox Co., a distance of 10 miles. The offices of the company will be at Barbourville.

Charleston, W. Va.—A charter has been issued to the Cheat River Ry. Co. for the purpose of constructing a railroad from Parsons to Rowellsburg, W. Va., thence along Cheat River to the State line, between W. Va. and Pa., to a point at or near Cheat Haven, Pa. Capital stock, $200,000. Incorporators: Wesley Mollohan, Geo. W. McClintic, Jas. H. Couch and others, of Charleston.

Cincinnati, O.—The Cincinnati & Columbus Traction Co. is stated to have completed acquiring its right of way between Cincinnati and Columbus. The distance by this route will be 119 miles.

Pittsburg, Pa.—Press reports state that the Pennsylvania R. R. Co. will soon let contracts for double-tracking part of the southwest branch, this being the line from Greensburg to Fairchance. The work involves the construction of several steel spans of 30 or 40 ft. in length, the laying of a great deal of masonry and a large amount of grading through a rough country. Estimated cost, about $300,000. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Hopkinsville, Ky.—Local press reports state that the Tenn. Central R. R. (L. S. Miller, Gen. Mgr. Nashville, Tenn.), is to be extended to a junction with the Ill. Central R. R. at Hopkinsville.

Toledo, O.—The Toledo Ry. & Terminal Co. is stated to have incorporated the Toledo, Angola & Western R. R. to construct a road from Toledo to the Indiana State line.

San Antonio, Tex.—A survey is stated to have been completed for a railroad 60 miles long from San Antonio to Crowther, in Atascosa Co.

Independence, Kan.—A charter has been granted at Guthrie, Okla. Ter., to the Cherryvale, Oklahoma & Texas Ry. Co., to build 900 miles of road, from Cherryvale, Kan., through Independence and Caney, Kan., and the Cherokee, Osage and Ponca Indian reservations, to Perry, Okla., where one line will be constructed to El Paso, Tex., and another via Pawhuske, Okla., to Paris, Tex. The capital stock is $18,000,000. Independence and Perry are the principal places of business designated.

Des Moines, Ia.—Local press reports state that the Whitebreast Fuel Co. will build a road 18 miles long to afford an outlet for its products to the Milwaukee on the north, and the Great Western and Rock Island roads on the south.

Apex, N. C.—The Cape Fear & Northern R. R. will, it is stated, soon let the contract for an extension from Angier to Fayetteville. Geo. E. Lemmon, Ch. Engr.

Jefferson City, Mo.—It is stated that a charter has been granted the Arkansas, Springfield & Northwestern R. R. to build a 120-mile road from Jefferson City to Seligman, in Barry Co. Capital stock, $1,200,000. Directors: C. H. Varnon, Henry C. Solomon, C. R. Funk, and others, of Kansas City.

Denver, Col.—The Denver, Northwestern & Pacific Ry. Co. is said to have filed articles of incorporation in Denver. Capital stock, $20,000,000. D. H. Moffat, Prest.

Terre Haute, Ind.—It is reported that the Southern Indiana Ry. is to increase its stock by $1,500,000, to build branch roads in Sullivan, Green and Lawrence Counties. F. W. Ranno, Engr., M. of W.

Nashville, Tenn.—The Tennessee Central R. R., it is stated, is preparing to extend the Crawford branch to the property of the Fentress Coal & Coke Co., a length of 3 miles. G. Bottiger, Ch. Engr.

Kansas City, Mo.—It is stated that the Kansas City, Dallas & Olathe Ry. Co. has been incorporated to build 25 miles of road. Incorporators: Henry G. Pert, A. A. Potter, W. E. Winner, and others.

Montgomery, Ala.—It is reported that a survey is being made by Ausfeld & Chapman, of Montgomery, for a 10-mile railroad from Booth's Station, on the Mobile & Ohio R. R., to Autaugaville.

Canton, S. D.—The Interstate Ry. Co. is reported incorporated to build a line from Duluth, Minn., to Galveston, Tex. Capital stock, $50,000.

Akron, O.—The Summit County Ry. Co. is reported incorporated by W. W. Pope, F. E. Ream and others. Capital stock, $10,000.

Concord, N. C.—The Carolina Colony Co. has been incorporated with a capital of $5,000,000, to build a railway from Concord, its principal place of business, to Fayetteville.

Oakland, Cal.—The East Side R. R. Co., M. J. Keller, Pres., has accepted the terms of the franchise which permit it to construct a road from Point Richmond to Emeryville.

Pittsburg, Pa.—It is stated that the Pittsburg Terminal R. R. & Coal Co., with a capitalization of $14,000,000, is preparing to build a mammoth railroad clearing yard.

New York, N. Y.—The Rapid Transit Subway Construction Co., now building the Manhattan-Bronx rapid transit subway, was, on July 24, awarded the contract for the construction of a tunnel and underground route to Brooklyn for $2,000,000. Three bids for the work, which it was estimated would cost $8,000,000, were received July 21 by the Rapid Transit R. R. Comn., as follows: Rapid Transit Sub. Con. Co., two bids; one, $3,000,000; the other, $2,000,000, the former bid being accompanied by a letter offering to construct an additional subway in the Manhattan-Bronx route for $100,000 provided that bid was accepted, the additional subway being located under Broadway, New York, between 42d St. and 14th St., and likely to cost, according to the estimate of the chief engr. of the Comn., Gen. Wm. Barclay Parsons, $3,600,000. The third bid was submitted by John L. Wells, as counsel for the Brooklyn Rapid Transit Co., and agreed to construct the Manhattan-Brooklyn route for $7,000,000. All three bids are exclusive of terminal and real estate, and estimated the cost of equipment of the road to be $2,000,000. The first two bids provide for a single ride without change of cars for a maximum fare of 5 cents from the Brooklyn terminus of the road to 59th St., New York, while the third offered a 5-cent ride from the outlying termini of a large number of the surface roads in Brooklyn to the New York terminus of the road at City Hall, and included the offer to construct an additional tunnel in Brooklyn to facilitate the movement of through trains. The contract provides that the contractor shall operate the road for a period of 35 years, with a right to a renewal for a term of 25 years. An annual rental is to be paid amounting to the interest paid by the city on its bonds for construction and 1 per cent. on the cost of construction. The work is to be started in 60 days and finished in 3 years, with a possible extension of 1 year in the East River work.

A resolution was adopted directing the Chief Engineer to draw plans for a direct tunnel route from City Hall, New York, to Boro. Hall, Brooklyn.

PUBLIC BUILDINGS.

West Seneca, N. Y.—Local press reports state that a brick building, to cost when fully equipped $125,000, is to be erected on site recently purchased on Ridge road, opposite Ingram Ave., in West Seneca, as an accident hospital in connection with the Lackawanna Steel Co.'s plant at Stony Point.

Racine, Wis.—Plans of A. C. Eschweiler, of Milwaukee, are stated to have been selected for the $25,000 church edifice to be built by St. Rose Church congregation.

Paterson, N. J.—Contracts for repairing the city hall have been awarded as follows: For plastering and marble work, to David Henry Bldg. Co., of Paterson, at $24,783; for carpentering work, to P. S. Van Kirk Co., Paterson, at $32,976; for electrical work, to the Northern Engineering Co., at $5,192.

St. Louis, Mo.—The Illinois Comrs. to the Louisiana Purchase Exposition are stated to have decided to erect at the World's Fair a $75,000 building to be constructed of wood and staff, 100x60 ft., with a veranda 20 ft. wide on each side. Competitive plans will be submitted for the building. Jas. M. White, of Champaign, Ill., is Consulting Archt.; Senator H. M. Dunlap, Savoy; Hon. John J. Brown, Vandalia, Pres., and Hon. James H. Farrel, Chicago, are among the Comrs.

Lewiston, Mont.—Bids are wanted July 31 by the Bd. of Co. Comrs. for building a pest house on the county poor farm. C. M. Kelly, Co. Clk.

Canton, O.—Bids are wanted Aug. 1 for erecting a church for St. Joseph's congregation. Address Jos. Dick, 1413 W. Tusc St.

Mitchell, S. D.—W. A. Dow, of Sioux Falls, has submitted to the City Council plans for a city hall, estimated to cost $20,000.

Washington, D. C.—The contract for building the engine house of Congress Heights has been awarded to Jas. M. Dunn, Washington, for $19,969.

Junction, Utah.—Bids are wanted July 29 for the erection of a court house for Piute Co. Horace Morrill, Co. Clk. R. C. Watkins, Archt., Provo City, Utah.

New York, N. Y.—Bids are wanted Aug. 1 for alterations and repairs to Bellevue Hospital and Bellevue Emergency Hospital. John W. Brannan, Pres. Bd. of Trustees, Bellevue and Allied Hospitals.

Marshalltown, Ia.—The State Bd. of Control, Des Moines, will receive bids July 31 for improvements at the Soldiers' Home at Marshalltown, estimated to cost $70,000.

Allentown, Pa.—Local press reports state that the Mayor will receive bids Aug. 5 for the construction of the proposed Hibernia engine house.

New Brunswick, N. J.—Bids are wanted Aug. 18 for the erection of a $50,000 Carnegie Library. G. K. Parsell, of New Brunswick, Archt.

Waco, Tex.—A $50,000 hospital is to be built in Waco (on land donated by the people of Waco) by the Sisters of Charity of the Incarnate Word, of Galveston; work to begin not later than Jan. 1, 1903.

Poughkeepsie, N. Y.—The Com. of the Bd. of Superv. has reported in favor of awarding the contract for constructing the court house and jail to Campbell & Dempsey of Kingston, N. Y., for $110,000.

Arcola, Ill.—Nicolai Juhl, of Rock Island, is stated to have the contract for the erection of a $30,000 R. C. Church.

Terre Haute, Ind.—The County Comrs. have adopted plans prepared by Richards, McCarty & Bulford, of Columbus, O., for a county jail, estimated to cost $75,000 to $100,000.

Sacramento, Cal.—The Bd. of Supervisors has purchased the block bounded by H and I, 6th and 7th Sts., for $55,000, as a site for court house. M. J. Dillman, Chmn. of Bd.

Utica, N. Y.—The general contract for the erection of the Public Library building has been awarded to the J. W. Bishop Co., of Providence, at $162,000.

Anoka, Minn.—Press reports state that a cottage costing $40,000 is about to be erected for the Anoka Hospital for Insane. S. W. Leavitt, Chmn. State Bd. of Control, St. Paul.

Brooklyn, N. Y.—Press reports state that the contract for the site for indoor public bath has been signed and plans are now being prepared and the contract for construction will be let as soon as the plans have been approved. The bath will be located at Watkins St. and Pitkin Ave., and will cost about $50,000.

Columbus, O.—Bids will be received by the Bd. of Trus. of the Columbus State Hospital, until Aug. 19, for furnishing material and erecting Awl Hospital and Greer Hospital. Frank L. Packard, Archt., 12th fl., New Hayden Bldg., Columbus. E. G. Carpenter, M. D., Secy.

Toledo, O.—Bids will be received by the Bd. of Police Comrs. until Aug. 16 for erecting a hospital. E. O. Fallis, Archt. C. H. Durian, Secy. Bd. of Police Comrs.

Buffalo, N. Y.—Bids are wanted Aug. 12 for erecting an armory, including mason work, cut stone, structural, metal-work, sheet-metal, etc.; also heating system. Jas. McLeer, Commanding Brigadier-Gen., Chmn. Armory Comrs.

Bridgeport, Conn.—Bids will be received by the Bd. of Fire Comrs. for furnishing material and erecting a fire engine house on Bostwick Ave. and Pine St. Henry A. Lambert, Archt.

Topeka, Kan.—W. R. Brown, Chicago, Ill., is reported to be preparing plans for a church for the First Baptist congregation in this city. It is to be of stone and pressed brick and will cost $40,000.

Columbus, Miss.—See "Sewerage and Sewage Disposal."

Scranton, Pa.—E. H. Davis, Connell Bldg., is the architect for 4 new buildings, fireproof construction, to be used as Alms House Dept. for Scranton Poor Dist. Cost, $200,000.

Paterson, N. J.—The Comrs. of the Free Pub. Library have invited certain architects to submit competitive plans, until Oct. 15, for the library to be built on Broadway and Auburn St., at a cost of $150,000, including heating apparatus, interior finishing, etc.

Moline, Ill.—Bids will be received by the Bldg. Com. of the Pub. Library Bd. until Aug. 5 for erecting the Carnegie Library; also for heating, plumbing and lighting the same.

Salt Lake City, Utah.—Plans have been prepared by F. M. Ulmer, for the W. H. Groves Latter Day Saints Hospital, to be erected at First South and First West Sts. It is to be a 4-story structure, of red pressed brick, with facing of terra cotta, and is estimated to cost $100,000. It is to be heated by steam from a central plant, to be located in the rear.

Van Wert, O.—Bids are wanted Aug. 8 for furnishing material and installing a central station hot water heating system in the Court House and jail. T. M. Berry, Co. Aud.

Cincinnati, O.—Bids will be received by the Bd. of Trus. of the Pub. Library until Aug. 19 for remodeling and ventilating the plumbing of the Public Library. Wm. A. Hopkins, Clk.

Beloit, Wis.—F. N. Garthwaite, of Chicago, Ill., has secured, according to reports, the contract to erect the Public Library at $21,000.

Neosho, Mo.—Lee Matthews is reported to be preparing plans for a city hall, jail and fire headquarters combined, which the Council is contemplating erecting.

Red Wing, Minn.—Bids will be received by the Library Bd. until July 30 for erecting the Carnegie-Lawther Library. A. F. Ganger, Archt., St. Paul, Minn.; W. H. Putnam, Pres. Library Bd.

Sonyea, N. Y.—Bids will be received by the Bd. of Mgrs. until Aug. 12 for constructing steel bridge, foundations and grading, also for resetting and repairing 2 60-H.-P. boilers at the Craig Colony for Epileptics. Dr. W. P. Spratling, Supt.

Massillon, O.—Bids will be received by the Bd. of Trus. of the Massillon State Hospital, at the office of Frank L. Packard, Archt., New Hayden Bldg., Columbus, until Aug. 20 (readvertised), for furnishing material and erecting an infirmary building and several cottages. H. C. Eyman, M.D., Secy.

Madison, Wis.—Bids will be received by the Governor until Aug. 1 for lighting and ventilating the Capitol.

Portland, Me.—Bids will be received by the Com. on Pub. Bldgs., Hon. Frederic E. Boothby, Chmn., until July 30 for erecting a group of buildings to be called the City Home. F. H. & E. F. Fassett, Archts., 98 Exchange St.

Terre Haute, Ind.—It is stated that bids are wanted Aug. 1 for erecting a church for the First Congregational Society of Terre Haute. A. Z. Foster, Chmn. Bldg. Com.; Turnbull & Jones, Archts., Elgin, Ill.

Greensburg, Pa.—Local press reports state that bids are wanted Aug. 14 for erecting a court house. John H. Brown, Compt.

Fort Smith, Ark.—It is stated that bids are wanted Aug. 1 for erecting a stone church to cost about $30,000. Hoffman & Blakely, Archts., 801 Garrison Ave.

St. Louis, Mo.—See "Water."

New York, N. Y.—The Bd. of Aldermen has approved the appropriation of $200,000 for a lighting and heating plant for the American Museum of Natural History.

Des Moines, Ia.—A Committee has been appointed to engage an architect to prepare plans and specifications for a $50,000 building to be erected at the La. Purchase Exposition, St. Louis. Gov. Larrabee, S. M. Leach and Jas. H. Trewin are on the committee.

Joliet, Ill.—It is stated that plans are being prepared by D. H. Burnham & Co., of Chicago, for a public library, which, with the site, is to cost $135,000.

Richmond, Va.—Local press reports state that bids will soon be asked for the erection of the R. C. Cathedral. Probable cost, $250,000.

Galveston, Tex.—Local press reports state that bids will be received Aug. by State Health Officer Geo. R. Tabor, Austin, for erecting a quarantine station in this city; appropriation, $15,000.

Jersey City, N. J.—Local press reports state that bids will be received by the Bd. of Freeholders until Aug. 7 for improving the Snake Hill Asylum. Hugh Roberts, Archt.

St. Louis, Mo.—Bids are wanted Aug. 1 for erecting the Liberal Arts Building of the La. Purchase Exposition. Isaac S. Taylor, Dir. of Wks.

Bids will be received by the Bd. of Pub. Improv. until Aug. 5 for furnishing material and installing steam heating apparatus in the infectious wards at the Quarantine and Smallpox Hospital. Chas. Varrelmann, Pres. pro tem.

Ballston Spa, N. Y.—Court House and jail improvement bonds, amounting to $59,000, have been sold.

Somerville, Mass.—It is stated that plans and specifications are being prepared for a battalion armory for Somerville, estimated to cost $60,000.

Pittsburg, Pa.—The Trus. of the First Unitarian Church are reported to have decided to erect a church at Ellsworth and Morewood Aves. at a cost of $60,000. Rev. L. W. Mason, Pastor.

Sidney F. Heckert has completed plans and specifications for an $80,000 Municipal Hospital.

Athens, O.—Bids will be received by the Bd. of Trus. of the Athens State Hospital until Aug. 22, for furnishing material for erecting an infirmary building and 2 cottages. E. H. Rorick, M.D., Secy.; Frank L. Packard, Archt., New Hayden Bldg., Columbus, O.

BUSINESS BUILDINGS.

Houghton, Mich.—Local press reports state that the Houghton Armory Opera House Co., incorporated with a capital of $50,000, will build a $50,000 theater in Houghton, according to plans prepared by A. C. Eschweiler, of Milwaukee.

Newark, N. J.—The Young Woman's Christian Asso. of Newark, has purchased property at 14 E. Park St., and it is reported that plans will be made for a 5-story building to contain a swimming pool, gymnasium, reception hall, auditorium, library, etc.

Camden, N. J.—The South Jersey Gas, Electric Light & Traction Co. has engaged Thos. Stephens, of Camden, to prepare plans for a warehouse 4 stories in height, a stable, wash house, blacksmith shop, wagon sheds and quarters for the storage of pipe, to be located on a site 142x183 ft., at the foot of Mt. Vernon St.

Red Oak, Ia.—Press reports state that a $30,000 depot is to be erected by the Burlington Route. H. E. Jarvis, Secy., Burlington.

Stevens Point, Wis.—W. E. Kingsbury is said to have decided to build a 2-story brick structure, 50x100 ft., for business purposes, on Main St.

Ottawa, Ont.—Local press reports state that the Canadian Atlantic Ry. proposes to build a new central depot. Probable cost, $200,000. G. A. Mountain, Ch. Engr., Ottawa.

Joplin, Mo.—L. A. Hunter, of Joplin, has prepared plans for a brick auditorium, 96x146 ft., to be built at a probable cost of $25,000. J. W. Baker, Pres. of the Joplin Choral Club, is said to be interested.

Marietta, O.—Plans prepared by W. B. O'Neill & Co., of Marietta, have been adopted for the proposed Y. M. C. A. building, which will be 4 stories in height and 135x40 ft.

Fremont, Neb.—Local press reports state that a $75,000 depot is to be built by the Union Pacific R. R. Co. J. B. Berry, Ch. Engr., Omaha.

Newark, N. J.—Plans have been filed for a 5-story brick factory, to be erected on Chester Ave. by the Rattan Paint Co. Cost, $67,800.

It is reported that the contract for the erection of the new building for the American Insurance Co. has been awarded to V. Hedden & Sons. Estimated cost of building, $250,000.

Burlington, N. J.—Jas. W. Lanning and John Barnhart, of Trenton, are stated to have the contract for the erection of an $80,000 opera house.

Clarksville, Tenn.—Local press reports state that contracts will soon be let for the passenger and freight stations, to be built in this city by the Tenn. Central R. R. W. E. Eastman, Secy., Nashville.

Everett, Wash.—Plans are being prepared for the American Natl. Bank Bldg., to be 4½ stories high and located on Hewitt and Colby Aves. Cost, $75,000.

Kansas City, Mo.—The building located at 901 to 907 Main St., and owned by Sarah Sheidley, is to be remodeled at a cost of $30,000, according to plans prepared by Louis Curtis, 1106 Baltimore Ave.

Gardiner, Me.—Bids are wanted July 28 for furnishing all materials and constructing a brick block to be used as a bank building. Coombs & Gibbs, Archts., Lewiston, Me.

Cleveland, O.—O. C. Ringle & Co. are said to be negotiating for a site on Prospect St. for a $100,000 theater and mercantile building.

The Genesee Savings & Banking Co. is said to have in contemplation the erection of a new bank at a cost of $90,000.

Norfolk, Va.—J. B. Conners, Supt. of the terminals for the Scioto Valley Div. of the Norfolk & Western Ry., is said to be interested in proposed erection at Norfolk of a $700,000 union station.

Grand Rapids, Mich.—Application has been made for a permit for the Herpolheimer building to be erected at Monroe and Ottawa Sts.; the building will be 6 stories and the estimated cost is about $100,000.

Chicago, Ill.—Benjamin H. Marshall, of Chicago, is said to be preparing plans for a marble, steel and terra cotta building, to be known as the Iroquois Theater, and to be located on Randolph St., between State and Dearborn Sts. The theater is to be under the management of Davis & Powers, Chicago; Klaw & Erlanger, New York, and Nixon & Zimmerman, Philadelphia.

It is reported that Hibbard, Spencer, Bartlett & Co. will erect a store and warehouse, to cost $1,000,000, at S. Water and State Sts.

Findlay, O.—It is stated that a building for the Y. M. C. A., costing $30,000, is contemplated.

Columbus, O.—Press reports state that the Columbus Merchandise Co. contemplates the erection of a business block on High St., for which it is said to have purchased the site at a cost of $125,000.

Pittston, Pa.—Press reports state that the contract for the erection of the new opera house on Broad St. has been awarded to the lowest bidder, Mathias Stipp, of Scranton, for $32,000.

Oswego, N. Y.—According to press reports, the contract for the erection of a building for the Diamond Match Factory, costing $50,000, has been awarded to Gustave Smith, of this city.

Fayette, Mo.—Geo. O. Garnsey, Chicago, Ill., is stated to have prepared plans for a $32,000 opera house, to be erected in this city. Lee Hollaway, Owner.

Minneapolis, Minn.—Bertrand & Chamberlain are said to be preparing plans for a 7-story brick and terra cotta building, which Dean & Co. intend erecting at Fourth Ave. N. and Washington. Estimated cost, $60,000.

Connersville, Ind.—W. S. Kauffman is stated to be preparing plans for a 3-story building, which the First National Bank intends erecting.

Superior, Wis.—See "Electric Railways."

Montezuma, Ia.—Bids will be received by E. V. Harper, Secy. Bldg. Com., Montezuma, until Aug. 11, for erecting a 2 story I. O. O. F. brick building, 33x132 ft., in this city. Liebbe, Nourse & Rasmussen, Archts., Des Moines.

Leadville, Colo.—It is stated that the plans of A. C. Higgins, of Pueblo, have been accepted for remodeling the Tabor Opera House. Probable cost, $40,000.

Buffalo, N. Y.—An organization has been incorporated to be known as the Buffalo Consistory S. P. R. S., 32d Degree, Valley of Buffalo, for the purpose of erecting a Masonic Temple, at a probable cost of $80,000.

Toledo, O.—The National Union is reported to have decided to erect a headquarters building at Toledo, and have appropriated $40,000 for the purpose.

Parkersburg, W. Va.—A. F. Withrow, of Charleston, is reported to have secured the contract to erect a building at 7th and Market Sts., for $175,000.

Los Angeles, Cal.—It is stated that plans have been prepared for a 5-story club building to cost about $200,000.

DWELLINGS.

St. Joseph, Mo.—Col. J. A. Corby is said to be organizing the Apartment House Bldg. Co. for the purpose of erecting a 3-story brick apartment house at 9th and Farnon Sts. Probable cost, $85,000.

Denver, Colo.—Gove & Walsh, 505 McPhee Bldg., have prepared plans for a 3-story brick apartment house, to be erected at 20th and Sherman Ave. Owner, Mrs. L. L. Gross. Cost, $50,000.

Des Moines, Ia.—W. F. Mitchell & Co., 818 Walnut St., have the first contract for work on the residence of W. O. Coffee, to be located at W. Grand Ave. and Park Lane. This contract, which amounts to $25,000, does not include plastering, interior finish, heating, plumbing, wiring, etc. Total cost of building, about $60,000.

Philadelphia, Pa.—John Stafford is reported to have purchased property at 213 to 215 S. 16th St., on which he proposes to build an apartment house 140x180 ft., at a cost of $800,000.

St. Paul, Minn.—Press reports state that Michael P. Ryan has plans for a $60,000 apartment house, to be erected at St. Peters St. and University Ave.

Aurora, N. Y.—It is stated that Edwin H. Gaggin, Syracuse, has prepared plans for a $40,000 dwelling which A. M. Zabriske, of Aurora, intends erecting near the shore of Cayuga Lake.

Reading, Pa.—Alex. Smith, 27 N. 6th St., is the architect for a $12,000 dwelling to be built for Mr. Potts.

SCHOOLS.

Adrian, Mich.—The School Bd. has prepared plans for a $50,000 school.

Hallowell, Me.—This city will soon receive bids through its Bldg. Com. for building the "Maria Clark" school, which is to be of brick and 2 stories high. L. D. Merchant may be addressed.

Laconia, N. H.—The contract for a new building for the State School for feeble-minded children, at Laconia has been awarded to J. H. Mendel, of Manchester, N. H., for $12,600; not including plumbing, heating and ventilating apparatus, bids for which will be opened Aug. 1. W. J. Ahern, of Concord, N. H., is agent for the Bd. of Trus.

Delray, Mich.—Bids are wanted July 29 for the purchase of $10,000 school bonds. Hugh Cary, Dir.

Springfield, O.—Bids are wanted Aug. 18 for the construction of 2 10-room schools. Robt. C. Gotwald, Archt., Springfield; Oliver H. Miller, Clk. Bd. of Educ.

Columbus, O.—Bids are wanted Aug. 13 for erecting an addition to the Chemical Bldg., of the Ohio State University. Alexis Cope Secy. Bd. of Trus.

Cleveland, O.—School bonds to the amount of $1,250,000 are reported to have been sold.

South Orange, N. J.—The Township Bd. of Educ. has engaged Chas. Granville Jones, of Belleville, to prepare plans for a school for S. Orange and a school for Maplewood.

School bonds to the amount of $63,000 were sold July 16.

Chicago, Ill.—Plans are being prepared for the erection of a school of technology at Northwestern University, and it is stated that the work of construction will be begun immediately after the return of Pres. Edmund James from the East.

Scranton, Pa.—School bonds to the amount of $250,000 are stated to have been sold.

The contract for heating and ventilating School No. 25 has been awarded to P. H. Haggerty for $6,050.

Bridgeport, Conn.—The Bd. of Educ. has authorized the purchase of a site upon which a $25,000 school is to be erected.

Oneida, N. Y.—The legality of the contract recently awarded to Geo. F. Avery for the High School, to cost $27,800, has been questioned, and it is stated that the Bd. of Educ. will receive new bids.

Washington, D. C.—Bids are wanted July 28 for furnishing and erecting 2 steam boilers, at Grant School, G St. Henry B. F. MacFarland, Acting Comr. D. C.

Jackson, Ia.—Bids will be received by Thos. H. Howells, Secy. of the Bd., Keokuk, until Aug. 14 for erecting an addition to the sub-district school No. 9.

Quincy, Mass.—It is stated that bids are wanted July 28 for erecting a 10-room school in Ward 2. C. F. Knowlton, Comr. Pub. Wks.

Merrill, Wis.—It is stated that bids are wanted Aug. 8 for erecting a brick school. Address Rev. H. Dalb, Merrill.

Charleston, W. Va.—Local press reports state that bids for erecting a high school have been rejected, the lowest received being $42,162, and that new plans will be procured and bids again asked, the cost not to exceed the appropriation, $30,000.

Marlin, Tex.—Press reports state that bids received for erecting a school in this city have been rejected, all exceeding the appropriation of $20,000.

Worcester, Mass.—Local press reports state that the contract for heating the library at Clark University has been secured by Evans, Almirall & Co., of New York City, for $8,000.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. of School Bldgs., until July 30 (extension of date), for erecting School No. 65, Boro. Bronx; also for installing electric elevators in the Wadleigh High School, Boro. Manhattan.

Waterbury, Conn.—Local press reports state that bids will be received by the Bd. of Educ. until Aug. 11 for erecting Washington Hill School. Leonard Asheim, Archt.

Yonkers, N. Y.—Bids are wanted Aug. 4 for $102,450 school bonds. Chas. H. Fancher, Chmn. Com. on Finance, Bd. of Educ.

STREET CLEANING AND GARBAGE DISPOSAL.

Findlay, O.—Bids are wanted July 31 for sweeping and cleaning the streets of this city. Frank C. Ray, Clk. Bd. of Improv.

Newark, N. J.—Ernest Adam writes that the following bids were opened July 17 for collecting separately, and disposing of garbage, paper and ashes with rubbish, for a period of 5 years from Jan. 1, 1903. The bids are respectively for the 1st, 2d, 3d, 4th and 5th years, and the total: Benjamin Meyer, Newark (the garbage to be treated by reduction system of Arnold & Edgerton patents), $79,000, $81,000, $83,000; $85,000, $87,000, $415,000; Horace J. Subers, New York, $80,700, $82,300, $84,000, $85,700, $87,500, $420,200; Matthew T. Meagher, Brooklyn, $88,000, $89,000, $90,000, $91,000, $92,000, $450,000; Gen. Industrial Cont. Co., Newark, $107,000, $108,600, $110,380, $112,350, $114,510, $552,840. The other bidders did not state in what manner the garbage would be disposed of.

Baltimore, Md.—The Md. Dredging & Contracting Co., which has the contract for the removal and disposal of garbage of this city for 10 years, is reported to have awarded the contract for the garbage reduction plant to be erected in So. Baltimore to John Waters for $250,000, including building and machinery.

Racine, Wis.—The Bd. of Pub. Wks. will receive bids for the erection of a crematory.

Haverhill, Mass.—A proposition for the collection and disposal of garbage, etc., is being considered by the city authorities.

West Chester, Pa.—The Bd. of Health has passed a resolution advising that a crematory be erected by the Boro. Council for the disposition of garbage.

Providence, R. I.—Bids will be received by the Com. on Health Dept. until July 30 for the collection and removal of swill, house offal and garbage for 1 year from Aug., 1902. Wm. E. Clarke, Secy.

Johnstown, Pa.—The Peoples' Garbage & Fertilizing Co. has been incorporated with a capital of $25,000 to erect and operate a garbage furnace. S. C. Ream, Pres.; Geo. McGarry, Vice-Pres.; W. H. Sunshine, Secy.

GOVERNMENT WORK.

Norfolk, Va.—Bids are wanted Sept. 13 for constructing a concrete and granite dry dock, exclusive of pumping plant and caisson at the Norfolk Navy Yard. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

San Francisco, Cal.—Bids are wanted Aug. 12 for furnishing at the Mare Island Navy Yard a quantity of machine tools, motors and transformers. A. S. Kenny, Paymaster Gen., U. S. N., Washington, D. C.

Ellis Island, N. Y. Harbor.—Bids will be received at the office of the Ch. Engr. and Supt. of Repairs, U. S. Pub. Bldgs., N. Y., until July 31 for constructing certain granolithic or cement walks and pavements at the U. S. Immigrant Station, Ellis Island. Area of pavement required will be about 45,000 sq. ft. Information may be obtained at Rm. 105, Post Office Bldg., N. Y. City.

Washington, D. C.—Bids are wanted July 31 for erecting a brick warehouse and office building on the grounds of the Dept. of Agriculture. Jas. Wilson, Secy. U. S. Dept. of Agriculture.

Ft. Slocum, N. Y.—Bids are wanted Aug. 15 for erecting a brick shop at Ft. Slocum. Address 1st Lieut. Edw. T. Donnelly, Artillery Corps, Q. M.

Tampa, Fla.—The following bids were opened July 17 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, elevators, electric wiring and conduits) of the U. S. Court House, Post Office and Custom House at Tampa: Miles & Bradt, Atlanta, Ga., $272,000, $308,700, $285,700; Hendricks & Levick, Tampa, $306,260, $347,190, $318,260; Cramp & Co., Philadelphia, $266,763, $305,573, $278,965.

Ft. Leavenworth, Kan.—Bids are wanted Aug. 18 for the construction, including plumbing, heating and electric wiring several buildings. Capt. D. E. McCarthy, Q. M.

Wheeling, W. Va.—Bids are wanted Aug. 19 for furnishing iron-work for lock gates for lock No. 6, Kanawha River. Capt. W. E. Craighill, Corps of Engrs., U. S. A.

New Orleans, La.—Local press reports state that bids will be received by Maj. Geo. McC. Derby, Corps Engrs., U. S. A., until July 28 for the following levee work: Cane Brake, 69,700 cu. yds.; Shamrock, 69,000; Vaucluse, 65,200; Roseland, 86,600; Excelsior, 86,600; Wildwood, 77,200; Home Place, 76,700; Ashland, from 58,200 to 74,000. Bids will also be received until Aug. 1 for the clearing of brush, roots and weeds from the levees from the lower limits of Baton Rouge to the River gauge at College Point.

Chickamauga Park, Ga.—The Secy. of War has allotted $450,000 for building a Cavalry Post at Chickamauga Park, exclusive of cost of land. Brig.-Gen. M. L. Luddington, Q. M. Gen., Washington, D. C., will direct the operations.

Portsmouth, N. H.—The contract for removing about 350 ft. of Henderson's Point in Portsmouth Harbor is reported to have been awarded to the Massachusetts Contracting Co., of Boston, at its bid of $749,000.

Annapolis, Md.—The following bids are stated to have been opened July 9 for constructing officers' mess at the Naval Academy: Connors Bros., Lowell, Mass., entire work, $169,600; entire work except granite, $131,500. Noel Const. Co., Baltimore, entire work, $176,000; entire work except granite, $125,000; entire work with Maryland granite, $155,000. Herman Probst, New York City, all except granite work, $118,468; if extra inspection required, per thousand, $250. Doyle & Doak, Philadelphia, entire work, $189,368. Webb Granite & Const. Co., Worcester, Mass., granite work, $38,074.

Ft. Howard, Md.—Bids are wanted Aug. 18 for furnishing material and constructing a brick quartermaster and subsistence storehouse at Ft. Howard. Samuel V. Ham, Capt. & Q. M., Baltimore.

Buffalo, N. Y.—Daly & Hanan of Ogdensburg, have received the contract for dredging the entrances to the harbors at Charlotte and Olcott Beach, at their bid of 10 cts. per cu. yd. Bids were opened July 18 by Maj. T. W. Symons, Corps of Engrs., U. S. A.

Des Moines, Ia.—Press reports state that specifications will be ready for contractors by Aug. 1 for 18 additional buildings for Ft. Des Moines. Estimated cost, $334,000. Maj. Turner, Q. M. in charge.

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., until Aug. 5 for furnishing material and making repairs to the U. S. Naval Museum of Hygiene and Medical School, Washington. A. S. Kenny, Paymaster Gen. U. S. N.

New York, N. Y.—Bids are wanted July 28 for dredging in Hudson River. Col. S. M. Mansfield, Corps of Engrs., U. S. A., Army Bldg.

According to the Washington "Star," Col. S. M. Mansfield, in his annual report to the Ch. of Engrs., upon the improvements of the rivers and harbors in and about New York City, submitted the following estimates: East River and Hell Gate, to complete the project, $903,840; for the fiscal year of 1904, $400,000; Harlem River, to complete the project, $1,380,000; for the fiscal year 1904, $500,000. Hudson River, to complete the project, $1,040,356; for the fiscal year 1904, $125,000. Peekskill harbor, for the fiscal year 1904, $33,000.

MISCELLANEOUS.

Greenville, Miss.—Press reports state that the Mississippi Levee Comrs. will soon let contracts for levee work to cost about $100,000. J. T. Atterbury, Pres.; C. H. West, Ch. Engr.

St. Louis, Mo.—The World's Fair Co. has let, through its Grounds & Bldg. Com., a contract for excavating and revetting the lagoons to the Bray Const. Co., St. Louis, for $79,010.

Philadelphia, Pa.—The Dept. of Pub. Safety has awarded to Andrew O'Connell contracts for laying out, grading and beautifying Westmoreland, Vernon and Athletic Parks. Aggregate amount of contract, $30,950.

St. Louis, Mo.—Bids are wanted July 31 for grading, masonry and timber bridging on about 32 miles of heavy work for the Missouri & Southeastern Const. Co. M. W. Wambaugh, Supt. of Const., 508 Granite Blk., St. Louis.

Superior, Wis.—Press reports state that the Northwestern Fuel Co.'s coal dock on the bay front, at the foot of Winter St., is to be doubled in capacity.

Bayfield, Colo.—Bids will be received by A. C. Morris, Secy., King Consolidated Ditch Co., Bayfield, until Aug. 1, for clearing and excavating 13 miles of ditch near Bayfield.

Toledo, O.—Local press reports state that King & Tracy, acting for the Manufacturers' Ry. Co., are preparing to receive bids for a mile of dockage.

Irvin, Pa.—Bids will be received by the United Coal Co., 1105 Bank for Saving Bldg., Pittsburg, until July 31, for sinking and timbering 2 shafts about 350 ft. deep; air shaft, 10x12 ft. finished measurement, and main hoisting shaft, 11x22 ft.

Cincinnati, O.—Mayor Fleischmann has signed the manuscript bond for $50,000 for improvements in the parks.

NEW INDUSTRIAL PLANTS.

The Emmert Mfg. Co., Waynesboro, Pa., expects to be in the market early in the fall for machinery, as it intends to build an additional shop.

The Callery Junction Brick & Tile Co., Callery, Pa., intends to erect a plant having a daily capacity of 20,000 brick.

The Powers Mfg. Co., Powersville, Iowa, is erecting a 2-story and basement, 32x100-ft. factory at Waterloo, Iowa, and expects to install a gasoline engine of about 10 H.-P.

The McClary Mfg. Co., London, Ont., is having plans prepared for a 198x220-ft. foundry; 2-story, 80x250-ft. mounting shops; 2-story polishing and fitting shop; power house and storage buildings. It is intended to operate by electric power and use compressed air for hoists, etc.

The Browansville, Tenn., Cotton Oil Co. is erecting a 40-ton oil mill. The power will be furnished by two 60x16-in. boilers and a 16x36-in Corliss engine.

The Louisiana Central Lumber Co., Clarks, La., contemplates erecting a double band saw-mill with a planing mill of about ten machines. Seven 66x72-in. boilers, a 300 and a 500-H.-P. engine, five brick dry kilns, machine shops, etc., will be required, to manufacture about 100,000 ft. of lumber daily. Contracts for planing mill machinery and boilers have been let.

The Apalache Mills, Greer Depot, S. C., will erect a 2-story, 104x200-ft. mill building and a 130x200-ft. loom shed. Water power will be used, with an immediate development of 500 H.-P. and a subsequent development of the same amount. There will be installed 17,000 spindles and 400 looms. Lewis W. Parker, Pres. & Treas.

The Wyoming Spinning Co., Norristown, Pa., is erecting a new factory.

The Garland Nut & Rivet Co., Frick Bldg., Pittsburg, Pa., capital stock $200,000, has taken over the business of the rivet department of the Garland Chain Co. and the Dunham Nut Co., Unionville, Conn., and will make hot and cold rivets and hot and cold pressed nuts. A 690x80-ft. brick factory building, to have a daily capacity of 20 tons, will be erected at West Pittsburg. The power plant will have a capacity of 250 H.-P. and the entire plant will be run by electricity. John W. Garland, Pres.; Robt. Garland, Treas.; Alfred Sang, Gen. Mgr.

Plans and specifications can be seen at the office of Joseph H. Wallace, Temple Court Bldg., New York, for the superstructure of a mill for the Kalamazoo, Mich., Paper Co., on which bids are wanted.

P. H. MaGirl, Bloomington, Ill., contemplates the erection of a foundry in the near future, but plans have not been adopted.

The Jasper, Tex., Brick Co. has been organized with a capital of $20,000, and proposes to install a plant with a daily capacity of 60,000. L. P. Scarborough, Secy.

The Horton Mfg. Co., Painesville, O., makers of brick machinery, expect soon to erect a 350x60 and a 50x100-ft. building and install a 100-H.-P. Corliss engine.

BUSINESS NOTES.

Jones & Laughlins, Pittsburg, Pa., have ordered from the Westinghouse Electric & Mfg. Co. one 800-Kw. direct-current generator, two 150-Kw. motor-driven two-phase alternators and two 125-light motor-driven arc generators.

The Allis-Chalmers Co., Chicago, reports the following among its sales during June, the engines being 1890 frame Reynolds Corliss unless otherwise stated: W. F. Stewart Co., Flint, Mich., 18x36-in.; Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., 22x48-in.; Brown, Cary & Woodruff Co., Salt Lake City, Utah, 12x36-in.; Tyee Copper Co., Ladysmith, Vancouver Is., 14x36-in. girder frame; Kioto, Japan, Traction Co., 16 and 32x36-in. cross-compound direct-coupled; P. A. Peterson, Rockford, Ill., 10x30-in.; Park City, Utah, Sampling Mills, 16x36-in.; Hudson River Lumber Co., Kansas City, Mo., 20x42-in.; International Paper Co., New York, 16x42 in.; Virginia-Carolina Chemical Co., Richmond, Va., 16x42 and 20x42-in. girder frame; Janesville, Wis., Cement Post Co., 14x36-in. girder frame; Geo. T. Houston, Chicago, 28x48-in.; Twin City Rapid Transit Co., Minneapolis, Minn., 46 and 94x60-in. vertical cross-compound direct-coupled (third order); West Allis, Wis., Malleable Iron & Chain Belt Co., 12x30-in. girder frame; John Q. Gant, Elon College, N. C., 18x48-in.; London, Eng., United Tramways, 26 and 54x48-in. vertical cross-compound direct-coupled (second order); Pennsylvania Railroad Co., Riedler air compressor with 15 and 24x36-in. air cylinders, driven by cross-compound non-condensing Corliss engine with 14 and 24x36-in. steam cylinder; Kennedy M. & M. Co., California, direct-acting double-drum hoisting engine with 10x7-ft. drums, driven by a 28x60-in. duplex Corliss engine.

The United Railways & Electric Co., Baltimore, Md., is installing a 350-H.-P. tandem compound engine, built by the Ball Engine Co., Erie, Pa.

The Thomson Meter Co., Brooklyn, N. Y., has received a contract for 1,500 ⅝-in. Lambert water meters and couplings from the City of San Juan, P. R.

G. M. Gest, 277 Broadway, New York, has received through his Cincinnati office a contract for 100,000 duct-feet of underground work of the Bell Telephone Co., of Cincinnati.

The Edison Electric Illuminating Co., Boston, has contracted with the Green Fuel Economizer Co. for an installation of an economizer in their Atlantic Avenue power station.

The Duquesne Fireproofing Co. is building a new plant at West Winfield, Butler Co., Pa., to be equipped with the latest machinery for the manufacture of sewer pipe, brick and fireproofing. The building will be 200x150 ft. Most of the machinery has been purchased. F. W. McKee, Pres.; E. J. Fronheim, Vice-Pres.; Joseph Fronheim, Secy.; W. C. Linn, Treas.; George H. Albertson, Gen. Mgr.

The Phoenix Iron Works Co., Meadville, Pa., reports the following among its recent orders: Farmers' Deposit National Bank, Pittsburg, three 240-H.-P. tandem compound engines and a 120-H.-P. simple engine; Grafton, W. Va., Gas & Electric Light Co., a 200-H.-P. tandem compound engine; Penn Iron & Coal Co., Canal Dover, O., two 320-H.-P. tandem compound engines; Mt. Pleasant Hotel Co., Fabyan, N. H., three 480-H.-P. simple engines; R. H. Macy & Co., New York, two 320-H.-P. tandem compound engines; H. C. Hallenbeck, New York, two 240-H.-P. tandem compound engines and an 80-H.-P. simple engine; Maritime Building, New York, three 120-H.-P. simple engines; Dunlap Building, Philadelphia, two simple engines; Cafe Martin, New York, two simple engines; Paulinskill Consolidated Power & Ice Co., Columbia, N. J., a 600-H.-P. cross-compound engine; Lehigh Power Co., Easton, Pa., a 600-H.-P. cross-compound engine; Chas. L. Seeger, San Vincente, Mex., a simple engine; Heyden Chemical Co., Garfield, N. J., a 125-H.-P. compound engine; W. J. Moxley Building, Chicago, two 200-H.-P. compound engines, and a 65-H.-P. simple engine; United Electric, Gas & Power Co., Santa Barbara, Cal., a 175-H.-P. compound engine.

The Sprague Electric Co. reports that in addition to foreign orders and contracts for small apparatus, it has recently made the following sales: Atlas Portland Cement Co., Hannibal, Mo., seven 35-H.-P. motors and eight 15-H.-P. motors; Atlas Portland Cement Co., Northampton, Pa., 30-H.-P. motor and two 35-H.-P. motors; E. W. Bliss, New York, fifteen 10-H.-P. motors, seventeen 25-H.-P. motors and one 50-H.-P. motor; Lehigh Portland Cement Co., Wellston, O., one 300-Kw. belted generator, one 230-H.-P. motor and six smaller motors aggregating 100 H.-P.; Emery Bird Thayer Dry Goods Co., Kansas City, three split-pole engine-type generators, 60 Kw., 100 Kw. and 350 Kw., respectively; Mergenthaler Linotype Co., Brooklyn, one 150-Kw. split-pole engine-type generator; Government Printing Office, Washington, D. C., contract for ventilating plant, consisting of direct-connected American blowers and the following motors: one 5-H.-P. motor and one 10-H.-P. motor, two 15-H.-P. motors and eight 20-H.-P. motors; Hatzel & Buehler, New York, one 125-H.-P. motor for the New York Herald; the Alliance Press, New York, nine motors for printing presses; Lackawanna Steel Co., West Seneca, N. Y., one 3-ton trolley hoist; the John Simmons Co., New York City, one 50-Kw. belted generator and two 20 and 25-H.-P. motors; Shoreham Hotel, Washington, D. C., three split-pole engine-type generators to develop 50, 75 and 100-Kw. respectively; Baltic, Conn., Mills Co., one 75-Kw. split-pole belted-type generator; Gorham Mfg. Co., Providence, R. I., one 40 H.-P. motor; Utica Steam and Mohawk Valley Cotton Mills, Utica, N. Y., two 100-Kw. split-pole belted generators; Duluth, Minn., Printing & Pub. Co., one 25-H.-P. motor; New York Life Insurance Co., New York City, two 50-Kw. split pole belted generators; James Wilson, Pittsfield, Mass., one 150-Kw. belted generator; United Coke & Gas Co., Sharon, Pa., one 50-H.-P. motor and one 15-H.-P. motor; Pennsylvania Steel Co., Steelton, Pa., ten 5-ton trolley hoists; Sigourney Tool Co., Hartford, Conn., one 75-Kw. split-pole engine-type generator; Lindell Hotel Co., St. Louis, one 60-Kw. and one 75-Kw. split-pole belted-type generator; American Can Co., New York, one 75-Kw. engine-type generator and one 35-Kw. belted generator; Lewis Institute, Chicago, one 75-Kw. split-pole engine-type generator; George A. Fuller Co., New York, four 25-H.-P. motors and one 10-H.-P. motor; Hibbard-Rodman-Ely Safe Co., Plainfield, N. J., two 25-H.-P. motors; Goes Lithograph Co., Chicago, 20 motors, various sizes; Tucker Elec. Construction Co., for the National Meter Co., Brooklyn, N. Y., one 75-Kw. split-pole engine-type generator.

The West Virginia Reform School at Fetterman, W. Va., is installing an electric plant. The engine will be furnished by the Ball Engine Co., Erie, Pa., and the generator by the Westinghouse Elec. & Mfg Co.

The Field Force Pump Co., Lockport, N. Y., reports the following among its recent sales of Carter pressure water filters; Troy & Cohoes Shirt Co., Cohoes, N. Y., a 40-in. filter, having a capacity of about 50,000 gal. daily; F. D. Killian, Washington, D. C.; G. E. Crawford, Bridgeport, Conn.; Chas. B. Scott, Scranton, Pa., and Slayton & Partridge, Wheeling, W. Va.

The Oliver Schlemmer Co., Cincinnati, O., engineers and contractors for steam and hot-water heating, power-pipe fitting, plumbing and drainage, have succeeded to the business of Oliver Schlemmer, and are prepared to do work on a larger scale than before. The officers of the company are: Pres., Oliver Schlemmer; Vice-Pres. & Mgr., Clifford T. Schlemmer; Secy. & Treas., Oliver H. Schlemmer.

W. H. Wagner Sons, Freeport, Ill., are installing an electric plant consisting of Crocker-Wheeler generator direct connected to an engine built by the Ball Engine Co., Erie, Pa.

Geo. M. Brill, Marquette Bldg., Chicago, has been retained as consulting engineer for the plant of the Victor Chemical Works, Chicago Heights.

Westinghouse, Church, Kerr & Co. announce the removal of their Pittsburg office from its former location on the first floor of the Westinghouse Building to more commodious quarters on the eighth floor of the same building. This change is the direct outcome of largely increased business in this district, and is accompanied by the acquirement of a commodious reception room devoted exclusively to the convenience of visitors.

Sanger Bros., Waco, Tex., will install an electric plant in their dry goods house, the engines being furnished by the Ball Engine Co., Erie, Pa.

The pipes in the plant of the Tesla Laboratory, Warden Clyffe, N. Y., were recently covered by the H. W. Johns-Manville Co. Mr. Tesla writes: "I have watched this work with interest, and am well satisfied with the manner in which it has been done." The covering used in this instance is the asbestos-sponge felted sectional pipe covering, constructed of fibers of asbestos and a small quantity of granulated sponge, thus combining the properties of asbestos with the lightness and porosity of sponge.

The Philadelphia Pneumatic Tool Co. has concluded arrangements for representation in South Africa, with headquarters at Johannesburg. This agency will be in charge of Gen. Samuel Pearson, late of the Boer forces. Gen. Pearson has been in the United States for some months in the interests of his Government, in the attempt to have the mule shipments from Port Chalmette stopped. Now that peace has been declared he will return to his former business in the machinery lines and will handle the accounts of the Philadelphia Pneumatic Tool Co. and others.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
July 28.	Grand Rapids, Minn.	July 26
July 29.	Sand, Poughkeepsie, N. Y.	July 19
	Adv., Eng. Record, July 19, 26.	
July 31.	Pittsburg, Pa.	July 26
Aug. 1.	Geneseo, Ill.	July 26
Aug. 1.	Boiler house, Dayton, O.	July 26
Aug. 1.	Elkland, Pa.	July 26
	Adv., Eng. Record, July 26.	
Aug. 1.	Springdale, Ark.	July 19
Aug. 5.	Wilmont, Minn.	July 26
Aug. 5.	Waterbury, Conn.	July 26
	Adv., Eng. Record, July 26.	
Aug. 5.	Stand pipe, etc., Yardley, Pa.	July 19
Aug. 7.	Elyria, O.	July 26
Aug. 7.	Pump, Yonkers, N. Y.	July 19
	Adv., Eng. Record, July 19.	
Aug. 7.	Pipe, etc., Yonkers, N. Y.	July 19
Aug. 8.	St. Louis, Mo.	July 26
Aug. 12.	Tell City, Ind.	July 26
Aug. 12.	Pumping plant, etc., Wash., D. C.	July 19
	Adv., Eng. Record, July 19, 26.	
Aug. 13.	Engines, Chicago, Ill.	June 14
	Adv., Eng. Record, June 21, 28.	
Aug. 14.	Well, Niles, O.	July 19
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
	Adv., Eng. Record, July 12, 19.	
Aug. 18.	Blakely, Ga.	July 26
	Adv., Eng. Record, July 26.	
Aug. 18.	Whatcom, Wash.	July 19
Aug. 20.	Ithaca, N. Y.	July 26
Sept. 5.	Engine and boiler, Milwaukee, Wis.	July 19
Dec 1.	Pumps, Seguin, Tex.	July 26

SEWERAGE AND SEWAGE DISPOSAL.

July 28.	Syracuse, N. Y.	July 26
July 29.	Dunkirk, N. Y.	July 26
July 29.	Cleveland, O.	July 19
July 30.	Sewer basins, Brooklyn, N. Y.	July 26
July 31.	York, Pa.	July 26
July 31.	Harrisburg, Pa.	July 26
July 31.	Boston, Mass.	July 26
	Adv., Eng. Record, July 26.	
July 31.	Long Island City, N. Y.	July 26
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American Shop Practice in Bridge Construction.

In January of the current year Mr. Henry Bridges Molesworth presented a paper before the Institute of Civil Engineers entitled "American Workshop Methods in Steel Construction," which possesses much interest for American engineers and manufacturers, and scarcely less for British bridge builders and engineers, as is evidenced by the tone of some of the discussions of it by members of the Institution. Mr. Molesworth's professional practice has brought him to this country in connection with a number of bridge structures which have been built for British colonies by the American Bridge Company at their Pencoyd shops, and he has been prompted by his observations to give to his professional brethren at home the reasons why American bridge builders have been able to underbid British constructors in modern steel bridgework. In passing it may be stated that our friends across the water have on various occasions assigned reasons for this state of things quite different from those set forth by Mr. Molesworth. At the very outset of his paper he states his judgment that "first-class American bridgework is fully equal, if not superior, to the best English work in design, material, workmanship and finish." Consequently there must be some more substantial basis for the underbidding of British constructors by those in America than that the work of the latter is of indifferent quality.

After giving a comprehensive and clear statement of some of the workshop methods and other features of the work executed at the Pencoyd shops, Mr. Molesworth proceeds to make comparison in a number of respects between the business of bridge construction in America and in Great Britain. Undoubtedly the unwise features of trades unions rules and influences are much more marked in Great Britain than in this country, to the decided financial disadvantage of the laborer himself in such a way as to greatly reduce his efficiency in the mechanical operations of the shop. In this country we certainly have no lack of active labor organizations nor do they avoid all measures that are unwise, but the American mechanic, in spite of all this, is a vastly more effective operator than the same type of man in Great Britain. Notwithstanding his pay may be two or three times that of the English mechanic he conducts his operations so much more effectively as to turn out four or five times as much work, making his services correspondingly more valuable. Doubtless the ability of the American bridge builder to undersell his British competitor in the colonial market of the latter is due largely to the greater efficiency of the American mechanic, as has many times been observed, but there is much more than that in the question, as Mr. Molesworth indicates.

He remarks most pointedly upon the readiness and perhaps even indifference with which the American shop owner or manager practically relegates to the scrap-heap, machinery in actual use, when improved machinery and tools may be made to produce a greater output at smaller cost. This is a feature of American shop and mill management which has not escaped the notice of many astute observers, and yet the wisdom of such a policy has not been promptly recognized even in some large American works. By far the most successful shops and mills in this country are those in which the most frequent changes of machines and tools have been made in the development of greater rates of output at reduced unit costs, whatever other influences may have aided in giving the American bridge constructor his present advantageous position. Mr. Molesworth makes this among his most effective points, although a number of his fellow members of the Institution could not apparently endorse his views.

Aside from the labor feature of the question, one of the discussers of the paper, Mr. H. F. Donaldson, put himself close to the kernel of the question when he said that "he read into the paper three main points, standardization, specialization and organization." He could scarcely have phrased the matter in a better way, for those three features have characterized American bridge practice most markedly ever since the building of bridges began in this country. Although there is, and always has been, reasonable latitude in design both among engineers and in the shops to meet the varying requirements of locality and competent individualism in the designer, there has been the constant standardizing motive through it all. This has not degenerated on the one hand into unprogressive routine, nor on the other to erratic or fanciful individual excess. Avoiding those extremes there has been a steady advance in excellence, with which standardizing of types, details and methods or processes, has been constantly introduced.

Again, the most scrupulous study has been given in this country to the organization of the office force and of the shop, also observed by Mr. Molesworth. This efficient organization enables the maximum of results to follow from the standardization which has been such a marked feature of American bridge work. Under these conditions there is no unnecessary loss in useless variety of operations in the shop. Every engineer familiar with shop processes is aware of the tremendous advantage of duplication resulting from standardizing in every possible branch of shop work, and this advantage is manifolded by shop organization which turns every handling of a piece into a long and direct step toward the shipping platform. Equal efficiency has been carried into the office force, including the computing and drafting rooms.

It is due to all these features of the American bridge constructing work that the output from the bridge shop per man in this country is from four to six times that in Great Britain, and that the fixed charges per ton of work in Great Britain may be even ten times as much as in the United States. In all probability ultra conservatism in Great Britain has much to do with these relative results. In this country expedition and economy have been absolutely imperative, sometimes it must be admitted to the impairment of the highest degree of excellence. This latter observation, however, has no application at the present time to any of the first-class American bridge work. The advantage which the American builder holds in the world markets is due both to the effective character of the American mechanic and to the advanced degree of engineering excellence in design and shop execution, both on the part of the engineer and the shop manager; both have had their parts to play and they have played them well. While in special instances there has been now and then a little friction, on the whole the civil engineer has striven for the highest degree of excellence in design and construction in such a way that the shop manager has had abundant opportunity to project into the final results, all the excellence which can follow from the most advanced shop organization and management.

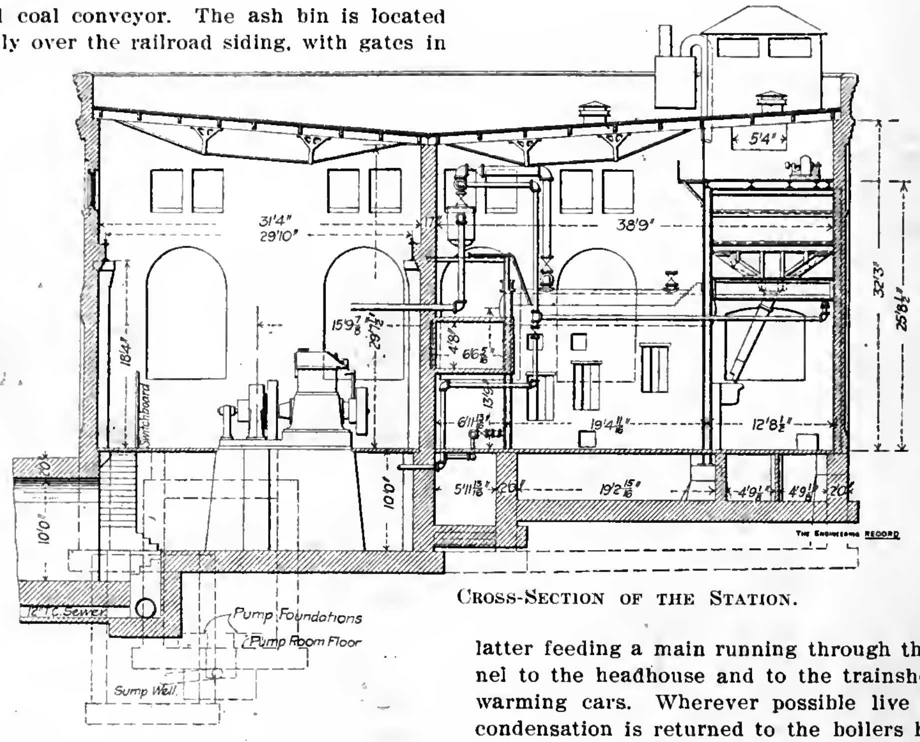
The Diverse Views held by courts of final jurisdiction in different States concerning the same subjects are exemplified by recent decisions of the Supreme Courts of Vermont and Ohio concerning the right of a town or water company to supply river water for manufacturing purposes, to the detriment of lower riparian power privileges. In the Vermont case, 50 Atl. Rep. 1,055, the Barre Water Company was enjoined from supplying water to granite-polishing works on the ground that such a supply diminished the flow to which lower riparian owners were entitled. The company's charter allowed it to take the water for the town and its inhabitants "for the extinguishment of fires, and for domestic, sanitary and other purposes." The court rules that "other purposes" should be construed to mean other like purposes, and that the sale of water for manufacturing uses does not come under this head. The second case, 63 N. E. Rep. 600, was brought against the City of Canton, Ohio, by a lower riparian owner, who contended that the city had no right to furnish water for manufacturing purposes when it thereby impaired his power privilege. The court decides that the city has the right to supply all reasonable manufacturing needs in addition to domestic requirements, within the municipal limits. The city is held to be an individual entity, endowed with all the rights and liabilities of a riparian owner. One of these rights is the reasonable use of water, and the court holds that the use of water for any legitimate industrial purpose is legally reasonable and subject only to one restriction. This is the equitable division of the water, other than that for domestic uses, between all riparian owners during periods of a scanty supply. This radical departure from the interpretation of the law of riparian rights made by the Vermont court is no greater than was the deviation from its view of "other purposes" which is recorded as happening years ago in Rhode Island. An eminent Senator was called to account for the unauthorized existence of a State bank in which he was interested that had been refused a charter by the Legislature. He admitted that the bank was openly doing a thriving business in Providence, but explained that it was working under the charter of the First Free Will Baptist Society of Foster Center, which was chartered "for the worship of God and other purposes." He certainly considered running a bank well within the scope of "other purposes," a view that the investigators were constrained to consider warranted by the facts.

The Mechanical and Electrical Equipment of the Pittsburg & Lake Erie Railroad Terminal, Pittsburg.—I.

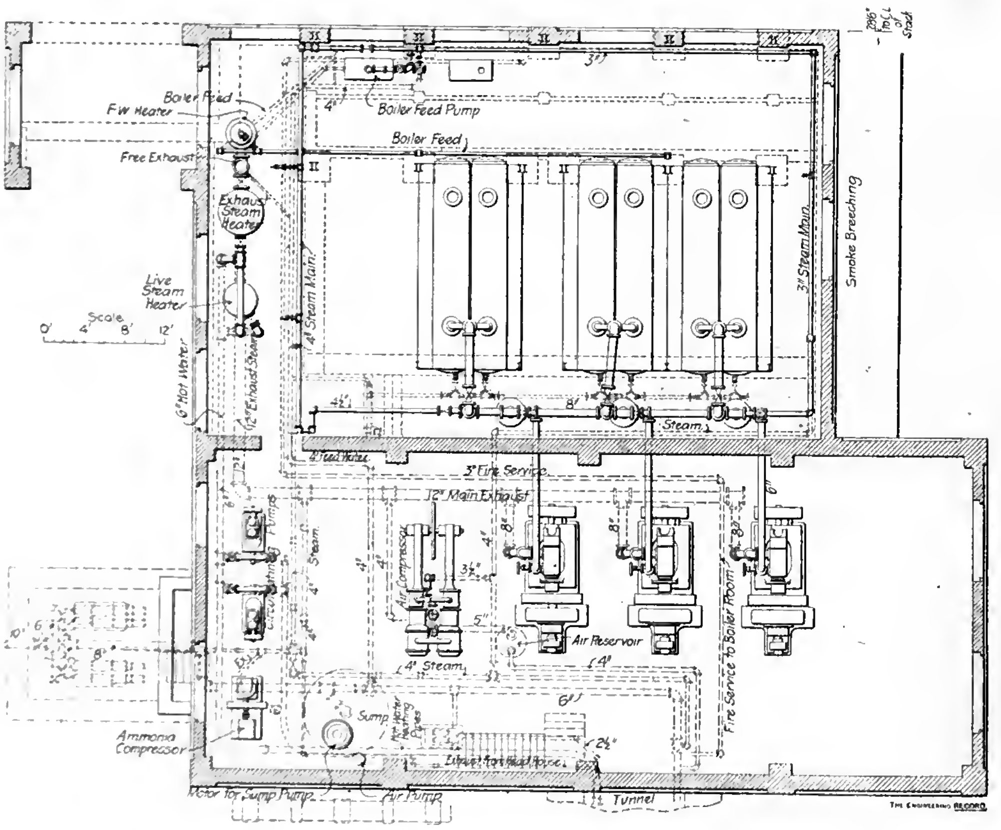
The Pittsburg & Lake Erie Railroad Company has been operated for about a year from a reconstructed terminal at Pittsburg, which includes a new seven-story station building or headhouse, a steel trainshed 500 feet long connected with the headhouse by a concourse 55 feet wide, freight sheds and an express building. The basement of the headhouse is largely taken up with apparatus for warming and ventilating the building, elevator machinery and other auxiliaries to meet the requirements of an up-to-date terminal. The power plant is installed in a separate detached building, and is connected to the headhouse by a tunnel, which also forms a passageway for all service wires and pipes. The principal equipment consists of three boilers and stokers, a total of 750 horse-power with space provided for one-third increase, a coal and ash-handling plant, three electric generating sets with room for a fourth, air compressors, a water distilling and refrigerating plant and several pumping plants for general drainage, for fire protection and for hot and cold-water supply.

The power house is a well lighted and well ventilated brick building with steel truss roof. The principal apparatus and piping is shown in the accompanying plan and sectional elevation. The boilers are of the water-tube type made by the Aultman & Taylor Machinery Company. They are designed for a working pressure of 150 pounds per square inch and are equipped with Roney mechanical stokers and smokeless furnaces adapted to burn all kinds of hard or soft coals. Coal and ash handling machinery of the bucket and chain type has been installed by Messrs. Heyl & Patterson, of Pittsburg. Coal is dropped from hopper bottom cars on a railroad siding into a chute, which carries it by gravity to an electrically driven elevator operated by a 7½-horse-power motor. By the elevator the coal is raised to a horizontal conveyor, also driven by a 7½-horse-power motor, which distributes the coal into an overhead masonry storage bin. From this it is drawn by gravity through steel spouts to the stoker hoppers. The apparatus has a capacity of 35 tons per hour, and the bin will hold 100 tons. Ashes are drawn from the furnace pits upon the boiler room floor and wheeled to an opening in the floor, where they are dumped into the boot of the same elevator which is used to elevate the coal. By means of a switch damper in the discharge end of the elevator the ashes are delivered into a masonry ash storage bin, instead of being discharged upon the horizontal coal conveyor. The ash bin is located directly over the railroad siding, with gates in the bottom to control the flow of ashes to the car. Draft is furnished by means of a self-supporting steel stack 135 feet high, lined with red brick its entire height, and 6 feet in inside diameter.

Steam is conveyed from the boilers to the engines and pumps through main piping supplied with separators, as shown, the separators being high enough so that the entrained water is returned to the boilers by gravity. Long turn bends of iron pipe were used for drops from the main header to the engines, and mention may be made here of the fact that no expansion joints are employed in any of the piping in the plant. The miscellaneous service requiring live steam and the auxiliary apparatus is supplied by a system of auxiliary piping having its origin in both ends of the main header, but otherwise independent of it. The auxiliary system comprises two loops, one in the boiler room and the other in the engine room, the latter feeding a main running through the tunnel to the headhouse and to the trainshed for warming cars. Wherever possible live steam condensation is returned to the boilers by the Holly gravity return system.



Cross-Section of the Station.



Power Plant of the Pittsburg & Lake Erie Terminal, Pittsburg.

The main exhaust piping receives the exhaust steam from all engines and pumps, and is utilized for heating water for warming the buildings and for heating the boiler feed. The exhaust heaters are provided with by-pass piping around them by which the surplus exhaust steam can pass through an exhaust muffler above the roof of the power house. The feed water heater is a 700-horse-power Goubert closed type heater. Although located on the bank of the Monongahela River, a steam condenser was found inadvisable, as the small saving possible by the use of a vacuum during the comparatively short periods when there would be surplus exhaust steam not required for heating, did not warrant the investment.

Three 14 and 24x14-inch Westinghouse single acting compound automatic engines are installed in the engine room, having an aggregate capacity of 600 nominal indicated horse-power, each directly connected with a 120-kilowatt Westinghouse engine-type generator. The engines are furnished with wrought-iron operating platforms with connecting galleries and pipe hand railings. A hand power traveling crane, having a lifting capacity of 20,000 pounds spans the engine room and travels its full length.

Direct current at 110 volts is used for arc and incandescent lighting, for the elevators and dumb waiters, and for motors to operate the coal and ash handling machinery, sump pump and ventilating fans, as follows:

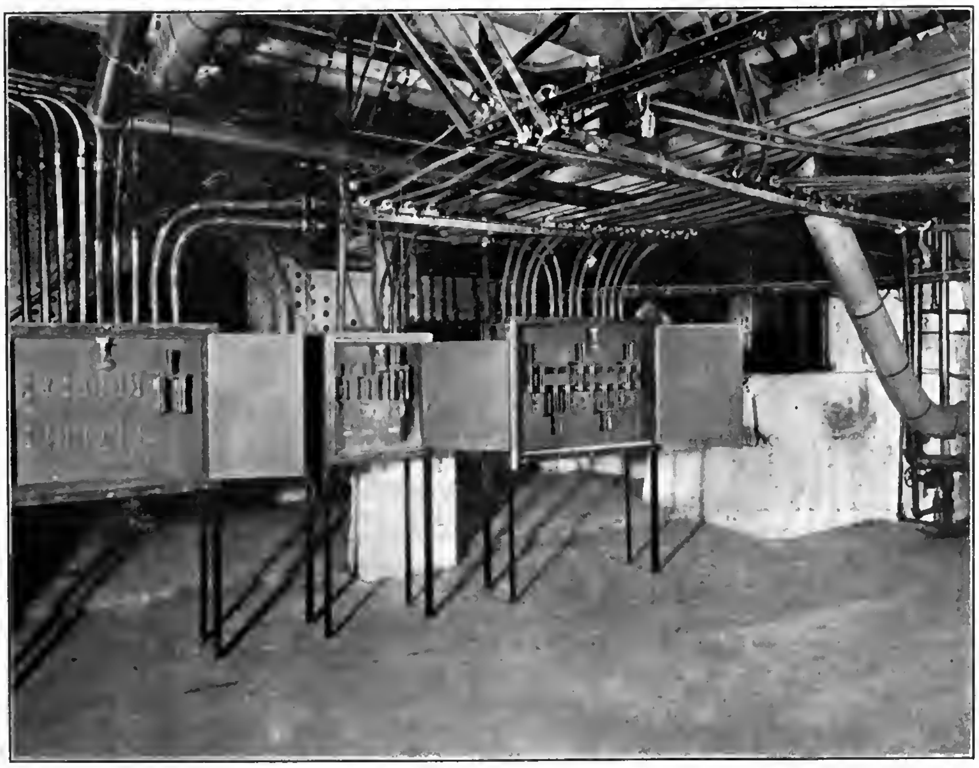
2,700 incandescent lights	159.5 kilowatts
71 arc lamps	43. "
5 elevators and dumb waiters	60.4 "
10 motors	53. "

Ordinarily two generators supply the current, the third being spare. The main switchboard is of white marble, the generator panels are located at one end of the board, the distributing panels at the other and a load panel in the center. Thirteen feeder circuits are carried from the board to distributing centers, located conveniently and with regard to the best general distribution, in different parts of the premises. Steel cabinets containing slate panels, with the necessary switches and fuses for local control of lights, are provided at distributing centers. Similar cabinets containing cutout panels are located where required. All cabinets are slate lined and in appropriate places are furnished with plate glass doors. Switches and fuses throughout the work are placed on the front of the boards, while all wires, bus bars and connections are on the back. Rubber covered lead sheathed cables are used for connecting the generators with the switchboard; feeder cables between the board and distributing centers have weather proof insulation; sub-feeder cables and branch wiring to lights are heavy rubber covered with double braid insulation installed in unlined steel conduit, concealed in the floors, walls and ceilings. The lighting system includes an illuminated sign: "P & L E R R" in letters 8 feet high, above the roof of the terminal station. The trainshed has an arc lamp for every 50 feet throughout the entire length of each platform.

Compressed air is used for cleaning coaches, for testing and charging train brakes and train signals prior to a train's departure and for cleaning the electric generators and motors. The supply is furnished by a horizontal duplex steam driven Laidlaw-Dunn-Gordon air compressor having a capacity to compress 500 cubic feet of free air per minute to 100 pounds pressure, a 9½-inch Westinghouse locomotive air pump being installed as an auxiliary for use in case of repairs to the larger machine, or at times when reqnirements for compressed air are small. Air is distributed through pipe mains equipped with large receivers or reservoirs, and the compressors are provided with automatic governing devices for maintaining a constant pressure on the system.

The water pumping apparatus for the station includes in addition to the domestic hot and cold water supply, a pump for the general supply of water, a pump for the fire service and a centrifugal motor-driven pump for the disposal of drainage. The general supply and fire pumps are located side by side in a pump pit outside the engine room, the water being led to the pit from a well driven between the power house and the river. The general water supply pump is a compound duplex steam pump, and water for all purposes, except fire protection, but including boiler feeding, domestic supply in all buildings for street sprinkling and for locomotive supply tanks can be supplied from it. It is cross-connected with the fire pump, so that either may reinforce or temporarily do the work of the other during repairs. By other pipe connections and controlling valves either pump or both can work in connection with the drainage pump during emergencies or floods, the three having a total capacity of 2,000 gallons per minute.

TUNNEL CONNECTING POWER STATION AND HEADHOUSE.



PANEL BOARDS IN THE HEADHOUSE BASEMENT.

The fire pump is a steam driven duplex underwriters' pump with a capacity of 500 gallons per minute at a pressure of 100 pounds. Mains from this pump connect with risers in the buildings and to hydrants throughout the yards. Two risers are in place in the headhouse, with hose connections on each floor and at the roof, a total of 18 outlets, connected with hose ready for instant use. The pump is continually under steam, and by means of a Ford governor, automatically maintains a constant pressure in the fire system.

The need of special provision for drainage arose from the fact that at times of flood the river rises more than 30 feet above mean low water line, making it necessary to provide means to handle water which might find its way through the waterproofing of the floor and side walls of the basements during high-water periods. A large sump well was built below the basement of the power house to receive all drainage from rooms below the high-water line. A vertical centrifugal pump, made by the Baldwinsville Centrifugal Pump Works, located in the bottom of this sump, but having its shaft extended through basement to engine room, is direct coupled to a special vertical Westinghouse motor of 20 horse-power capacity. The pump is designed to handle 1,000 gallons per minute and is automatically started and stopped by the rise and fall of a float connected to a Cutler-Hammer starter. If the water to be handled exceeds the capacity of the pump, the float continnes to rise, making an electric connection to a high-water alarm. Under these conditions the fire and general water supply pumps can be put into action, as already stated.

For the domestic hot and cold water supply separate pipe systems deliver hot and cold water to wash bowls, toilet rooms and baths. The system for hot water is connected to a closed National heater containing a live-steam coil, the desired temperature being maintained by thermostatic control of the steam supply. The hot-water is circulated by gravity through several loops of distributing piping, which leave and return to the heater. The supply for these systems is taken from the general water supply pipe, and a constant pressure is maintained in the distributing system by a small duplex steam pump, controlled by a Ford governor.

The drinking water system comprises a filtering, distilling and a cooling apparatus, to render the water pure and palatable and afterwards to prevent its becoming contaminated by contact with impurities in the atmosphere. To accomplish this all apparatus is air tight. The water to be treated passes through a pressure quartz filter, which removes matters held in suspension, then to a Jewell water still where the water is evaporated by a submerged steam coil and to a surface condenser forming part of the still, which has a capacity of 25 gallons per hour. The distillate is piped to a closed storage tank in the basement containing submerged ammonia refrigerating coils by which the water is cooled to the desired temperature. A small steam pump circulates the water through highly insulated loops of piping to fountains in offices, corridors and waiting rooms, and it is intended to carry it to the trainshed for filling drinking tanks in all outgoing trains. The refrigerating plant, consisting of a Westinghouse ammonia compressor direct coupled to a slow-speed vertical engine, together with an atmospheric condenser and auxiliaries, is located in the power house.

The elevator equipment of the building is electric, and comprises two passenger elevators, one freight elevator and two dumb waiters. The passenger elevators are designed to carry a live load of 2,500 pounds each, at a speed of 250 feet per minute, the freight elevator a live load of 5,000 pounds and the dumb waiters a live load of 300 pounds each. The freight and passenger cars operate between the ground and upper floors. The dumb waiters for restaurant and kitchen use operate between the basement, where all supplies are received, to the kitchen, located on the sixth floor. The elevator machinery was manufactured by the Sprague Elevator Company and the freight and passenger cars have electric lever control. An electric device connects the hoistway gates with the machines and prevents the starting of a car unless all gates in its hoistway are closed and locked. The dumb waiters are operated by a full automatic push button control, by which an attendant at any floor may send a car to any other floor by pushing a button. The hoistway doors to these shafts are also electrically connected with the machines in a similar manner to the large elevators.

As already stated, the terminal is warmed by hot water. The system is a closed circulating system, with two heaters for warming the water, one to utilize exhaust steam, and the other for live steam when the exhaust steam is insufficient, and with centrifugal pumps to obtain a positive circulation. The pumps are driven by vertical steam engines and are in duplicate to prevent an interruption of the system. The heaters and pumps are located in the power house and the temperature is regulated there to meet atmospheric changes during the day or season without the necessity of turning on or off radiators in any of the rooms warmed. The water is distributed through both direct and indirect radiators in the headhouse, but it is intended to describe this work more in detail in a subsequent article.

The plant was built under the supervision of Mr. J. A. Atwood, chief engineer of the Pittsburg & Lake Erie Railroad, and Mr. A. R. Raymer, assistant chief engineer, from the plans of Messrs. Westinghouse, Church, Kerr & Company, who were engineers and contractors for the entire equipment.

(To be continued.)

Heaters in Powerhouse for Hot-Water Heating System.

Test of a De Laval Steam Turbine Using Superheated Steam.

The attention of engineers has been drawn frequently to the fact that a steam turbine is particularly adapted to use superheated steam. The works of the De Laval Steam Turbine Company, at Trenton, N. J., are driven by electrical power generated by dynamos directly connected to De Laval steam turbines. The steam is supplied by Babcock & Wilcox boilers equipped with superheaters made by the boiler company. A short time ago Messrs. Dean & Main, Engineers, of Boston, Mass., made an elaborate series of tests upon a 300 brake-horse-power De Laval turbine operated at various loads and using saturated and superheated steam. With superheated steam, 13.94 pounds were consumed per brake-horse-power per hour and with saturated steam, 15.17 pounds per brake-horse-power per hour, the saving by the use of superheated steam amounting to 8.8 per cent. The amount of superheating was 84 degrees Fahrenheit. The details of these remarkably interesting tests are given in the following report of Messrs. Dean & Main, which is printed through the courtesy of the De Laval Company:

On May 21, 22, 23 and June 10, 1902, we conducted several trials under various conditions, of a 300-brake horse-power De Laval Steam Turbine, which is in operation at your factory in Trenton, N. J.

The turbine shaft is geared into two other shafts, instead of one, as is frequently the case with De Laval turbines, and on each of the latter shafts there is a direct current electric generator, both revolving in the same direction, and operating in series.

The current generated is used for driving the tools in the machine shop where turbines are manufactured, but the capacity of the shop is not at present sufficient to utilize the whole power of the turbine or generators. The excess load over the shop requirements was taken up by a water rheostat, which also served the purpose, by frequent adjustment, of maintaining a uniform load. The load could not be kept strictly uniform, but was sufficiently so for all practical purposes. The three-nozzle test on June 10 was made in the evening and the load was all absorbed by the rheostat and was uniform.

Steam was supplied to the turbine by a 250 horse-power Babcock & Wilcox boiler, with the same company's superheater attached, and operated at a pressure of about 200 pounds by the gauge. There were two of these boilers in the room, but that supplying steam to the turbine was separated from the other by disconnecting steam, feed, blow-off and drain pipes, and blanking them in such a way that there were no losses or gains of water from leakage. All work in the shop by steam, independent of that done by the turbine under test, was carried on by another boiler.

Several of the tests were made with superheated steam and several without, as stated in the detailed results of the tests. This could be conveniently done as the Babcock & Wilcox superheater can be thrown out of use at any time and the pipes forming it filled with water so as to add to the water heating surface of the boiler.

The De Laval Turbine.—The De Laval steam turbine consists of a single disc with properly formed buckets on the circumference, against which steam impinges at a proper angle. The steam enters a ring-shaped chamber surrounding the casing of the turbine and cast in one piece with it, and from this it enters several nozzles that convey the steam to the turbine buckets. These nozzles are formed in a way that has been found to be most suitable for the purpose, the interior being tapered with the large end towards the buckets. The steam in passing through the nozzles freely expands, thereby acquires velocity, gives up its work by impact upon the buckets, and thereby rotates the turbine wheel. It is apparent from this brief description of the process of obtaining the energy from the steam that if the means of

Tests with Superheated Steam.

Number of Nozzles Open, 8. Average Reading of Barometer, 30.18 Inches. Average Temperature of Room, 83 Degrees Fahr. Date, May 22, 1902.

Hour.	Steam used per hour, lbs	Pressure above governor valve, lbs.	Pressure below governor valve, lbs.	Vacuum, in.	Superheat above governor valve, deg. F.	Revs. per minute of generators.	Brake horse-power.	Steam per B.H.P. per hour, lbs.
8- 9	4,833	208.3	200.6	27.2	81	...	356.6	13.55
9-10	4,936	207.5	199.3	27.2	86	...	355.7	13.88
10-11	5,083	207.7	202.1	27.2	91	...	357.8	14.21
11-12	4,976	208.3	199.4	27.2	88	...	354.1	14.05
12- 1	4,841	207.5	194.3	27.3	82	...	343.5	14.09
1- 2	4,768	206.9	195.6	27.2	75	...	344.4	13.84
Avge.	4,906	207.0	198.5	27.2	84	750	352.0	13.94
Number of Nozzles Open, 7. Average Reading of Barometer, 30.07 Inches. Average Temperature of Room, 90 Degrees Fahr.								
2- 3	4,316	207.5	196.2	27.4	67	...	299.8	14.39
3- 4	4,248	207.3	197.9	27.4	61	...	297.3	14.29
Avge.	4,282	207.4	197.0	27.4	64	756	298.4	14.35
Number of Nozzles Open, 5. Average Reading of Barometer, 29.79 Inches. Average Temperature of Room, 89 Degrees Fahr.								
8- 9	3,068	199.2	196.5	27.6	8	...	195.3	15.71
9-10	3,010	201.5	197.2	27.4	12	...	197.3	15.26
10-11	3,020	201.4	196.1	27.4	10	...	196.5	15.37
Avge,	3,033	200.7	196.6	27.5	10	743	196.5	15.44
2- 3	3,107	201.4	196.7	27.4	13	...	194.8	15.99
3- 4	3,054	203.1	199.0	27.3	15	...	197.9	15.43
4- 5	3,025	202.7	197.5	27.4	19	...	194.7	15.54
Avge.	3,062	202.4	197.7	27.4	16	747	196.0	15.62
Average of both tests,						745		15.53

converting the energy of the impact into useful work are sufficiently good the efficiency of the machine will be high. There are many sources of loss to which the reciprocating engine is subject that are not present in the steam turbine, and, of course, to some extent, vice versa. In the case of the turbine the nozzles are not in contact with the turbine buckets, and therefore if economy once exists it will be maintained indefinitely.

The power of the turbine depends upon the number of nozzles in action, and these nozzles can be opened or closed by a hand wheel on each. The machine tested had twelve nozzles, but seven gave the rated capacity. It will be seen from this that the turbine is capable of great overloads. Regulation of speed is accomplished by a throttling valve operated by a centrifugal governor.

In connection with economy of steam and the ability to throw nozzles into and out of action, it is at once apparent that each nozzle performs its function as perfectly when operating alone as when any other number of nozzles is in operation. For this reason the turbine does not change its economy of steam per indicated horse-power, if such could be determined, as does a reciprocating engine. There is no "range of temperature" of any importance in the turbine to cause condensation of steam. The principal cause of diminished economy with lighter loads than the rated load is the fact of constant friction with all loads. At overloads there is even greater economy than with the rated load for the reason that the extra nozzles are of maximum economy and the friction losses are constant.

The turbine exhausted into a Worthington injector condenser, and the vacuum was measured by means of a mercury column connected into the exhaust chamber of the turbine. The turbine rotates very rapidly and the speed is reduced by the employment of a spiral spur pinion on the turbine shaft gearing into one or two spiral gears, as the case may be, depending upon whether the power is desired on one or two shafts. The pinions and gear are both double with the teeth inclined in opposite directions so that there will be no end thrust to either shaft.

The Water Measurements.—The water used by the boiler to make steam for the turbine was weighed in a barrel resting upon an elevated platform scale, and from the barrel it was emptied into a barrel below. From the lower barrel the water was forced into the boiler by an injector which was worked by steam from the same boiler, correction for the overflow when starting the injector being made. The height of the water when starting a test was noted by tying a string around the water glass, the height of which was measured in order to re-establish the height when desired.

The water quantities were determined for each hour separately during the tests, and with such uniformity in amounts, that one hour would have been sufficient to approximately establish the rate of consumption of the turbine if such had been necessary. From the tables, however, it will be seen that longer periods were employed. The hourly quantities are given because it is a matter of interest to know with what degree of uniformity hourly results can be obtained. The final averages, however, should only form the means of judging of the economy of the turbine.

When superheated steam was used the amount of superheat was determined by a bare stem Green thermometer inserted in a well of cylinder oil in the steam pipe between the throttle and the governor valves. When saturated steam was used the amount of moisture therein was determined by a Peabody throttling calorimeter drawing steam from the same place. The calorimeter discharge was weighed and deducted.

A separator was located in the line of steam pipe near the turbine. When superheated steam was used no condensation was weighed from the separator, but when saturated steam was used a quantity was continually discharged. This was weighed and deducted from the turbine consumption. There was a drain from the chamber which supplied the turbine nozzles, but it was considered that such steam, having once entered the apparatus undergoing the test, should not be deducted from the water weighed. It accordingly was trapped and the discharge allowed to waste. There was a slight drip from a small pipe at the bottom of the main steam pipe. This was of little consequence, but was nevertheless caught and deducted from the weighed water.

The Electrical Tests.—The power, the measurement of which was desired, was the brake horse-power of the turbine, as it might have been measured by some form of friction brake simultaneously applied to each shaft on which the electric generators were secured. For this purpose the generators might have been disconnected by means of a flanged coupling in each shaft, but as the electrical power was needed for operating the shop, the generators were used and their efficiencies determined. The electrical measurements were made by nice instruments and their errors were determined by taking them to the works of the Weston Electrical Instrument Company, Waverly Park, N. J.

The efficiencies of the generators were ascertained for each load carried. The friction of generators was determined by driving them as motors for another generator. Other resistances were computed by well known methods and under the actual condition of temperature, speed and output. Into these features of the tests this report does not enter, as the steam consumption per brake horse-power, only, is desired. The electrical data were taken simultaneously by one of our assistants and by the electrical engineer of the De Laval Steam Turbine Company. The computations for powers, efficiencies and brake horse-powers, were made by Messrs. Stone & Webster, of Boston, and by the De Laval electrical engineer.

Regulation of Speed.—No tests were made to ascertain the instantaneous effect in speed of change of load or to see how quickly the normal speed was regained after a change. In regard to the permanent effect of change of load on speed, this can best be observed from the data given in the tables of results further on. The speeds and loads are here tabulated for convenience with percentages of variations of load and speed referred to these with eight nozzles in operation.

TESTS WITH SATURATED STEAM.

Number of Nozzles Open, 8. Average Reading of Barometer, 29.92 Inches. Average Temperature of Room, 90 Degrees, Fahr. Date, May 23 and June 10, 1902.

Hour.	Feed water per hour, lbs.	Condensation from separator, lbs.	Moisture in steam at throttle, per cent.	Dry steam entering turbine, lbs.	Pressure above governor valve, lbs.	Pressure below governor valve, lbs.	Vacuum, in.	Revs. per min., generators.	Brake horse-power.	Dry steam per B.H.P. per hour, lbs.
8- 9	5,289	70	2.15	5,107	204.7	196.2	26.7	...	332.2	15.37
9-10	5,073	70	2.15	4,896	206.2	196.2	26.6	...	332.4	14.73
10-11	5,286	70	2.15	5,104	207.2	196.3	26.6	...	332.2	15.37
11-12	5,283	70	2.15	5,101	207.4	198.9	26.6	...	334.9	15.23
Average ..	5,233	70	2.15	5,052	206.4	196.9	26.6	747	333.0	15.17
Number of Nozzles Open, 7. Average Reading of Barometer, 29.90 Inches. Average Temperature of Room, 97 Degrees, Fahr.										
1- 2	4,675	60	2.15	4,516	207.0	196.6	26.8	...	284.4	15.88
2- 3	4,499	60	2.15	4,344	207.7	196.4	26.8	...	285.2	15.23
Average ..	4,587	60	2.15	4,430	207.3	196.5	26.8	746	284.8	15.56
Number of Nozzles Open, 5. Average Reading of Barometer, 29.83 Inches. Average Temperature of Room, 97 Degrees, Fahr.										
4- 5	3,483	51	2.15	3,358	207.5	196.5	27.3	...	194.8	17.24
5- 6	3,219	51	2.15	3,100	207.8	195.1	27.4	...	195.6	15.85
Average ..	3,351	51	2.15	3,229	207.6	195.8	27.3	751	195.2	16.54
Number of Nozzles Open, 3. Average Reading of Barometer, 29.81 Inches. Average Temperature of Room, 80 Degrees, Fahr.										
7- 8	1,996	33	2.15	1,921	201.1	196.5	28.1	...	115.0	16.70
8- 9	2,098	33	2.15	2,021	201.6	198.9	28.1	...	122.0	16.57
9-10	1,984	33	2.15	1,909	201.7	198.4	28.1	...	121.5	15.71
Average ..	2,026	33	2.15	1,950	201.5	197.9	28.1	751	118.9	16.40

All barometer readings are reduced to 32 degrees, Fahr.

Table of Different Loads and Speeds, Using Superheated Steam Except with Three Nozzles.

Nozzles open.	Loads B.H.P.	Relative Loads. Per cent.	Speed R.P.M.	Differences in speeds.
8	352	100	750	+
7	298	85	756	$+\frac{8}{10}$ of 1%
5	196	56	745	$-\frac{7}{10}$ of 1%
3	119	34	751	$+\frac{1}{10}$ of 1%

Table of Relative Steam Consumption for Different Loads, per Brake Horse-power.

Nozzles open.	Loads B.H.P.	Relative loads, per cent.	Steam per B.H.P. per hour, lbs.	Increase for diminishing loads, referred to max. load, per cent.
Superheated Steam.				
8	352	100	13.94	....
7	298	85	14.35	2.9
5	196	56	15.53	11.4
Saturated Steam.				
8	333	100	15.17	....
7	285	86	15.56	2.6
5	195	59	16.54	9.0
3	119	36	16.40	8.1

Effect of Superheated Steam.—By comparing the results of the tests with superheated and saturated steam, the saving by the use of the former can be determined for the particular amount of superheat existing. As the tables show, the superheat steadily diminished as the load became lighter. This was caused by the fire and draft being very light with the lighter loads. The superheat for the eight-nozzle load averaged 84 degrees Fahr., while that for the five-nozzle load only averaged 16 degrees Fahr. There is, therefore, scarcely any propriety in making a comparison for the effect of superheat, except with eight and seven-nozzle loads.

Table Showing the Saving by the Use of Superheated Steam for Eight and Seven Nozzle Loads.

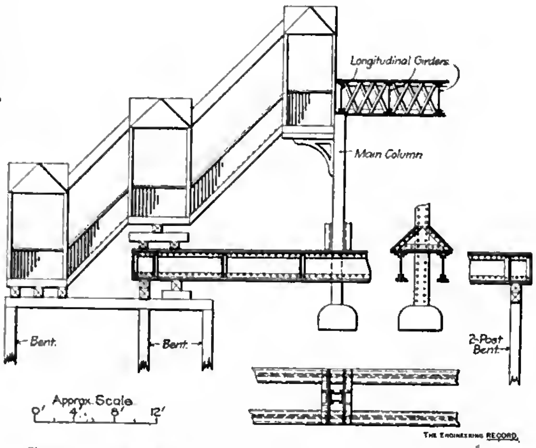
Nozzles in use.	Amount of superheat, deg. Fahr.	Load with superheated steam, H.-P.	Load with saturated steam, H.-P.	Steam per B.H.P. with superheated steam, lbs.	Dry steam per B.H.P. with saturated steam. lbs.	Saving by use of superheated steam. per cent.
8	84	352	333	13.94	15.17	8.8
7	64	298	285	14.35	15.56	8.4

In all of the statements made in this report of the consumption of superheated steam, the actual consumption without reduction to dry saturated steam as a standard, is given. This is customary, while with the results by saturated steam the moisture is deducted.

The Second Division of the New York Rapid Transit Railroad.—III.

The columns carrying the tracks and 42nd Street station platforms of the Sixth Avenue elevated railroad and two of the entrance stairways are located over the south side of the subway and directly over the open trench from which the excavation was made. The stairway and columns were first supported over the southwest corner of the street intersection by plate girders, wooden beams and trestle-bents, as indicated in the accompanying diagram, so that the stairway was maintained in service and the elevated structure carried its train traffic without interruption or modification.

The main trench in 42nd Street was first opened west of Sixth Avenue. Before it was opened under the west elevated stairway two narrow pits were dug across its axis, carried down to sub-grade, and their bottoms covered with sections of the subway floor. These pits were about 20 feet on each side of the column which supported the elevated railroad structure at the street corner, and in each of them a trestle bent of 12x12-inch timber was set with its cap about 5 feet above the street level. On these trestles, about 15 inches apart in the clear, were set two plate girders, about 3 feet deep, one on each side of the column and parallel to the axis of the trench. Two vertical transverse plates with flange angles on all sides were set across the top flanges of the girders and were field riveted to them and to the opposite faces of the column, through holes from which rivets in the cover plates had been cut out. This provided side brackets by which the column was securely supported on the girders. One end of the girders projected under the middle landing in the stairway, its floorbeams were blocked up from the top flanges of the girders and the short supporting column removed. Additional transverse pits were dug in the line of the trench and more trestle-bents set in them from which were supported wooden beams parallel to the plate girders and just below the street level. These beams carried at one end crossbeams supporting the lower landing and foot of the stairway, and near the opposite end had crossbeams wedged up against the lower flanges of the plate girders to reduce their span and give additional direct support to the middle of the stairway. After all the beams and girders were set the trench was completed and the main column left suspended above it. After the subway structure is completed a solid masonry pier will be built on its roof to carry the two columns and the lower landing of the stairs. The stairway and columns at the northwest corner of 42nd Street and Sixth avenue were supported over the subway excavations in a similar manner, as will be the two stairways on the east side of Sixth Avenue.

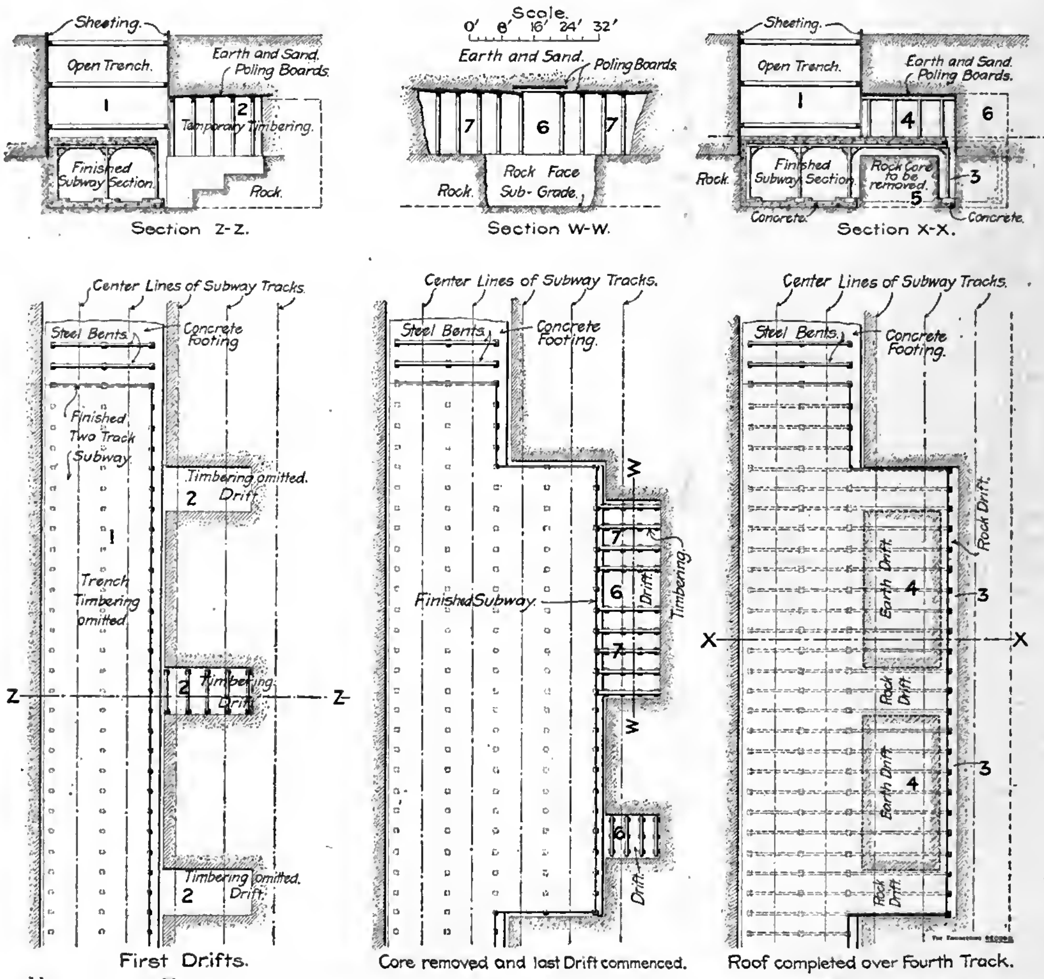


Supports of Elevated Railway Station.

The excavation for the subway between Fifth and Sixth Avenues was commenced from a long trench about 20 feet wide on the south side of the street, by driving a transverse drift about 12 feet wide on the north side of the subway and constructing in it two complete panels of the subway. The excavation was widened out two bents east and west and timbered and the subway construction continued. It was intended to proceed in this way, but the timbering was found to be too expensive and this method was superseded by the method with the 24-inch I-beams and roof poling boards described last week.

On 42nd Street between Fifth Avenue and Madison Avenue there are five tracks and the structure is widened for the 42nd Street depot. The excavation is about 35 feet below the curb, extends 10 to 15 feet into the rock and was made by a special method not employed elsewhere on the line. A trench marked 1 in the diagram, was first opened to sub-grade the same as elsewhere on 42nd Street, but it was made about 30 feet wide and in it was built the subway structure complete for two tracks. Transverse drifts marked 2, 12 feet wide and 50 feet apart on centers, were drifted from the north side of the trench to just beyond the fourth track. They were made about 4 feet higher than the level of the subway roof and their floor was the surface of the rock.

The north ends of these drifts were connected by similar longitudinal drifts marked 3, which were 7 feet wide, parallel with the axis of the subway and the rock bottom was drilled and blasted to sub-grade in all the drifts, care being taken to work between the vertical timbers and leave them seated on ledges on each side so as to support the roof from the original surface of the rock. The bottom of drift 3 was covered with a section of the finished subway floor, and on it was set the third row of columns, which, in this special case, was 25 feet from the second row. The original drifts, 2, 2, were then extended east and west by working faces on both sides of them until they met and left the whole roof of poling boards supported on vertical timbers about 10 feet long set on the rock surface, which was for the present left undisturbed. This portion of the earth excavation is marked 4 on the plan and after it was completed the 25-foot roof beams were erected on the second and third rows of columns and the concrete was laid on them to complete the roof over the south four tracks. After the roof was completed the columns were protected by timber shields and the core of the rock marked 5 in the cross-section X X was blasted out to sub-grade and the floor concrete laid there. The original drifts, 2, 2, were extended to the north edge of the subway, as shown at 6, 6 in the plan, and then their sides were excavated east and west in drifts marked 7, 7, in the plan and in section W W. The rock bottom having been blasted out, the



Method of Excavation on Forty-Second Street between Fifth and Madison Avenues.

excavation was completed and the remainder of the subway structure was built.

In these operations the earth and rock was wheeled to the drifts, 2, 2 2, and loaded on narrow-gauge cars on transverse tracks which transferred them to the south side of the tunnel where suitable holes had been left in the roof to allow them to be hoisted out by the cableways. The work at this point was complicated by the special provisions for connection with the Park Avenue tunnels at the east end and for the enlargement for the depot, and was successfully executed with minimum obstruction to the heavy traffic overhead and around the entrance to the Grand Central Station. The street car service was uninterrupted and the street was not obstructed except on the extreme south side. Here as elsewhere the roof timbers and poling boards were left permanently in place and were thoroughly wedged up on brick piers built on top of the subway roof.

A 4-foot water main in Madison Avenue is temporarily supported across the south trench of the 42nd Street subway by a pair of triangular combination trusses from the lower chords of which it was suspended before the rock underneath it was removed. The trusses each have an 8x8-inch horizontal bottom chord about 30 feet long with inclined top chord sections which run from the ends of the bottom chord to meet at the vertex about 12 feet above its center point. The truss is divided into four equal panels by vertical tension rods having nut bearings and washers on flat wooden blocks at the lower ends and on wooden angle blocks at the upper ends. The middle vertical is composed of two 1-inch, and the end verticals are each composed of one 1-inch rods. Diagonal struts are run from the tops of the end verticals to the bottom of the middle vertical, and below the tops of these diagonals the top chord is reinforced by a 2x6-inch plank on the under side, the upper end of which serves as an angle block to receive the thrust of the diagonal. The two trusses are braced together about 3 feet apart over all by pieces nailed to the top chords and by 8x8-inch cross beams supported on the bottom chords. Holes are bored through these cross beams, just outside the bottom chords and 1-inch vertical eyebolts are passed through them and have nut bearings on the tops of the beams. A chain is attached to the eyes in the lower ends of each pair of rods and engages the water main at a joint. By screwing up the nuts on the upper ends of the rods the main was lifted free of its original support and is maintained clear of the subway until permanent piers are prepared for it on the subway roof.

Architectural and Structural Steel Draftsmen are wanted by the Navy Department and examinations will be held on August 19 and 20 at Pittsburg and Chicago. Circulars giving information concerning the positions and examinations can be obtained from the Secretary of the Navy.

Yellow Pine and Puget Sound Fir have been tested on a large scale by Naval Constructor F. W. Hibbs, who described his experiments and summarized their results at a recent meeting of the Pacific Northwest Society of Engineers. Yellow pine proved more brittle and better able to withstand wear, owing to the large amount of pitch it contains. Fir is more fibrous and better adapted for beams and tension members. In tension tests the pine cracked and pulled apart, while the fir twisted like a rope and the fibers stood out like strings. The tests were made with green lumber, as well as that which had been air-seasoned and kiln-dried.

The Loss of Capacity of the Vyrnwy Aqueduct, Liverpool, England.

The water supply of Liverpool comes from three sources, the Vyrnwy reservoir, the Rivington reservoirs, and from wells in the vicinity of the city, the first of these furnishing nearly half of the total supply, which during 1901 was at an average rate of 27,800,000 imperial gallons per day. The aqueduct carrying the water from Vyrnwy to the Prescot reservoirs at Liverpool is 68 miles long. At Oswestry, about 17 miles from the reservoir, the water is filtered through 2 to 2½ feet of sand in order to remove suspended particles and discoloration produced mainly by iron and peat.

Soon after the Vyrnwy aqueduct was put in use in 1892, it was found that the capacity of that part from the inlet to Oswestry was decreasing to a very noticeable extent, while for the remainder of the distance to Prescot it remained practically constant. Mr. Joseph Parry, M. Inst. C. E., chief engineer of the waterworks, believed at first that the reduction in capacity was due chiefly to accumulations of air, but the results following the introduction of additional air valves did not confirm this view. One day when he happened to be on the aqueduct line a pipe burst and discharged an immense quantity of a black deposit. Samples were sent for analysis to the city's chemist and bacteriologist, and an investigation was started which showed that the decreased capacity was due to this deposit. The rapidity with which it formed is shown by the fact that in November, 1898, after a thorough cleaning out of this deposit, the measured discharge to Oswestry was 16,530,000 imperial gallons per day, and by the middle of June, 1900, the delivery had fallen off, notwithstanding frequent sluicings, to 13,970,000 imperial gallons. A partial cleaning out of the deposit then resulted in an increase of a million imperial gallons per day, but by the end of October, 1901, it had fallen again to 13,770,000 imperial gallons. Since then nearly the whole length has been cleaned, resulting in a discharge nearly up to what it was originally.

On February 25, 1899, an experimental plant was put in operation near the outlet of the Hirnant tunnel, about 2¼ miles from Lake Vyrnwy, in order to determine the effect of adding lime to the raw water. The treated and untreated water was delivered into two parallel and similar lines of 4-inch cast iron pipes. After being in operation for six months the pipes were taken up for examination. Both lines of pipe contained in about the same quantity thin deposits of the slime observed in the large pipes. It was then decided to increase the proportion of lime so as to make the water quite neutral or very faintly alkaline, and to place small sand filters in each of the two lines of pipe. The filters were put in operation November 17, 1899, and there was also added to the untreated side near the inlet a fine copper gauze screen. On April 19, 1900, when the pipes were again taken up for examination, there was found in the short lengths between the intake and the lime cylinder and screen respectively, abundant evidence of the deposits. After the lime treatment the pipes were substantially free from slime before filtration, and absolutely free after filtration. On the untreated side there was slime between the screen and the filter, but none beyond the filter. The next examination was on September 24, 1900, when it was found that the lengths between the lime cylinder and the filter were free from the black slimy deposits, but on the untreated side there was red slime and jelly-like growth occasionally to be found. After filtration the pipes on both sides showed neither slime nor deposit. It was then decided to discontinue the lime treatment, but to continue the experiments with the filters. The latter had up to this time been composed of sand obtained from the river bed screened through a ⅛-inch mesh sieve. They were subsequently remade with crushed Silurian rock of various degrees of coarseness.

A centrifuge was used to determine the relative amounts of suspended matter at different stages of the experiments. The diameter of the centrifuge was 18 inches, and it was run by an electric motor at from 2,000 to 3,000 revolutions per minute. The following figures give the suspended matter from samples taken February 8, 1901, in parts per 2,750, and February 25, 1901, in parts per 2,740:

	Raw water.	Screened.	Filtered.	Screened and filtered.
Feb. 8	39	9	6	3
Feb. 25	28	12	4	13

In a paper published recently in the Thomson-Yates Laboratories Reports Professor Robert Boyce, the consulting bacteriologist of the works, deals with his investigations on the Vyrnwy water. He states that wherever the deposit occurs in the unfiltered water, whether in Lake Vyrnwy, or along the aqueduct or at Oswestry, the appearances under the microscope are essentially the same. The bulk of the deposit consists of irregular flakes of a soft material of a characteristic golden-brown color, numerous silicious particles, a considerable amount of vegetable debris, but remarkably few green algæ of any kind. The higher green forms of aquatic plants are also conspicuous by their absence from the lake. The number of bacteria present is comparatively small, and this is corroborated by the culture experiments which have been made on an extended scale. The golden-brown irregular masses have imbedded in them or sticking to them all kinds of debris. They are soft and appear to be composed of some gelatinous material impregnated with the yellow oxide of iron. They often show no trace of structure, but flakes will be met with which, on very careful examination with high power, show passing through them one or more distinct hyphæ.

When the material which clings to the copper gauze screen is examined, the hyphal character of the flakes is much more evident, and long, unbranched threads can be seen possessing a greater or less amount of sheath. Prof. J. Campbell Brown, the analytical chemist to the water department, has drawn attention to this organism, and there is every probability that it is a gelatinous iron-forming thread fungus of the Cladothrix, Leptothrix, Crenothrix group. In none of the deposits which Professor Boyce examined has he been able to detect active growths of the organism; it almost invariably occurs in the short, irregular, broken fragments or flakes described above. A most remarkable feature is that the gelatinous material appears to increase with age; it is not on the actively growing filaments that it is most abundant, but it is thickest on the broken and apparently dead fragments. As regards the relation of the organism to the iron in the water he says there are numerous examples of bacterial activity leading to the oxidation of dissolved iron, and a group of organisms have been called "Iron" and "Manganese" bacteria from their power of producing the oxide of these metals from the soluble forms dissolved in the water. T this group Crenothrix and allied thread forms, including the present one, belong, and if Winogradsky is correct, the filament absorbs the soluble iron salt and deposits the oxide in its sheath.

The history of the deposit he gives as follows: "The iron fungus grows in some parts of the watershed, fragments are carried with other debris into the lake, and they fall to the bottom; other larger and younger threads float in the water of the lake and are caught on the copper gauze strainer; innumerable small fragments, however, pass through the strainer into the aqueduct, and gradually collect at the sides and form a coat on the brickwork, wood or iron of the pipe. Their gelatinous nature facilitates their adhesion, and they entangle with them all kinds of other debris, as sand, diatoms, etc. Not all the particles are deposited on the sides of the pipe line; some pass on with the water into the reservoir at Oswestry, and no doubt also particles are continually being detached from the surface of the aqueduct. But the filters remove them. In so far as the dark color of the unfiltered water is due to the presence of particles of the dark red fungus held in suspension, it is clear that the mechanical filtration will help to remove the color. But the dark tint remains after the particles have been removed, this color being due partly to the presence of some organic coloring matter, and partly to the presence of some iron compound in solution."

In a report by Dr. Brown, dated December 9, 1901, the deposits in the Vyrnwy aqueduct are divided into three kinds: (1) Incrustations derived mainly from corrosion, (2) organisms growing on the inner surface, and (3) accumulations of debris attached to these organisms, both mineral and organic.

The second division is the most interesting one, and the following statements from Dr. Brown's report show how the growth takes place: "When a protected pipe is laid down and Vyrnwy water sent through it, little masses of jelly begin to form and gradually enlarge on the inside surface of the pipe. In this jelly there are centers of growth—later there are growing threads which lengthen and twist. The older portions of these or other threads straighten out and acquire a sheath, and in this sheath a ferruginous deposit accumulates and thickens. I presume it ultimately kills the older end. Certainly the tip grows as a projecting thread, while the rest becomes a foxy-red mass of inextricably intertwined ferruginous sheaths. These are attached to the pipe, but portions break off and are carried forward from the tunnel and the pipes as well as the lake. The successive appearance of all these forms has been traced in the experimental pipes at Hirnant.

"In the slime are black particles formed of binoxide and other oxides of manganese. I have come to the conclusion that the dark manganese particles grow by chemical action from the materials present in minute proportions in the water. Some of the ferruginous particles also may be the result of chemical decomposition of the constituents of the water, but a very considerable proportion of them is the result of the accumulation and breaking up of the old organisms, similar in principle though differing in detail from the accumulation of coral."

Dr. Brown states further: "I have proved by observation and experiment that the Vyrnwy organisms can live upon organic matter in water containing no iron, while if iron compounds are present in the water, ferruginous matter is deposited in their sheaths. In Vyrnwy there is no ferrous carbonate. There is a soluble organic compound of iron.

"In some waters having some of the characters of Vyrnwy similar growths occur. In other waters coming from similar gathering grounds, but not containing the organic compounds of iron found in Vyrnwy, there is no similar slime. In certain waters having neither iron nor acidity, but containing peat, there is no similar slime. Various analyses of the slime have been sent in, showing great variations in the proportions of silicious and clay particles and of the ferruginous organic debris. There are no particles of peat in the slime."

A number of schemes have been proposed to prevent this troublesome growth in the aqueduct between Lake Vyrnwy and Oswestry, among which a system of screening and rough filtration is held by Mr. Parry to be most promising. The subject is of so much importance that it occupies the larger part of Mr. Parry's 1901 report, from which the preceding account has been prepared. He hopes to explain shortly at greater length and with technical details the course of the investigation and the conclusions to be drawn.

Concrete Sewer Construction at the Chicago Clearing Yards.

The switching yards of the Chicago Transfer & Clearing Company, southwest of the city, occupy some 4,000 acres of land bounded on the north and south by 63rd and 79th Streets respectively, and extending westward from the city limits about five miles to the Chicago Drainage Canal. This territory before the construction of the Clearing Yards was almost a dead level, at a general elevation of about 27½ feet above Lake Michigan datum, and was practically without natural drainage. At the extreme western portion of the land there is a sudden drop in elevation of about 15 feet to the old Illinios & Michigan Canal. To the east there is a slight, almost uniform slope to the lake, a distance of about ten miles. To the north and south there is no natural watercourse within a range of some miles. As a preliminary operation to building the Clearing Yards, it was decided to drain the whole area and to raise the level of the yard site about 2½ feet by filling in with sand. The construction of the main sewers, which were of concrete laid in open trench which for over a mile averaged 24 feet in depth, is described in a paper by Mr. E. J. McCaustland, recently printed in the "Transactions" of the Association of Civil Engineers of Cornell University, from which the following account has been condensed:

It was decided to drain the entire territory into the Illinois & Michigan Canal, this being the only outlet within the range of economic possibility. After a consideration of the conditions, Mr. A. W. Swanitz, chief engineer of the company, decided to use concrete for everything 36 inches in diameter and over. Broken stone could be had at a reasonable figure and in unlimited quantities, while brick was high and deliveries uncertain. The cost of labor for concrete construction would be but a fraction of the cost for brick construction. Furthermore, aside from the question of first cost and facility of construction, it was believed that a monolithic main of large diameter, built under proper supervision, would prove more durable and reliable than if constructed of blocks; that the interior of such a main would present less resistance to flow in time of flood, and would be more easily kept clean by the extremely limited dry weather flow.

The width of trenching at the surface varied from 14 feet for the 90-inch to 7 feet for the 36-inch mains. The excavation on the entire line of concrete main was done by steam shovel, supplemented, in the deeper trenches by derricks operated by steam. Two styles of steam shovel were used on the work, one a 75-ton machine made by the Vulcan Iron Works of Toledo, Ohio, used for the wider and deeper trenches, and the other a lighter machine built by the Bucyrus Company, of Milwaukee, Wis. The excavation was mostly in a blue clay containing occasional small water seams and overtopped with a surface layer of about 2 feet of black soil. When using a steam shovel sheeting and bracing can be put in place only after the shovel has removed all material within reach and is ready to move forward; hence such a method of excavation would not be suitable in cases where the sheeting must be carried down with the excavation. The material excavated was deposited upon the bank alongside the ditch, except for a few thousand yards which were dumped from the shovel bucket directly on flat cars and used for filling.

In preparing for work the trucks were removed from the shovels and they were mounted on heavy timbers crossing the trench and resting on sills which in turn were borne upon wooden rollers running on plank runways. The machines were thus placed in the most advantageous positions for work; they were moved forward by their own engines hauling in a cable attached to a dead-man ahead. The Vulcan shovel cut the larger trench to a depth varying from 18 to 22 feet; however, a reach of more than 20 feet is not considered wise in hard digging, since it induces excessive stresses in the machine. A 2-yard bucket was first used, but it was found that better progress could be made with a smaller one, there being less liability of overstraining the machine and causing breakdowns.

The work done by the shovels is shown in the accompanying table. The figures are close averages, and may be relied upon to approximate closely the amount of work these types of shovels may be expected to do under ordinary circumstances where there is little trouble to be apprehended from caving. On some days the Vulcan shovel reached a figure nearly double the average given, but such work was exceptional.

Diam. sewer, in......	90 and 84	48	42	36
Length trench, ft.....	6,400	4,540	2,660	3,340
Av. width, ft........	12.5	8	7	6
Av. depth, ft.........	20	17	14	11
Av. lin. ft. per 10 hrs.	69.8	98	85	120
Av. cu. yds. per 10 hrs.	640	500	310	300

Note.—The Vulcan shovel with 1½-yard bucket was used on the 48, 84 and 90-inch sewers, and the Bucyrus shovel with ¾-yard bucket, on the 42 and 36-inch sewers.

The deeper trenches, for the 90 and 84-inch mains were cut by the shovel to a depth of only 20 feet; this left from two to four feet to be removed from the bottom by some other means. The removal was accomplished by using an ordinary swinging boom derrick mounted on a turntable directly over the trench, with a boom of such length as would give control of about 30 feet of ditch. The hoist was operated by steam and all the movements of boom and derrick were under control of the engineer. Usually twelve men were in the trench in groups of four, filling the buckets. Four wooden buckets were in use, holding about two yards each; three of these were in the trench at all times, the gangs working in regular order so as to keep the hoist always busy. The buckets were rectangular in both plan and elevation, and consisted of a bottom and three sides. The sling for the bucket consisted of three short chains attached to a ring which was held by a hook to the hoisting tackle, one of these chains being provided with a trip hook for dumping the bucket. In taking out a 4-foot bottom for the 90-inch sewer, working in a hard blue clay where the invert was carefully trimmed to fit the external form, a gang of twelve men could easily complete a length of 100 feet in a day of 10 hours. Very little loosening of the soil with the pick was done; digging with good, round-pointed, short-handled shovels, using foot irons, was more effective. In the shallower trenches the derrick was used only to remove the material cut out in shaping the invert.

The thickness of the 90 and 84-inch sewers was 12 inches; of the 48-inch sewer 10 inches, and of the 42 and 36-inch sewers 8 inches. A ½-inch coat of plaster was put on the inside except on the upper quadrant. The concrete was a 1:3:5 mixture, proportions by volume. The stone was a clean limestone furnished by the Chicago Crushed Stone Company, and was in two sizes varying from 1 to 2½ inches and ½ to 1½ inches. These two sizes of stone were used in equal proportions at first, but later were mixed in the proportion of 1 of the larger size to 2 of the smaller. The sand used for concrete was the kind known in Chicago and vicinity as "torpedo" sand. It is in reality a very fine angular gravel with an admixture of some coarse sharp sand, and is in all particulars a first class material for concrete work. The stone cost delivered about 80 cents per cubic yard, and the sand about 90 cents. The cement used was the Illinois Steel Company's Steel Puzzolan, costing $1.30 per barrel delivered, and passed the usual tests in a very satisfactory manner.

To mix the concrete, a rotary machine was used, the type being that with horizontal shaft and radial arms or knives set spirally so that a revolution of the shaft would not only mix the material thoroughly, but would force it forward through the machine. It was mounted on a flat car and run on a track, used as a supply track, which was laid along the line of the trench as the work progressed; an independent engine with upright boiler, mounted on the same car, furnished the motive power for the operation of the mixer. Usually the material supply train was made up with the mixer car in the middle, three cars of stone in front, and two of sand and one of cement in the rear. An ordinary day's run would use up something over two cars of stone and about one and one-half of sand. A 60-ton yard engine was kept by the contractor to make up the supply train and keep the mixer as near as possible to section under construction. Runways of plank, supported on detachable brackets, were arranged along the side and at the top of the cars containing the crushed stone and sand. Iron body wheelbarrows were used to transport the material to the mixer and the loading of the barrows was made to conform as nearly as possible to 3 cubic feet of sand and 2½ cubic feet of stone; two barrows of stone being thrown in to one barrow of sand and one cubic foot of cement added. The proper amount of water was discharged from a hose under the control of a workman and the whole became thoroughly mixed in passing through the machine. The operation was continuous, and the uniformity of incorporation of the aggregate with the mortar was excellent.

The concrete was deposited by transporting from mixer to trench in wheelbarrows, and dumping through open chutes to the bottom. Owing to the long drop some tendency was developed for the larger stones in the aggregate to become separated from the mortar. It was found, however, that a single workman with a shovel could easily restore almost perfect homogeneity by a few well directed efforts upon each barrowful as it was dropped. This, of course, was a most important detail for the inspector to keep within bounds; and it is believed that some form of gravity mixer would be more satisfactory for such deep trench work, and much cheaper to operate.

The bottom of the trench was cut to the form of the exterior circumference of the sewer ring by means of templets. The invert was put in place in layers and tamped until free water appeared on the surface. The ring was carried up on the sides until the invert occupied about 140 degrees of arc.

The centering for the arch was carried loosely on ribs made circular in form to rest on the invert and with allowance for the lagging over the 220 degrees of arc above the invert. The lagging was of 3x2-inch material in 16 or 12-foot lengths, the edges chamfered to give radial joints. The strips were held in place on the ribs by a 3/16x2-inch iron band passing over them at the end ribs and bent up under the two outside strips, forming a hook to support the lower ones, on which all the others rested. When the centering was in place and keyed up tight the concrete was deposited on top of the finished invert and carried up as far as the proximity of the trench walls would justify. When a height was attained beyond which the sides of the trench would no longer serve as a form, planks were inserted and braced against the trench walls until the arch was carried up at least 30 degrees above the springing line. Beyond this, form was preserved by use of a templet at the forward end and the finished sewer ring at the rear.

As soon as a length of arch was completed and thoroughly tamped, all form planks were removed from the trench and a light covering of surface soil was deposited over the green concrete to protect it from the wind and sun. The centers were usually removed after 48 hours. This was easily accomplished by swinging the ribs about their vertical diameters and removing the lower strips of lagging first.

In performing the work the contractor furnished only the labor, tools, etc., all materials being supplied by the company. The quantities and prices were as follows:

Diam. sewer, in..	90	84	48	42	36
Depth trench, ft..	24	22	17	14	11
Length, ft.	5,400	1,000	4,540	2,660	3,340
Cost per foot.....	$6.68	$5.91	$3.57	$3.00	$2.30

In addition to this main concrete sewer, the contract included the construction of about 5 miles of vitrified pipe sewers ranging in size from 8 to 33 inches, together with the necessary manholes and catchbasins, which were of brick.

The backfilling of the trenches was done almost entirely by machine. A derrick of the same style as used in excavating the bottom, was mounted on timbers and rollers for ease of transport. The swinging boom was long enough to reach to the extreme limit of the spoil bank when the machine was located on the opposite side of the trench. The derrick was operated by a double drum, reversible hoisting engine with upright boiler, mounted on derrick platform. The bowl from an ordinary wheeled scraper was fitted with a bale in front to which a cable was attached by which it could be pulled forward, and in the rear a ring was fixed to which a light steel cable was attached. This cable passed around a sheave at the end of the boom, thence to the engine drum around which several turns were taken, and back again to the ring in scraper bowl. This cable served to pull the scraper back to position for loading, and, being endless, served to hold the bowl into any position as desired by the engine man. Handles were fixed to the bowl as for an ordinary drag scraper. Two men at these handles could hold the bowl in place for filling and the engine would pull it forward until filled. When this was accomplished, and the load drawn forward over the trench, the endless cable was held taut on the drum to prevent backward movement of the scraper and a slackening of the pulling rope would dump the load. This machine, with two men to operate it in addition to the engineer and fireman, could easily handle 900 cubic yards of earth per day. No tamping or puddling of backfilling was required. This machine was constructed from the designs of Mr. John Dowdle, of the firm of Nash & Dowdle, of Chicago, the contractors for the construction of the sewers.

The original plans for the work were prepared by Messrs. Alvord & Shields, Chicago; and Mr. C. W. Hotchkiss was chief engineer of the company when the work was undertaken. Before construction began, however, Mr. A. W. Swanitz was made chief engineer, and Mr. E. J. McCaustland principal assistant. It is stated that the plans underwent some modification after leaving the office of Alvord & Shields.

Erection of the Uganda Railway Viaducts.

On the Uganda railway between Kilindini on the east coast of Central Africa and Port Florence on Lake Victoria, there are about 12,000 lineal feet of single-track plate girder trestle viaducts which have a total weight of about 13,000,000 pounds and were built and erected by American contractors. The spans weigh about the same as the towers and generally alternate 20 and 40 feet in length. They have two lines of longitudinal plate girders 3 feet deep and about 8 feet apart, with laterals and angle-iron sway-brace frames but no floorbeams or stringers. The track rails are laid directly on the cross-ties, which overhang both sides of the girders and carry sidewalks with hand rails on both sides of the track. The towers, 20 feet long and 40 feet apart in the clear, each have two trestle bents with columns battered in the vertical transverse planes. They are from 20 to 120 feet high and are divided into panels of 20 feet or less, by longitudinal and transverse horizontal struts with pin-connected diagonal rods. All girders and compression members have field-riveted connections and their details conform to standard American practice, as approved by the English engineers. The tower columns have separate short masonry piers, and the girders are seated directly on their caps.

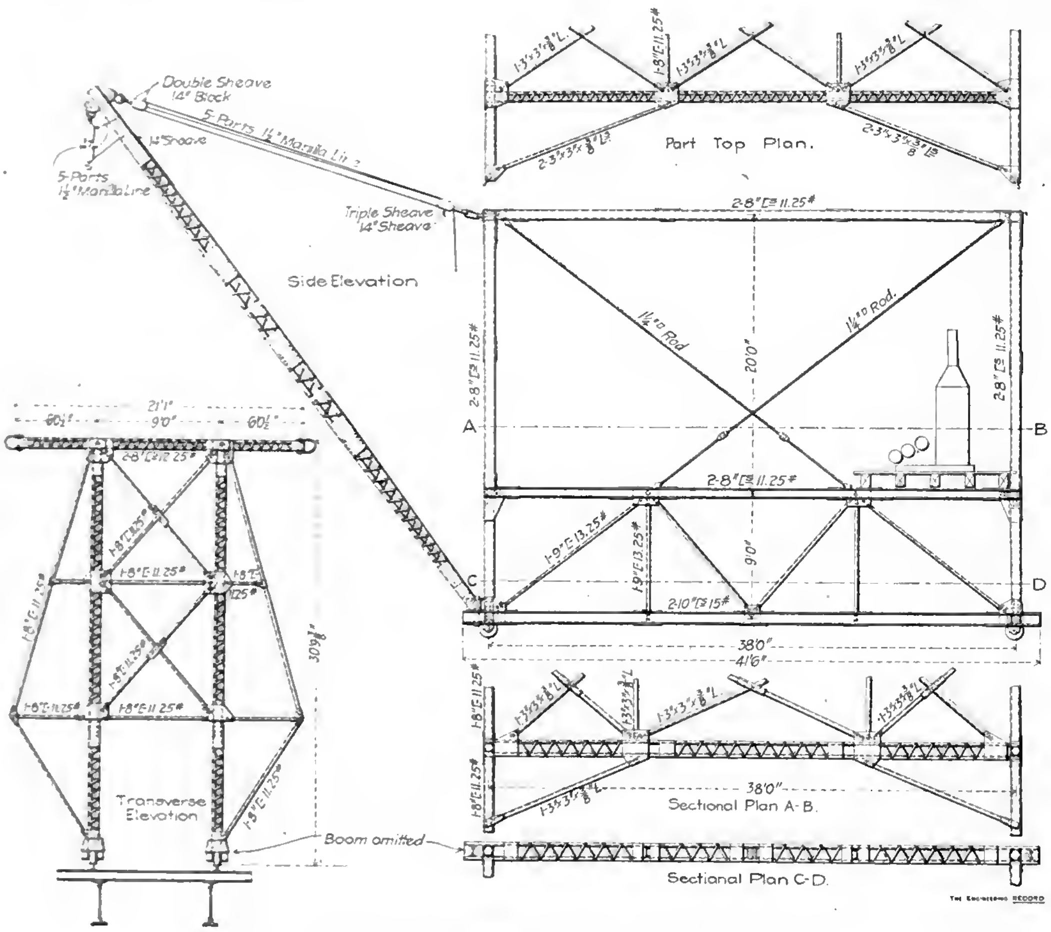
The superstructure was erected by an overhead steel tower traveler with two 70-foot booms which overhung the completed structure far enough to assemble a tower and two spans in advance. It had four vertical posts, 9 feet apart transversely and 38 feet apart longitudinally, which were braced together as shown, by horizontal struts and diagonals on all sides. The tower was about 40 feet high over all and traveled on a 9-foot gauge track with the rails laid on transverse 8-inch I-beams on top of the main longitudinal girders. There was a single 16-inch double-flange wheel under the foot of each vertical post with its axle set in cast iron journal boxes bolted to the under sides of the longitudinal sills. Transverse sills were omitted to give clearance through the traveler at rail level. The upper part of each transverse bent had two panels of X-bracing and the vertical posts were each strengthened by trussing on the outside which also served for outriggers to lead the lines which swung the derrick booms around their vertical axes.

The intermediate longitudinal horizontal struts were 9 feet above the sills and braced to them with zigzag angles virtually forming trusses, the end diagonals of which were continued with pin-connected sleevenut rods to the tops of the vertical posts. Transverse wooden beams across the top chords supported a working platform for the hoisting engine, boiler, coal, water and about ten tons of ballast for counterweight. There were complete lateral systems of horizontal transverse struts and X-braces in the planes of the top chords and of the tops of the vertical posts, all the members being composed of single angles with field-riveted or bolted connections. The vertical posts and principal struts were made of pairs of channels latticed, with jaw connections or double gusset plates.

Each of the forward vertical posts served as a mast for a derrick boom which had a horizontal pivot through a riveted foot-block revolving on a vertical pin which took bearing in the top and bottom cover plates of the projecting end of the sill. The boom was made in three sections of nearly equal length, which were spliced together with flange cover-plates, shop-riveted to the end of one section to form jaws which were field-riveted or bolted to the other section. The end sections were tapered, but the middle section was straight and could be omitted and the end sections spliced together without it to make a shorter and proportionately stronger boom. The links to receive the tackles were attached to eye bolts through the tops of the masts, and were set between pairs of plates riveted across the end of the boom and secured there by pins. The lead line from the hoisting tackle passed over a sheave set inside the boom near its upper end. The upper transverse struts projected 6 feet on each side of the traveler and had yokes on vertical pivots at the ends to receive guy lines led in any direction. The rear ends of the lower sills were clamped to the erected girders to afford an estimated reaction of 10,000 pounds against upward pull when the traveler was in service. The weight of the completed traveler was about 40,000 pounds and it had a capacity of 20,000 pounds, enabling it to handle a 5-ton longitudinal girder at the extremity of each boom.

The steel work for twenty-seven viaducts was manufactured at the Pencoyd shops of the American Bridge Company, and arrived at Port Kilindini about 45 days after shipment. It was erected by Mr. N. P. Jarrett and seven bridge erectors sent from the shops to do the derrick work and assembling, with from 200 to 300 natives to rivet and perform labor. Steel derricks were shipped with the viaducts and were first set up to unload the materials and afterwards their booms were taken for the traveler. As fast as the viaduct was erected a material track was laid on it between the traveler rails, and the members were run out on it to the last completed span and through and under the traveler, where there was a clearance 7½ feet wide and 10½ feet high which enabled the cars to deliver directly to the derrick booms.

According to "Indian Engineering," between the Kikuyu summit and the Great Rift Valley there are eight viaducts from 120 to 780 feet long and from 32 to 85 feet high which were erected by a traveler of different construction. It also was an overhead traveler, had a 60-foot fixed overhang and was apparently built entirely of timber except the diagonal tie rods. It had two longitudinal trusses about 10 feet high, 30 feet long and 10 feet apart, which were each mounted on two double-flange wheels at each end. At the forward end of the traveler two masts about 35 feet high were seated on the bottom chords of the trusses and overhung their ends about 5 feet at the top. They were guyed to the kneebraced ends of a transverse strut about 18 feet long on the top chord of the trusses and had back-stays to the rear ends of the bottom chords. The tops of the masts were connected by a horizontal strut and had diagonal rods to the ends and intermediate points of 60-foot inclined fixed booms, which were continuations of the forward diagonal braces in the trusses. The booms were king-post trussed on the under side between the intermediate guy and the traveler. Each boom had two tackles suspended from the end and two from the foot of the intermediate diagonal, and there were two tackles suspended from the head of each mast. The tackles were operated by windlasses on a floor laid across the top chords of the traveler trusses, under which there was clearance for the viaduct members to be delivered on trucks on a narrow gauge track between the traveler rails. They were unloaded by the mast tackles and fleeted out and lowered to position by the boom tackles. Views of the bridges during erection are given in the journal mentioned.



Steel Traveler for Erecting Viaducts on Uganda Railroad.

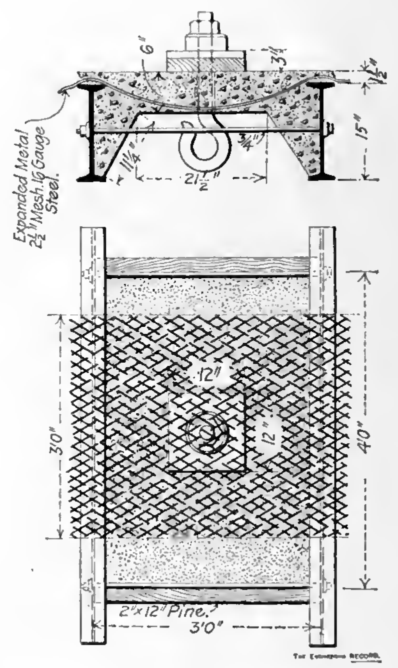
Test of a Concrete Slab Reinforced with Expanded Metal.

By O. W. Connet, Asst. City Eng., Baltimore.

In connection with plans to replace wooden floors on some bridges in Baltimore, it was decided to make a test to destruction of a 6-inch concrete slab, reinforced with expanded metal. The result of the test is such as to be of general interest and was made as follows:

Two 15-inch I-beams about 6 feet long were placed on top of two stout wooden trestles about 8 feet above the ground and fastened rigidly 3 feet apart center to center by two 2x12x35-inch plank 4 feet apart and by two ¾-inch bolts just inside the plank.

A form was made of 1-inch plank such that the concrete would be 6 inches thick for a width of 21½ inches, having a bearing on the lower flange and finishing 1½ inches above the top of the I-beams. The concrete was thoroughly rammed in between the form and I-beams and brought up to the proper position of the expanded metal, which was then laid across the top of the beams and bent down 4 inches in the center. A piece of 3-inch water pipe 5½ inches long was placed on end in the center of the slab and forced through one of the meshes of the expanded metal down onto the form, so that the top of the pipe finished ½ inch below the top of the concrete slab. The concrete was then filled in to the required thickness. The sheet of expanded metal used was No. 16 gauge steel, with 2½-inch mesh and was 4 feet long in the direction of across the beams by 3 feet in the other direction.



Test Block of Concrete.

The concrete was composed of one part American Portland cement (Nazareth), two parts clear fine river sand and four parts of crushed gneiss stone of a size to pass through a 1½-inch ring down to ¼-inch stone. After the concrete had set for seven days the form was removed and on the twenty-eighth day the test was made.

A washer of Georgia pine 12 inches square and 3 inches thick was laid directly over the hole in the center of the slab, and an iron washer 4 inches in outside diameter was placed on top of the wood; a 2-inch bolt with a hook on the lower end was put through these and held by a nut. Four strands of a ⅞-inch wire cable were suspended from the hook and passed around six iron gutter plates 5 by 6 feet 8 inches and ¾ inch thick. On these plates timbers and plank were arranged on which street paving block were piled until the bolt pulled a hole through the concrete.

After about 20 tons had been put on, three minute cracks began to show on the under side of the slab, radiating from the center in practically straight lines towards the corners of the slab. These did not increase perceptibly as the load was increased, and there was no deflection of the top of the slab before it failed.

When the slab failed the bolt pulled through carrying a conical shaped mass of concrete with it and tearing the expanded metal apart. The hole in the top of the slab was elliptical in shape, about 8x11 inches, while at the bottom it was more nearly square and about 20 inches on a side. The total concentrated load on the bolt at the time of failure was 28 tons.

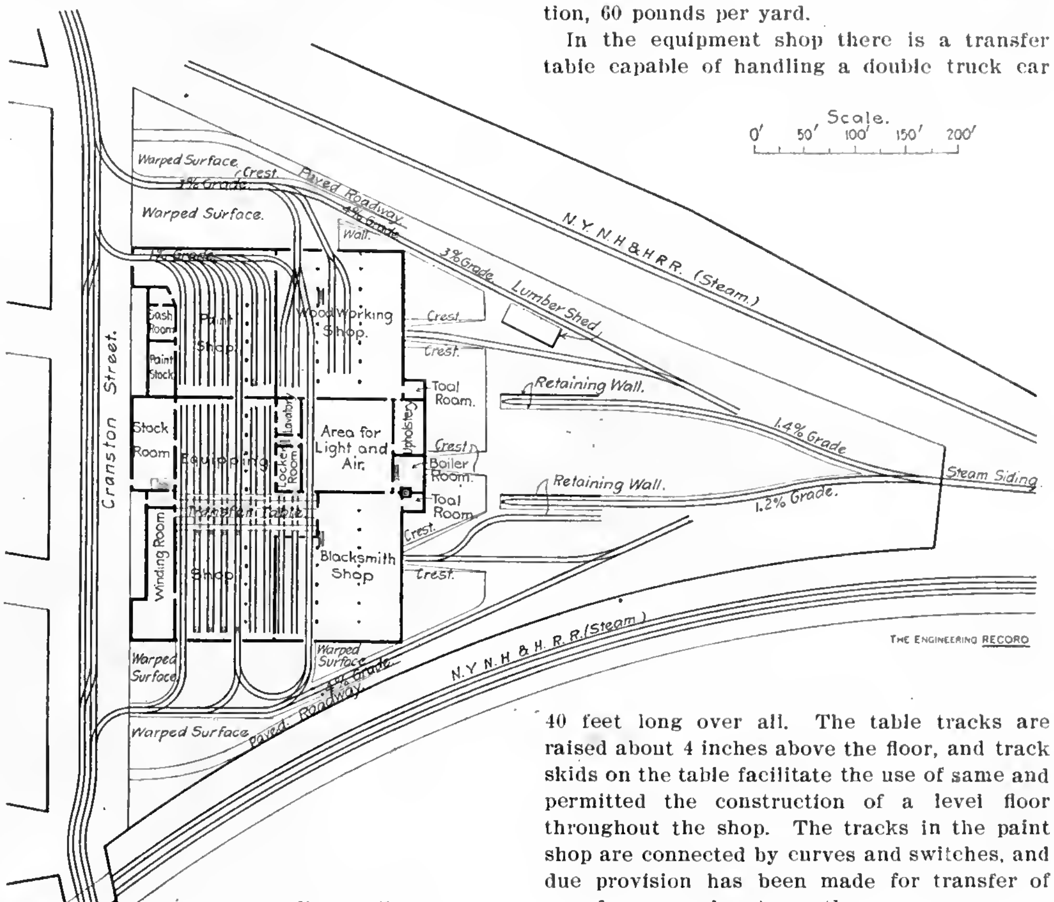
The test was perhaps more severe than could ever happen on a bridge, as the pavement would distribute the load more than the washers did, for in fact the iron washer crushed its way into the wood over an inch, so that the wood did not distribute the load. The iron pipe through the slab probably weakened it from the neutral axis downward.

As loads of five tons on one wheel are rare, this would give a factor of safety of between 5 and 6. All of the conditions of construction for this test can be duplicated in practice.

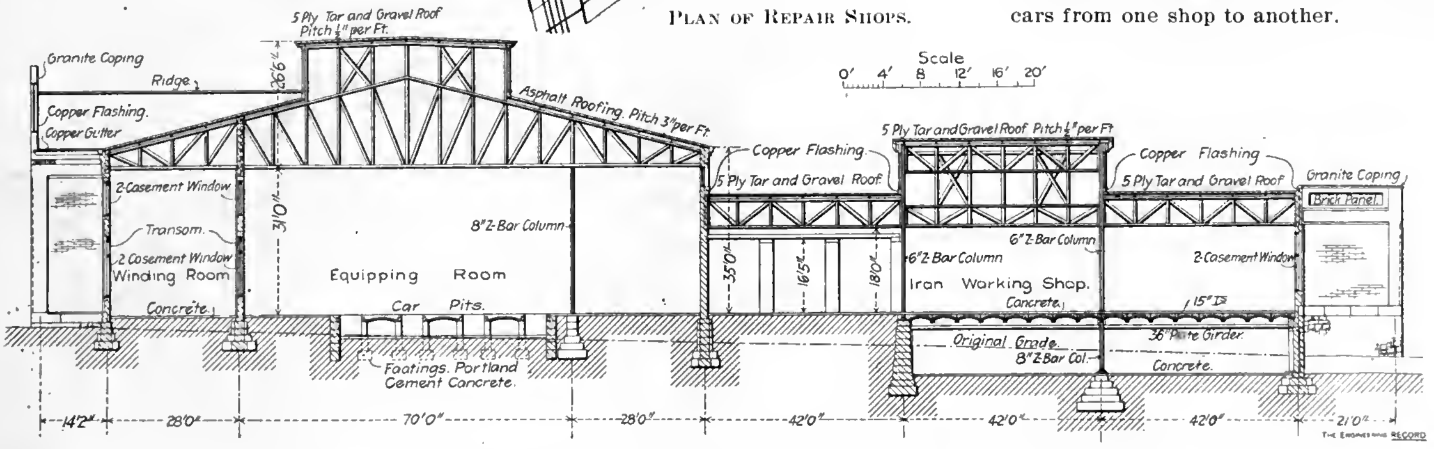
New Repair Shops of the Rhode Island Suburban Railway.

The accompanying cuts illustrate the arrangement of shops which were recently erected by the Rhode Island Suburban Railway Company at Providence, R. I. It is the purpose of the company to use these shops for repairs to the rolling stock of the street railway system of Providence and vicinity, which embraces the Union Railroad, the Pawtucket Street Railway and the Rhode Island Suburban Railway. This system includes about 270 miles of track, some 25 miles of which are on private right of way.

It will be readily understood that such a system is equipped with sufficient rolling stock to require large capacity in the repair department. The shops are located on a triangular lot between main and branch tracks of the New York, New Haven & Hartford Railroad. This advantageous situation has rendered it feasible to arrange for steam railroad sidings on the rear of the lot which has been laid out as a road department yard for the street railway company. Derricks have been provided for handling heavy material, and tracks have been run into the basements of the building for direct handling of smaller stock. Sufficient driveways have been provided for teams, and all parts of the shops are accessible to such traffic. All supplies can thus be conveniently received, and these facilities proved of great service during the construction of the building.



Plan of Repair Shops.



Cross-Section of the Repair Shops of the Rhode Island Suburban Railway.

The shops front on a suburban thoroughfare in a good residential section, and an effort has been made to develop a building which in the character of its contour and general lines would, with due regard to utility and economy, produce a structure at once expressive of its purpose and pleasing to the eye. This has been accomplished by more than the usual regard on the part of the engineers for the strictly architectural features of the structure. The building has a frontage of 390 feet along Cranston Street, which is 80 feet wide, and a general depth of 270 feet back from the street. The main portion along the street is of sufficient height to give the desired architectural effect, and is built without a basement. The rear wings are not so high and have a basement which is lighted by windows on two sides.

The shops include the following departments and are laid out so that there may be proper harmony in the relation of one department to another: equipping shop, winding room, machine shop, paint shop, paint stock room, wood working shop, general stock room, toilet room, locker room, tool room, sash room, office, and upholstery room.

The riveted steel roof trusses have been specially designed as to strength so that reasonable loads may be hung from them by means of chain hoists. This greatly facilitates the handling of heavy equipment and allows much flexibility in the arrangement of the shops. The floors are granolithic throughout, and the only wood used is in the roof planking, doors and windows. The shops have been in use by some of the departments for several months, and a noticeable result of this use is the excellence of the granolithic floors which appear to stand great abuse without damage. The car pits in the equipment shop and paint shop have brick walls on the exterior sides and brick piers between tracks. These piers support the tracks and intermediate platforms, but allow communication between the pits. The tracks in the shops are laid on concrete without cross ties, and consist of tee rails, Am. Soc. C. E. section, 60 pounds per yard.

In the equipment shop there is a transfer table capable of handling a double truck car 40 feet long over all. The table tracks are raised about 4 inches above the floor, and track skids on the table facilitate the use of same and permitted the construction of a level floor throughout the shop. The tracks in the paint shop are connected by curves and switches, and due provision has been made for transfer of cars from one shop to another.

The buildings are heated by the indirect hot blast system. Near the rear of the building is located a Bigelow-Manning vertical tubular boiler from which steam is conveyed through asbestos-covered piping to the heating chamber situated on the second floor over the toilet and locker rooms and practically in the center of the shops. Two fans of special design force the warmed air from the heater through galvanized piping to the various rooms of the shops. This piping varies in diameter from 5 feet near the chamber to 6 inches at the various outlets, which are usually located on the inside of the outer walls of the building about

7 feet above the floor level, each being provided with a hand damper. The outlets are placed about 12 feet apart so that the warm air is freely distributed through the rooms. The fan apparatus is in duplicate and the fans are operated by two motors constructed to run at varying speeds, which give at least four variations in the amount of hot air that may be supplied. The main ducts are located under the roofs of the building and are gauged to deliver the air at the outlets with practically a uniform velocity. The system has proved satisfactory, and during the cold weather of the past winter all of the shops have been kept at a suitable temperature. This system was designed and installed by Westinghouse, Church, Kerr & Company of New York.

The large number of windows on all sides of the building together with the monitors in the roof provide efficient illumination. The ceilings of the shops are equipped with a sprinkler system installed by the General Fire Extinguisher Company of Providence, and fire hydrants are located on three sides of the building a short distance away in the yard.

The general stock room is fitted with racks for a proper handling and storage of the various kinds of supplies. There is a second floor over the stock room and an office for other purposes. A second floor can also be put in over the winding room and other rooms on the front of the building if the capacity of the shops become inadequate. The shops have been equipped with modern machinery and tools and such of the machinery and tools from the company's old shops as were in good condition. The machines are belted to shafting driven by electric motors, the current for which is obtained from the main power station located in another part of the city. The shops are fitted with small traveling cranes and armature, car body and truck hoists located at various points.

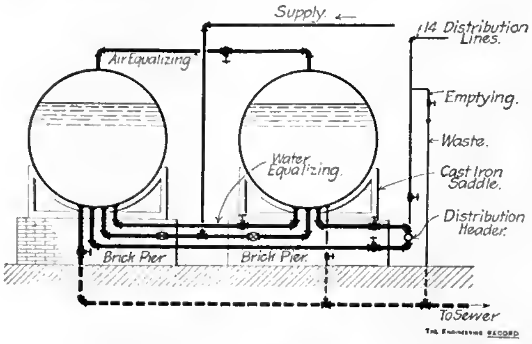
The shops have been equipped under the direction of Mr. W. D. Wright, the company's superintendent of equipment. Mr. Geo. B. Francis, M. Am. Soc. C. E., until recently chief engineer, devised and supervised the execution of the project, the drawings for which were prepared in his office under the direction of Mr. Joseph H. O'Brien, Assoc. M. Am. Soc. C. E., assistant engineer. The contractors for the building were Horton & Hemenway of Providence.

Plumbing in the Carnegie Residence, New York.

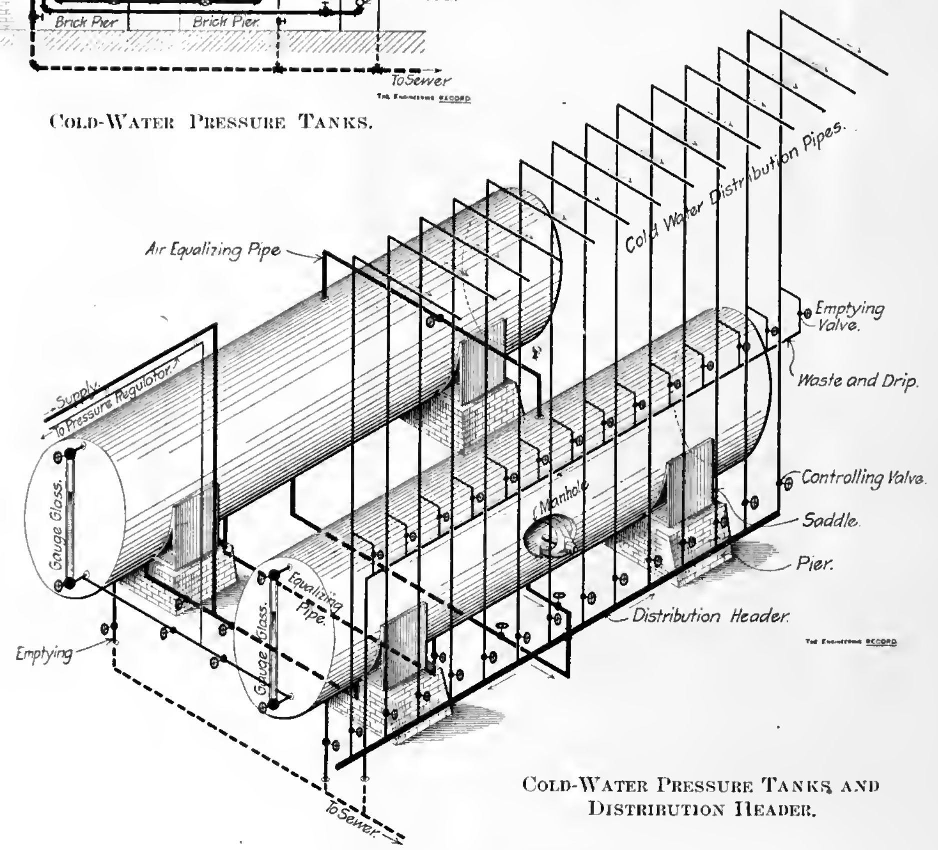
The new residence of Mr. Andrew Carnegie, on Fifth Avenue, between 90th and 91st Streets, New York, is a large four-story and basement building which occupies the entire west end of the block between the streets mentioned. A description of the general features of the water supply system and diagrams showing the arrangement of the pumps, tanks and filters and the location of the principal lines of water mains in the basement were published in The Engineering Record of July 5. These indicated the general arrangement and operation of the plant for the water supply and showed the connections to the pumps, tanks and filters in the conventional way indicated on the contract drawings. The piping is extensive and rather elaborate and great pains have been taken to arrange it neatly and symmetrically, and to make the connections with directness and simplicity. The valves have been grouped so far as possible close together so that they can be easily controlled, and are placed in order where their use and sequence is easily understood. The principal groups are for the pump and filter supplies, the cold-water distribution and the hot-water heating, supply and return, which are illustrated by the accompanying sketches, intended to supplement the general plans given in the previous article.

Provision is made for a very large daily consumption of water which is drawn from two separate street mains and is used for domestic purposes, fire service, steam boilers, hose washing, lawn sprinkling and spraying the trees and shrubbery in the extensive lawns and gardens. Water for domestic purposes and the steam heating boilers is filtered and distributed under a street pressure of about 20 pounds and under a direct pump pressure of 55 pounds. The former is intended to supply normally all fixtures below the second story and the latter to supply all fixtures above that level, but both are constructed with duplicate apparatus and cross-connected so as to be interchangeable and prevent any interruption of service through accident or alterations to any part of the plant.

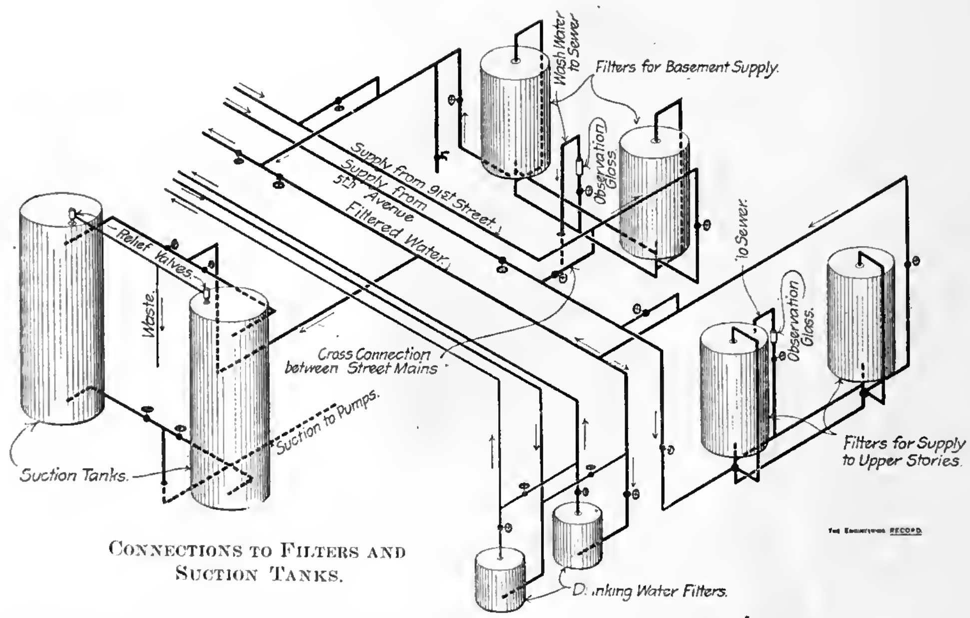
Branches for sill cock lines, hose connections and flush pipes for the fresh air inlets are taken from the street supplies inside the meters, beyond which they are run on the high basement ceiling to the filter room which has its depressed floor at the same level as that of the adjacent boiler and pump rooms, about 8 feet below that of the basement and 10 feet below the level of the street sewer. This gives a height of about 16 feet to the ceiling and affords ample headway for the pipes to run above the filters and the tall suction tanks. The room has no windows, is lighted by electric lamps and, having its walls faced with white glazed bricks and all the tanks coated with white enamel paint, presents a neat and airy appearance. The tanks and filters are arranged around the sides of the room and in a curved alcove as indicated in the general plan which accompanied the previous articles, and the center of the room is unobstructed except by the auxiliary hot air pump and furnace which is installed there. All the pipes are suspended by long rods from the steel ceiling beams, but at a sufficient height to provide ample head room beneath them, and are arranged in the same



Cold-Water Pressure Tanks.

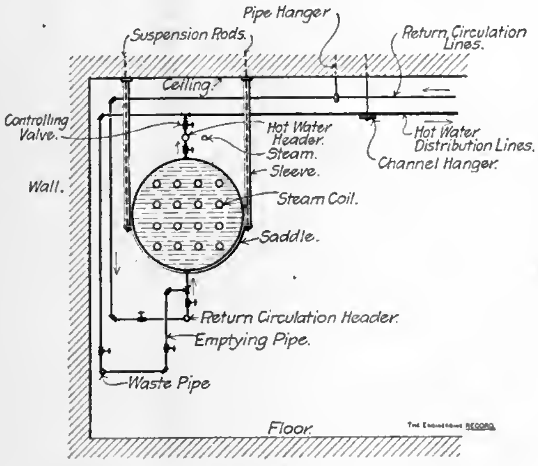


Cold-Water Pressure Tanks and Distribution Header.



Connections to Filters and Suction Tanks.

horizontal plane. All the supply and delivery pipes are brought in adjacent parallel lines to the center of the room, and thence that from the Fifth Avenue main is branched to the double filter intended to supply normally the street pressure system. Vertical inlet and outlet pipes are run down near the wall and connections made in the usual manner to the operating valve at the bottom of the filter. The filter for the pump pressure service is similarly connected and the supplies to both are cross-connected. The delivery pipes from both filters are cross-connected, and the one from the Fifth Avenue service is branched to a pipe with valved inlets to the tops of the two vertical 50-inch suction tanks, 12 feet high. The tanks have cross-con-

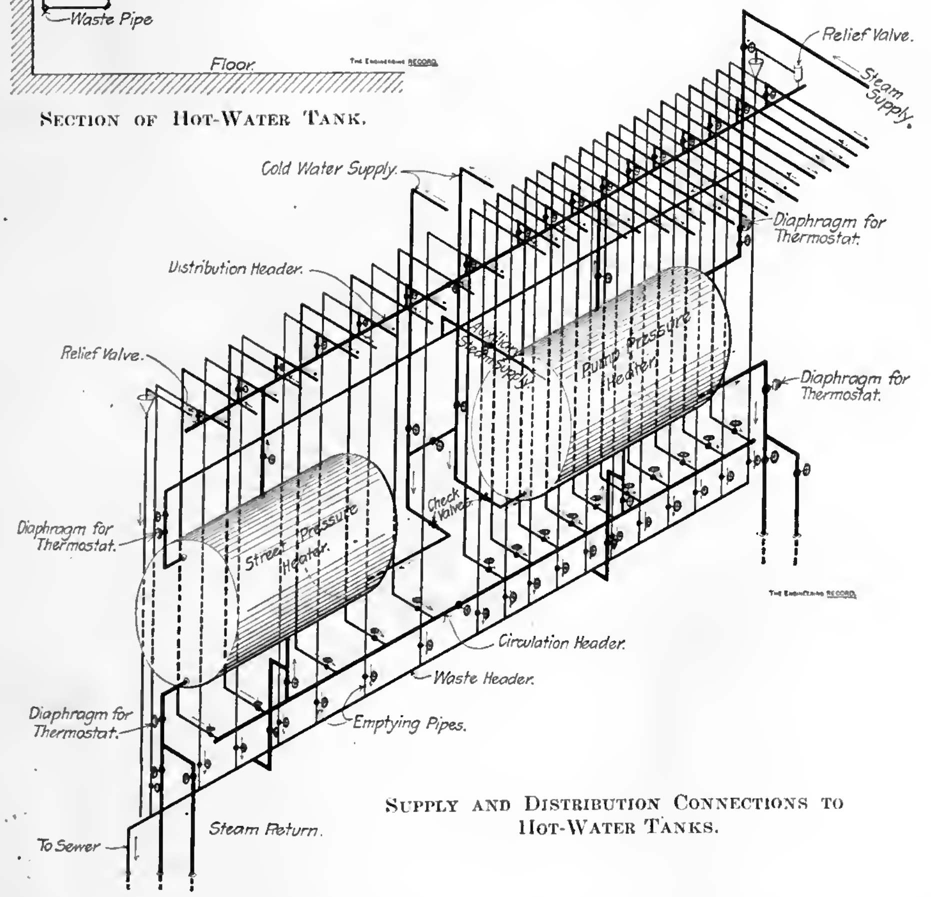


SECTION OF HOT-WATER TANK.

nected outlet pipes on the front side near the bottom from which a 4-inch suction main is carried under removable cast-iron floor plates to the pumps. On top of each tank there is set vertically a check valve with an inside ball-float connected to it in such a manner that if the water is pumped out faster than it enters from the filters it will fall and the opening of the valve will prevent the formation of a vacuum in the top of the tank.

The house pumps deliver directly to a pair of horizontal cylindrical pressure tanks seated in cast-iron saddles on brick piers on the basement floor. These tanks, like the suction tanks, were intended to be galvanized inside, but as this was found to be impracticable they were painted instead, and great difficulty was caused from the fumes of the paint, which could only escape through the manhole and were so suffocating that the men could remain inside only a short time at once. The pressure tanks are set low and are in the corner of the room so that it is necessary to have a special door through the wall on one side to give access to the manhole in the outside tank.

The principal connections are made with vertical pipes screwed into the cylindrical shell, and all of them are on the under side on the center line except those for the air-equalizing pipe, which are on top. The inlets and the emptying pipes are near the front ends of the tanks, and the water equalizing pipe and the outlets are near the middle points. The outlet pipes are connected with a double T to the 4-inch header, made up of T's and nipples. It is set horizontally near the floor, and from it the distribution lines are run vertically to the ceiling and thence taken to the feet of the riser lines for the different groups of fixtures. The two tanks are intended to operate together and all their principal valves are normally open but can be closed so as to cut out either tank and maintain complete service with the other one. It is intended to have the upper parts of the tanks always filled with air to provide an expansion cushion and prevent water hammer, and gauge glasses nearly 60 inches high are provided to show the water level. The



SUPPLY AND DISTRIBUTION CONNECTIONS TO HOT-WATER TANKS.

bottom inlets of the gauge glasses are connected by a horizontal cross pipe from which a small pressure pipe is run to a regulator, which automatically controls the operation of the pumps so as to maintain a constant pressure of about 55 pounds in the tanks and throughout the distribution system. A supply of compressed air in the tops of the tanks is provided by Quimby electric pumps which are valved to inject a portion of air with the regular water supply. If too much air accumulates in the tanks it can be drawn off through pet cocks not shown in the diagram, and the pump can be arranged so as to deliver less air with the water.

The tinned copper hot-water tanks are suspended from the ceiling beams, as indicated in the sketch, by vertical screw rods with pipe sleeves against which the flanges of the saddle bands are screwed up tight so as to hold them rigidly in place. This secures the tanks vertically, and the connections of short stiff pipes, which are screwed into the reinforced shells, brace them firmly in transverse and longitudinal directions. During the winter steam for the interior brass coils is supplied from the main boilers installed for the radiator system. In summer these boilers will not be in service and an independent small boiler enclosed in a setting of fire bricks faced with glazed white bricks is provided to operate the domestic hot-water system. Both steam supplies are connected to a horizontal longitudinal pipe over the tanks and are controlled by Johnson thermostats having valves operated by pneumatic diaphragms with air compressed by a special electric pump arranged to be started and stopped automatically by the variations of pressure in the receiver.

There is a vertical outlet from the upper side of each tank which is connected to the distribution header. A gate valve in the center of the header separates the street and pump pressure tanks, but may be opened to put both under the same pressure if necessary. Seven short vertical pipes are connected to the street pressure end of the header and ten to the pump pressure end, and at the ceiling all terminate in T's with a pipe in one direction to the foot of the riser line and one in the opposite direction, which is carried down the face of the adjacent wall and is valved to a waste pipe to provide for the emptying of any line without interfering with any other line. Safety valves are set at the ends of the header to discharge any steam or excess pressure, and have drip pipes terminating over funnels connected to the same waste pipe, which is trapped below the floor and discharges into an open sink.

Return circulation pipes from above the highest fixtures on the different lines are run between and parallel to the supply pipes on the basement ceiling; they are carried down the face of the wall with the waste pipes and are branched horizontally to enter the return circulation header under the tanks, near which they are valved so as to enable the lines to be cut out for repairs. The return header, like the supply header, has a middle gate valve dividing it into pump and street pressure ends corresponding to the tanks and connected with them by the upper ends of emptying pipes which are valved into the waste pipe.

The large number of parallel pipes suspended from the ceiling are symmetrically arranged with unions, valves, T's, etc., in straight lines and present an attractive appearance. Where they turn at right angles to go to opposite sides of the house the angles have their vertices in the same diagonal line, giving the effect of a regular miter joint which is very workmanlike. Some of the pipes are supported on simple cross-bars made of a length of horizontal pipe with vertical hangers reaching to the upper side of the ceiling beams and supported from them with cross pieces through T's at their upper ends. In other cases the horizontal pipes are over instead of under the supported lines and have ordinary double yoke standards screwed into them and engaging the pipes. In many cases the pipes are screwed down on top of narrow boards laid between the flanges of a 4-inch horizontal channel web down, which is suspended from the ceiling by vertical screw rods through the ends. Care is taken to provide efficient support for all pipe lines. All water pipes are carried from the ceiling and sewer pipes are carried from the ceiling or are supported on piers of white enameled brick built up from the cellar floor 10 feet apart.

All fixtures in the house have their exposed piping, traps, valves and all other metal work made of white metal, which is also used for the legs and corners of sinks and wash stands, for floor strainers, escutcheon plates, towel racks, brackets, etc. In the basement and in the servants' rooms in the fourth floor the white metal is polished and is not plated; elsewhere it is silver plated. All sinks, even for the refrigerator wastes and tell-tales in the basement, are made of porcelain. In the scullery and kitchen there are extra large sinks with white marble wall slabs above them and large white marble countersunk floor slabs. The two scullery sinks are set 5 feet apart and the space between them and at each end is covered by drip boards hinged to fold up vertically against the wall. Each sink has a large Tucker grease trap and is provided with hot, cold and drinking water.

A handsome 12x20-foot bathroom is provided in the basement for the engineer. It has mosaic floor and white marble wainscot 8 feet high and all trim and mouldings are of white marble to the exclusion of all woodwork, except for the doors. At one end three wash basins are set in a long white marble slab, with a plate glass mirror in the wall above it. In the opposite end of the room there are two water closets with white marble partitions and three-quarter length screen doors of dark polished oak with dull bronze locks and hinges. Adjacent to the water closets white marble partition slabs as high as the wainscot enclose a porcelain bath tub with a shower and a duck curtain on a rod. The bathroom has a full length solid oak door glazed with frosted glass.

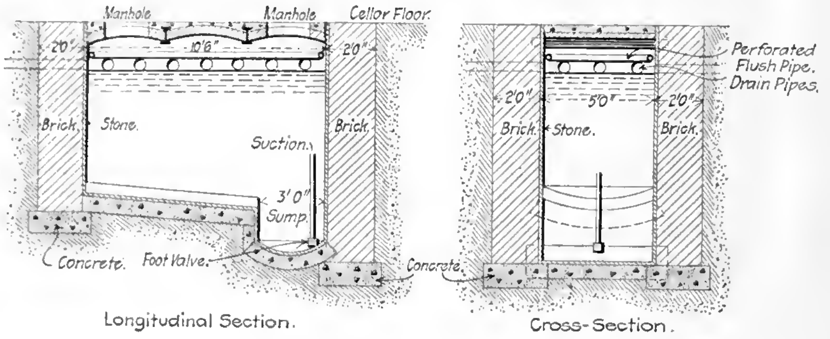
The boudoir bathroom is about 20 feet square with a white marble floor in parquetry pattern and white marble wainscot 6 feet high. The upper part of the walls is finished in white and the large windows and wall mirrors combine to give a very bright and airy appearance not often found in such rooms. There is a porcelain bath tub and sitz bath and two wash basins with separate tables, one of them being fitted with a swinging shampoo shower which has supply pipes rising from the tops of the hot and cold water faucets. In one corner of the room a separate enclosure extends to the ceiling for the water closet.

The owner's bath room is similar, but somewhat smaller, and has only one wash basin; all the guests' bathrooms have the water closets enclosed by walls reaching to the ceiling and forming separate inner rooms. One of the guests' toilet rooms is provided with a white metal large size needle bath with shower and liver sprays which is set in an alcove with white marble partition slabs and shallow floor basin and is screened in front by a white duck curtain. There is a third family bathroom, and a special bathroom and kitchen or pantry for the nursery, and there is a small bathroom for the seamstress. This room is limited in size by the pipe shaft and only contains a 4-foot tub, a wash basin and a water closet without enclosing partition, but the character of the fixtures and their quality correspond with the others described. All bath tubs are provided with 3-inch overflows and wastes which are tested to insure their capacity to discharge the water faster than it can be received through both faucets full open under maximum pressure. In the fourth story there is one bathroom for the women servants and another for the men servants. Each has two wash basins in a white marble slab, with a marble back and countersunk floor slab. There are two water closets and a bath tub enclosed with 6-foot white marble partition slabs with oak doors, and in the women's room there is a slop sink. In most cases the slop sinks are in separate closets and all are supplied with drinking water which is delivered through a special faucet attached to and just above the long braced spout for the hot and cold water to the sink and for filling pails, etc. In the butler's pantry and nursery pantry there are large single and double sinks which, with their tables, are lined and covered with copper, silver plated, and are supplied with hot and cold water and drinking water through high goose-neck swing faucets.

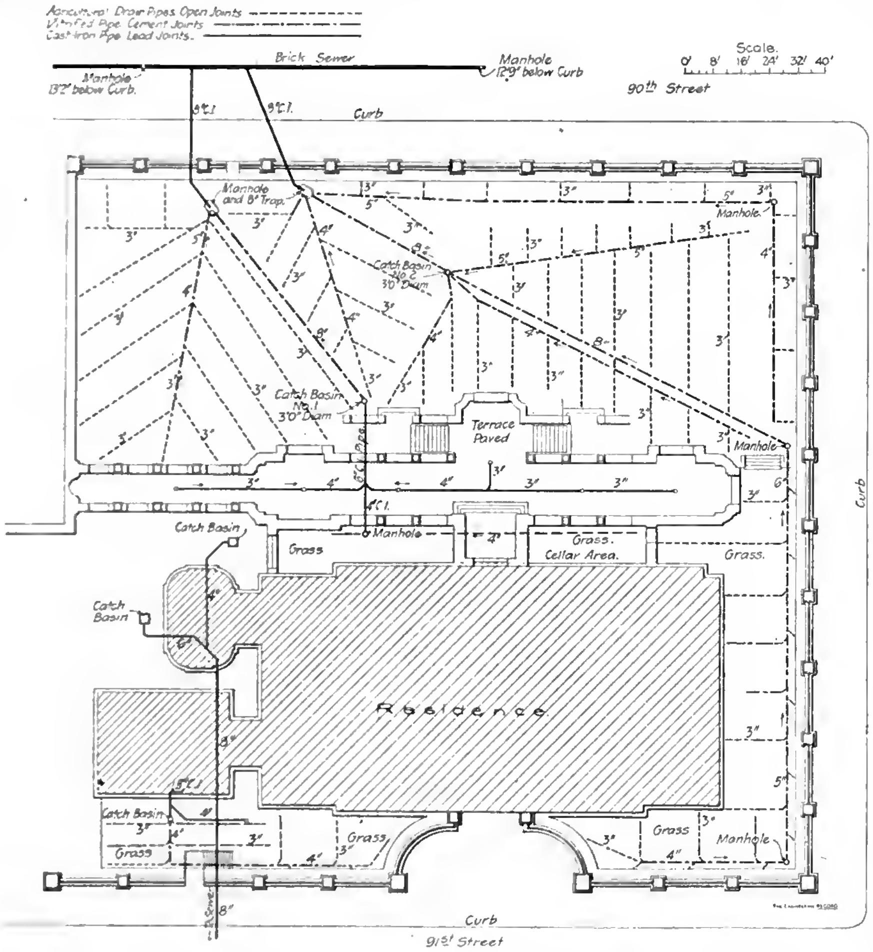
The storm water from the cellar areas around the building, the wastes from the engineer's and drip sinks, the emptying pipes from the hot water, suction and pressure tanks, the drips from the relief valves and the drainage from the floor strainers are connected in one 5-inch, four 4-inch, two 3-inch and one 2-inch cast-iron pipes under the cellar floor and drained into a tank under the pump room floor and about 10 feet below the level of the street sewer. It is 4 feet wide, 6 feet deep and 12 feet long with a 1½-foot sump at one end. It has 12-inch brick walls and a concrete bottom surfaced with bricks set edgeways. It is lined with Alberene stone slabs 1 inch thick, and is covered with flat brick arches supported by I-beams 4 feet apart. It has two 24-inch cast-iron manhole covers and a 1-inch perforated brass pipe for washing down the walls.

The tank is automatically emptied by two improved centrifugal pumps made by the Lawrence Machine Company. They are specially made of bronze or composition metal and have a capacity of 100 gallons each per minute. Each pump has a 3-horse-power direct-coupled electric motor on the same bed plate and is guaranteed to work noiselessly. The pumps are controlled by tinned copper ball floats operating electric switches which start or stop them when the tank is full or empty. The 3-inch suction pipes are provided with continuous service foot valves and steam primers. The 3-inch discharge pipes are trapped into the 4-inch sewer pipe at the boiler room ceiling. The suction pipes have gate valves which may be closed to allow the pumps to empty the blow-off tank.

Special provision was made for the subsoil drainage of the site of the house and the adjacent grounds. The cellar excavation and excavations under the moat and gardens were filled 1 foot deep with broken stone, in which 3 and 4-inch lines of unglazed agricultural drain pipes were laid with open joints. These lines are connected with Y-branches in lines of vitrified sewer pipes with cemented joints



Drainage Tank under Boiler Room.



Sub-Soil Drainage for Gardens and Moats.

which in turn discharge into cast-iron pipes with lead joints, which are run to the street sewers. After the pipes were laid the area outside the house was backfilled with selected earth and the moats, terraces and gardens were constructed.

Messrs. Babb, Cook & Willard are the architects and Mr. William Paul Gerhard is the hydraulic and sanitary engineer of this residence and grounds. Mr. James Armstrong is the contractor for the plumbing and Mr. Charles T. Wills is the contractor for the sub-surface drainage system.

The Economic Need of Technical Education.

Extracts from a paper by Victor C. Alderson, Dean of Armour Institute of Technology in the "Journal" of the Western Society of Engineers.

Most, if not all, recent improvements in educational methods in this country have been purely academic or philosophic; they have been evolved by musing in the library, or perhaps from class-room experience; but none of them have resulted from a close acquaintance with the real conditions of the industrial and business warfare into which the student enters when he leaves the school. The so-called "systematical development" given to young people is but a twentieth-century way of training a "jack-of-all-trades." The one thing needful will not come from teachers' conferences, nor county institutes, nor the august meetings of school superintendents, for the attendants at these assemblages have not, and cannot get from their experience, the proper point of view. Educators of to-day should break out of the circle in which they are traveling and look at matters from a new point of view. This should be from the vantage ground of the factory, the workshop, the railroad or the counting-room; it should be industrial and commercial rather than academic. The practical needs of every-day workers should be considered, after a scientific study of conditions at present existing.

With advancing civilization, with the luxuries of yesterday becoming conveniences to-day and necessities to-morrow, with our products going to far-away lands in competition with local goods, with competition becoming sharper day by day, with the margin of profit becoming steadily narrower, it is found necessary to seek new lines of economy. In the accurate application of the laws of science, an almost limitless field is open. Mere practice, no matter how long continued, cannot long avail against theory followed by intelligent application. A stupid fireman can burn up the profits of his establishment by ignorant firing; an engineman was recently discovered running an engine for no other purpose than to get exhaust steam to heat his building. He was a "practical man of long experience." A soap manufacturer who had depended upon the "knack" of one workman for many years nearly went into bankruptcy when the man died, for no one else seemed to have the requisite "knack"; but the employment of a trained chemist without the "knack" regained for him his lost business. A large railroad company recently saved more than half a million dollars in six months by equipping a laboratory in connection with its machine shops and putting in charge a technically trained man—one who could unite theory with common sense. The present age has truly been called the age of science, but with this designation the story is only half told. Pure science to be of the greatest value must be applied. The application of science to industry has made this the age of technical education; it has changed many of the conditions of life and has given rise to new problems, the solution of which depends in a high degree upon men who have received a technical education. A dozen years ago the introduction of manual training was always preceded by a spirited controversy; to-day its value is generally conceded and its introduction is becoming fairly common. Not only is it incorporated into the high school curriculum, but it is fast going where it especially belongs—into the graded schools, as an organic part of educational training. In another dozen years the necessity for advocating manual training will probably have ceased. What new features will be advanced to take its place? What new element in educational progress will be demanding recognition? In all probability it will be secondary technical education. Leaving out of consideration the two extremes—unskilled labor at the foot of the educational ladder and those professions at the top which demand a preliminary college training—there are many vocations in the middle ground for which a technical training is necessary. This broad field has been cultivated very little in this country. England, France, Holland, Belgium, Germany, Austria and Switzerland have all done more than we have, and it may not come amiss to examine the system of technical education in one of these countries.

Switzerland is best known to Americans as a region of mountain scenery, but it is an object lesson for us in a manner not yet fully recognized. The natural conditions under which the Swiss people have struggled for the past six hundred years have been so burdensome and their industrial success so pronounced, that Switzerland is to-day the best of the European countries in which to study the close relation which exists between the technical education of the masses of the people and national industrial prosperity.

Like the United States, Switzerland has no national school system. The constitution of the federation allows the Federal Government to establish a polytechnicum, a federal university and other institutions of higher instruction or to subsidize such local schools as may be selected. Provision for elementary instruction must be made by the several cantons, but the Federal Government in most cases subsidizes these cantonal schools. There is no Federal university, but six cantonal universities exist at Basel (founded in 1460), Zurich (1835), Berne (1834), Geneva (1873), Fribourg (1889), and Lausanne (1891). The polytechnicum at Zurich (founded in 1854) is supported entirely by the Federal Government. The school covers the higher scientific and technical fields in a most thorough manner. For accuracy of instruction, completeness of equipment, and high professional standard, it is the peer of any technical school in Europe. With a most complete cement-testing laboratory; a mechanical laboratory covering every possible demand that can be made upon it; with a department of electricity equipped regardless of expense; with extensive departments of chemistry, forestry and agriculture; with a new department devoted to the testing of building material alone, it is evident that the Federal Government has provided liberally for the most advanced instruction in technical lines. There seems to be no fear in the minds of the Swiss that a man can be too scientific, or that too deep a study of the scientific basis of industrial questions is possible.

Next below the Zurich Polytechnicum are three technica, or technical schools, offering less theory and more practice, and relating their work more closely to the trades and industries. One is located at Bienne; the second, at Winterthur, is noted all over Europe for the thoroughness of its instruction and the success of its graduates; the third is at Burgdorf, where Pestalozzi taught his first school and where Frœbel at one time was developing his philosophy of education. This group of technical schools gives scientific character to the entire Swiss system of technical education.

The trade and industrial schools—to be carefully distinguished from the group first described—have been established to teach the homely trades, and are a conspicuous feature in the educational and industrial life of Switzerland. They are found in every canton, and are intended to make the local industries more successful.

Swiss education is the result of no single philosophy, no one method, no selfish utilitarian object; it has not been dominated by social reformers nor by mere theorists; it is a composite type, the result of many conflicting views and necessities. Throughout the entire system can be seen, however, an attempt to solve the problem of the relation between education and industrial prosperity. This point of view is the one thing needful in developing our own system of technical education, and the one idea which we can best borrow from the Swiss. With them no valuable feature—either cultural or technical—is ignored. Each branch of knowledge is prized according to its value as discipline or as a distinct aid in professional or industrial pursuits. Their object is not only to train men and women for their vocations, but to build up new industries or at least to extend and strengthen those already established.

Technical education in this country is a product of the last quarter of a century. The first legislation which gave a decided impetus to this form of education for the American youth was the Morrill Land Grant Act of 1862. This act granted public land to the several States, apportioning 30,000 acres for each Senator and Representative, to be devoted solely to the advancement of instruction in the agricultural and mechanic arts. The full effect of this act was not felt until after the beginning of the last quarter of the century, when there was established in almost every State a school to carry out the purpose of the act. From that time on the growth of technological education was remarkable, whether we consider the actual outlay upon material equipment, the increased number of students, the constantly improved methods of instruction or the continued elevation of the standard of instruction. This great advance came from a general acceptance of the view that industry needed the aid and assistance which comes from technical training. With this change of industrial demands came the needed supply in the form of young men trained, not in the classic halls of some favored university, but in the workshops and the laboratories of institutes of technology. These men are educated to understand the fundamental principles of science not merely in their broad, general aspect, but in every matter of practice, detail and application. They supply, to only a limited extent, however, the needs of modern industry, since they furnish merely the highest grade of workers, as does the Zurich Polytechnicum and the technica at Winterthur, Bienne and Burgdorf. They furnish a technical training not for the many, but only for the few. What should be done for the great army of workers in our industries, who need at once the skill of the mechanic, together with sufficient intelligence and training to understand the directions of the professional engineers above them? Their number is legion. At the present time this country makes little or no adequate provision for their instruction. This is the realm of secondary education.

In considering so radical a measure some important features should be emphasized in order to avoid misapprehension. The main idea in such a plan would be to take a boy just graduating from the grammar school and give him a good secondary education, together with a training on one or more technical or trade lines. Such a scheme would be unsuccessful if the school were to be maintained on the usual high school lines of to-day; it would necessitate a highly elastic or elective plan of operation, because no individual could successfully study all the subjects offered. The routine courses in physics, chemistry, mathematics and drawing would necessarily be much shortened; but every progressive teacher knows that much of these subjects, as at present taught, is of little value in strictly technical pursuits. Much of the laboratory, drafting-room and testing work now done by the technical colleges could be incorporated into the courses, and we should have technical high schools as real "people's colleges." There can be no reasonable doubt that our technical education in the United States is weakest in this spot.

In our high-grade institutes of technology we are training the commissioned officers of our industrial army, but the great mass of non-commissioned officers and privates are left uncared for. As indicated in the report of the Carnegie committee, technical education may be said to run parallel with the general lines of education, and be divided into three parts, corresponding to the grammar, high school and college grades of the established system. The lowest grade is generally picked up in the shop by boys without special training, who have had merely a grammar school education. It is represented in Switzerland by the Sunday, holiday and evening schools for artisans. It develops the "practical man." The highest grade is represented by the polytechnicum and technica in Switzerland and by technical colleges and institutes of technology in this country. These represent the phase of technical education that demands thorough knowledge of mathematics and the sciences, and is distinctly professional in character. Between these two extremes lies the region of secondary technical education which is represented in Switzerland by the trade school and the specialized technical school. In the United States it is represented by more or less feeble efforts in a few trade schools, in a limited number of private institutions aimed to help the workingmen, and in night schools. Besides these instrumentalities there is another, arisen only within the past few years, which for pure bigness eclipses all other efforts—the schools of correspondence. While our educators have been discussing mere theories and methods and have been building a Chinese wall about their so-called superb school systems, shutting out all who were too large to walk through the narrow gateways which they themselves had made, private enterprise has discovered that half a million young Americans outside the walls were hungry for a technical education. When the history of education shall have been written, no greater reproach will rest upon the educators of this decade than their failure to hear the call of this multitude for an education suited to their needs. If the farmer's son can secure at the State university free instruction in scientific agriculture, what good reason is there for depriving the son of a mechanic from securing free instruction in engineering practice, machine tool work, or any other industrial calling, at the city technical high school? We should follow the example of Switzerland and, recognizing the dependence of national prosperity upon technical education, set about the task of providing an education for all classes of workers suited to their lives. The technical high school, if properly equipped and put in close relationship with the trades and industries, will satisfy this national need; it will not be a copy of the European trade school, but rather an adaptation of the trade school which will be in harmony with American thought and American educational ideals.

Industrial warfare is not a new idea, but its sociological effect in giving impetus to technical education during recent years is noteworthy. We are familiar with martial warfare. Our newspapers for the past few years have been teeming with reports of battles, of warfare, of disease and death as the concomitants of war. But in the midst of all this clamor there has been going on—largely unknown and unnoticed—the most bitter, the most relentless war in the history of the world; a war not for territory, not for naval nor military glory, but for wealth, for industrial supremacy—a contest of brain with brain, skill with skill, economy with economy, technical training with technical training. It is only another example of the "struggle for existence." The war in South Africa or the Philippines is less fatal to the workingman than the ceaseless competition of similar workingmen in other countries. It is this unremitting rivalry between workers of the same class the world over that makes the cultivation of the workingman's powers by means of technical education an absolute necessity. That nation that neglects to equip its workmen with the armament of industry—technical education—will surely be defeated and become a decaying nation. These workers should receive immediate and thoughtful attention, for they are the bone and sinew of successful national and industrial life. That they should be technically trained through the medium of the technical high school is at the present time the greatest economic need of the American people.

Trade Publications.

The DeMan system of fireproof construction has a number of special features of which the most generally interesting is a concrete beam system with a reinforcement of steel bars. The cross-section of the metal varies with the loading and design of beam or floor, but the bars are always given twists every 2 to 4 inches which form shoulders that anchor the strips in the concrete. Full descriptions of this and other features of the system, tables for computing the strength of the work, and illustrations of buildings where it has been employed are given in an 80-page book published by the American Fireproofing & Cement Construction Co., 1135 Broadway, New York. The company has also prepared a catalogue illustrating in colors a variety of tiles about 8 ins. square and 1 in. thick used for floors in buildings, private sidewalks and like situations.

A beautifully printed book entitled "How Best to Heat Our Homes" has been issued by the Gurney Heater Mfg. Co., Boston. It describes the general features of steam and hot water heating, and explains the general construction of the company's warming apparatus.

A type of reinforced concrete flooring has been introduced by W. N. Wight & Co., 160 Fifth Ave., New York. It is called the lock-woven system from the high-carbon steel fabric forming the reinforcement of the concrete, described in a circular recently prepared by the firm.

A paint called "Galvanum" has been prepared particularly for covering galvanized iron and steel. It is made in two shades only, dark lead and stone drab, but can be given another coat of any desired color. The makers, the Goheen Mfg. Co., Canton, O., have issued a pamphlet giving references to a number of large users of it.

A system of piling recently introduced in the Middle States is constructed by placing a steel core inside a tapered sheet iron shell and driving this like a wooden pile. The core is then withdrawn and the shell filled with concrete, steel rods being embedded in the concrete if lateral strength is desired. The system is described in a pamphlet issued by the Raymond Concrete Pile Co., Merchants' Loan & Trust Bldg., Chicago.

The Coffin Valve Co., Neponset; Boston, Mass., has prepared a useful illustrated folder concerning standard foot valves from 6 to 48 inches in size.

A successful test of a garbage cremator for use in private and public buildings was recently made in New York under the direction of Mr. Morgan J. Cragin, 285 East 43d St., Chicago. The device has a coal grate under a water-tube grate on which the garbage is incinerated. The tube grate is used as a water heater if desired. The apparatus is fully described in a pamphlet published by Mr. Cragin, which also gives a list of many Chicago buildings where it is used.

An automatic circuit-breaker has been designed by the Westinghouse Electric & Mfg. Co. for use in charging automobile storage batteries. Its purpose is to protect the battery automatically against overcharging, and its construction and use are explained in an illustrated circular which every user of an electric automobile will find of interest.

Several months ago Dr. F. A. C. Perrine, president of the Stanley Electric Mfg. Co., read an interesting general paper on the power plants of the Pacific Coast before the New York Electric Society. It has recently been published in an elaborately illustrated pamphlet which will prove valuable to all who desire to become acquainted with the notable plants of that section. Copies can be obtained from Ray D. Lillibridge, 170 Broadway, New York.

A catalogue of drawing instruments, paper, inks, surveying instruments and similar supplies has been issued by Williams, Brown & Earle, 918 Chestnut St., Philadelphia. Special attention is paid to transparent cloths and special drawing boards.

A pamphlet has been issued by the American Air-Compressor Works, 26 Cortlandt St., New York, describing the general features of its steam and power compressors, vacuum pumps, receivers and air-lift plants. Tables of sizes are given and rules for setting up compressors.

A 52-page album of excellent views of concrete structures with a reinforcement of twisted steel rods has been published by the Aberthaw Construction Co., 8 Beacon St., Boston. The illustrations show bridges, buildings, power plants and industrial plants built wholly or in part of reinforced concrete, a number of the structures being already familiar to the readers of this journal, such as the buildings of the Pacific Coast Borax Co., the Paterson Edison Illuminating Co. and the Central Lard Co., the Nassau County Courthouse, the St. James Church in Brooklyn, and a large Philadelphia sewer.

Mr. Edward M. Hagar, manager of the cement department of the Illinois Steel Co., Chicago, has reprinted in handy form the report of the Board of Engineer Officers, U. S. A., on Testing Hydraulic Cements, which was published some months ago. This is one of the most important American documents on the subject and gives specifications as well as directions for testing.

An album of large engravings of views along the New York Rapid Transit R. R., with an excellent description of the way construction is carried on, has been published by the Rand Drill Co., New York. It is easily the best concise description of the work yet made public, and the illustrations merit the term sumptuous.

The Stanley Electric Mfg. Co., Pittsfield, Mass., has issued a complete illustrated catalogue of the types of switches it makes, from the simplest small knife switch to the large 60,000-volt combined switch and fuse or the combined oil switch and circuit-breaker. This pamphlet appears as No. 127 in the company's series of bulletins.

The Riehlé Bros. Testing Machine Co., 1424 North 9th St., Philadelphia, has issued a large catalogue of the many varieties of testing apparatus it makes. The requirements of purchasers of many classes of material call for tests of some sort, and the machines made for the purpose have reached a degree of specialization that is surprising, as this book will conclusively prove.

Personal Notes.

Mr. J. R. C. Brown has been elected city engineer of Ironton, O., to succeed Mr. F. G. Leete, resigned.

City Engineer McDonald, of Anaconda, Mont., has resigned to accept a position in the School of Mines, in Butte.

The Lauer & Harper Co., engineers and contractors for steel buildings and bridges and heavy timber construction, have moved from Baltimore into their office and works at Westport, Md.

Mr. Charles H. Ledlie, M. Am. Soc. C. E., whose association with the New Orleans Railways Co., of New Orleans, was mentioned in this column April 12, is first vice-president. Mr. Alexander Black is announced as chief engineer and head of the electrical department, and Mr. E. B. McKinney, superintendent of power houses.

Major George McC. Derby, Corps of Engineers, U. S. A., has been ordered to Louisville, to relieve Major Ernest H. Ruffner, and his duties in connection with the fourth district of the Mississippi River improvement, at New Orleans, are to be assumed by Capt. Charles S. Bromwell, who has been detached from the office of the Chief of Engineers for that purpose. Lieut. W. J. Barden, for some time city engineer of Havana and only recently back from that post, has been assigned to duty at the Engineer School of Application, Washington Barracks.

A Water-Power Plant that will include a 10x10-foot tunnel, 440 feet long, driven at an inclination of 14½ degrees is now being developed near Shoshone, Idaho, on the Snake River. The tunnel, of which 240 feet has been driven, will tap the Bridal Veil Fall and will provide a head of 190 feet. According to Mr. J. V. Blow, the superintendent of the plant, a total of 5,000 to 7,000 horse-power is to be first installed, and when it is desired to increase the production, a second tunnel will be driven.

Drafts in Schoolrooms in Detroit, caused by the air passing along the floors to the vent flues, are to be overcome, if possible, by running one or two rows of steam pipes under the windows, according to Mr. Ralph Collamore, in "The Technic," of the University of Michigan. Whenever possible, several vent openings are provided, usually by taking off about 6 inches from the bottoms of the doors opening to the cloak rooms, the vent flue proper leading from these rooms. The schoolrooms are warmed by the fresh warm air supply, five-eighths of the total heating surface in the heating coils and three-eighths in the tempering coils.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xvi, xviii and xxvii.

WATER.

Mt. Gilead, O.—Engr. J. B. Weddell, of Mansfield, O., writes that contracts for constructing a water works system for the Mt. Gilead Water, Light & Power Co. (bids opened July 23) have been awarded as follows: Pipe for the 5 miles of line, 2,000 ft. 8-in., 46 tons; 12,000 ft. 6-in., 200 tons, and 12,000 ft. 4-in., 150 tons, to the Massillon Iron & Steel Co., Massillon, O., at $32 per ton; pipe laying, to J. M. Healy, of Chicago, Ill., total for labor and material, $18,000; valves, 32, and hydrants, 48, to Darling Pump Co., Williamsport, Pa., for $1,350; tower, 50,000-gal. capacity, 129 ft. high, to Chicago Bridge & Iron Co., of Chicago, for $4,125. Contract for pump was not awarded.

Cheyenne, Wyo.—Bids will be received by the City Clk., E. A. Abry, until Aug. 21 for constructing a masonry dam on the Middle Fork of Crow Creek.
Bids are wanted Aug. 14 for furnishing 8,000 bbls. of Portland cement, to be used in the construction of masonry dam.

Columbus, Ind.—Bids are wanted Aug. 7 for the construction of a new water works pump of 5,000,000-gal. capacity. Jas. Cochrane, City Clk.

Baldwins, L. I., N. Y.—Bids are wanted Aug. 8 (readvertisement) for furnishing, constructing and erecting a pumping plant, with all appurtenances complete at Millburn Engine House. Address Robt. Grier Monroe, Comr. Dept. of Water Supply, Gas & Electricity, New York City.

Henry, Ill.—Bids are wanted Aug. 10 (extension of date) for a system of water works, including 1,050 ft. of 8-in., 2,940 ft. 6-in. and 25,000 ft. of 4-in. pipe, with specials, hydrants, gate valves, etc. A. G. Humphrey, Mayor.

New York, N. Y.—Bids are wanted Aug. 7 for furnishing, delivering and laying water mains in numerous streets in the Boro. of Bronx; time for the completion of contract, 300 days; amount of security required, $50,000. Robt. Grier Monroe, Comr. Dept. of Water Supply, Gas & Electricity.

South Bend, Ind.—City Engr. A. J. Hammond writes that the city will extend the water mains, requiring about one mile of 12-in. cast iron pipe. M. L. Rogers, Supt. of Water Works.

Evansville, Minn.—Village Clk. S. L. Burton writes the contract for constructing water works has been awarded to W. D. Lovell, of Des Moines, for $6,402.

Anadarko, Okla. Ter.—City Clk. F. V. Hamilton writes that the contract for preliminary surveys, with plans for a system of water works, has been awarded to Burns & McDonnell, of Kansas City, Mo. Estimated cost of system, $40,000.

Chinook, Mont.—Town Clk. M. F. Marsh writes that at the recent election bonds to the amount of $24,000 were voted for water works.

North Yakima, Wash.—Chester A. Congdon, of Duluth, writes that the Yakima Valley Canal Co. proposes to extend the Congdon Canal, at a probable cost of $35,000. Work to be done by day's work. Alfred Bannister, Engr. in Charge.

Revelstoke, B. C.—Engr. Henry B. Smith, of Rossland, B. C., writes that a survey with report and estimate has been made for water works, and these are now under consideration of the Council.

Dallas, Tex.—The City Council has adopted a report from the Pub. Improv. Com. urging that bids be asked for sinking one or more artesian wells near the Turtle Creek pump house.

Arlington, S. D.—O. Claussen, of St. Paul, estimates the cost of a system of water works at $13,550.

Yazoo City, Miss.—The City Council has authorized the issue of $200,000 water, light and sewer bonds.

Springfield, O.—The City Council has decided to readvertise the $30,000 water works bonds.

Oroville, Cal.—The Palermo Land & Water Co. has asked for a 40-year franchise to lay pipes and supply water to this town.

Los Angeles, Cal.—The Miradero Water Co. has been incorporated, with a capital stock of $75,000. Directors: L. C. Brand, W. H. Taylor, of Los Angeles; Fred. H. Taft, Santa Monica, and others. Principal place of business, Los Angeles.

Phenix, R. I.—Engr. in Charge J. A. Latham, of Providence, writes that the Phenix Valley Water Co. has awarded the contract for constructing a reservoir to J. Vaughn, of Stamford, N. Y., for $40,000.

Chase City, Va.—The citizens have asked the Town Council to take steps toward the construction of a system of water works and the macadamizing of the principal streets.

Lorain, O.—City Engr. Chas. S. Fergnson writes that bonds to the amount of $32,000 have been authorized for water works extensions.

Freeport, O.—Corp. Clk. Walter Jones writes that bids will be received Aug. 16 for the construction of water works estimated to cost $5,000. Engr. in Charge, S. C. Kelly, Freeport.

Manning, Ia.—Bids are wanted Aug. 21 for the construction of a water tower, as advertised in The Engineering Record.

Albany, Ore.—The Albany Canal & Water Co., E. W. Langdon, Pres., has been formed to take over and improve the plant of the old water company.

New Philadelphia, Pa.—The New Philadelphia Water Co. has been incorporated, with a capital of $1,000. Stockholders: Alex. H. Scott, New Philadelphia; W. M. Faussett, Pottsville, and others.

Boston, Mass.—The only bid received July 26 at the Bureau of Yards & Docks, Navy Dept., Washington, for constructing a concrete and steel conduit and laying a 16-in. C. I. water main at the Navy Yard, Boston, was from the Aberthaw Const. Co., of Boston, at $55,564.

North East, Pa.—Boro. Secy. F. B. Comstock writes that at the election held July 29 it was voted to borrow $20,000 for extending and enlarging the water works.

Roundlake, Minn.—Bids will be received Aug. 6 for constructing a water works system, consisting of a wooden tank, on steel tower, gasoline pumping plant, pump house and a system of distributing mains with appurtenances. J. C. Thomsen, Village Recorder.

Allegheny, Pa.—Bids are wanted Aug. 12 for erecting an addition to the Howard St. pumping station. D. L. Fulton, Dir. of Dept. Pub. Wks.

Rockford, Ia.—A vote has been taken in favor of the construction of a standpipe.

Westbrook, Minn.—Plans prepared by M. B. Haynes, of Mankato, Minn., for a system of water works are reported to have been adopted.

Mt. Horeb, Wis.—This village is reported to have voted $12,000 for a system of water works.

Castana, Ia.—Town Clk. W. C. Newton writes that on July 28 an additional $3,000 bonds were voted for water works.

St. Ansgar, Ia.—Town Clk. C. T. Tollefson writes that the contract for constructing water works has been awarded to the Des Moines Bridge & Iron Wks., Des Moines, Ia., for $7,879.

West Milton, O.—John D. Force is said to have been engaged to prepare plans and estimates for a system of water works.

Lawton, Okla. Ter.—Bids are wanted by the City Council until Aug. 15 for constructing a system of water works. L. P. Ross, Chmn. Council Com.

Enfield, N. H.—Bids are wanted by the Water Comrs. until Aug. 12 for clearing and grubbing and removing all soil and vegetable matter from about 25 acres of land to be used as a reservoir, and also for constructing a puddle earth dam, 750 ft. in length, with a masonry core; also for a masonry waste weir and screen chamber with the necessary appurtenances. Everett B. Huse, Chmn.; Arthur W. Dudley, Engr., Manchester.

Sterling, Colo.—Local press reports state that Ch. Hydrographer F. H. Newell has recommended to the Interior Dept., Washington, that land on the north side of South Platte River be set aside for the first great national reservoir to be built under the new irrigation law.

Schuylerville, N. Y.—The proposition to establish a system of water works at a cost of $55,000 was adopted at the election held July 25.

Ft. Plain, N. Y.—Water works bonds to the amount of $20,000 have been sold.

Ft. Barrancas, Fla.—See "Government Work."

Rayne, La.—Bids are wanted Aug. 30 for $20,000 water and light improvement bonds. O. Broussard, Mayor.

Buffalo, N. Y.—New bids have been ordered readvertised for furnishing hydrants for the year ending June 30, 1903.

Fairview, W. Va.—Bonds to the amount of $10,000 have been voted for water works.

Los Angeles, Cal.—The Bd. of Water Comrs. has unanimously indorsed a plan for the improvement of domestic water works, which involves an expenditure of $235,000.

Lima, O.—The Council is considering the construction of a reservoir estimated to cost $97,840 to $146,793, according to the location.

Lincoln, Neb.—The City Council is reported to have voted to lay $12,000 worth of water main extensions.

San Francisco, Cal.—The Fire Com. of the Bd. of Superv. has requested the City Engr. to prepare plans for a salt-water system to be installed for the use of the Fire Dept., and for flushing sewers and other purposes.

Great Neck, L. I., N. Y.—Local press reports state that the Town Bd. of North Hempstead will soon let the contract for furnishing a water supply. Probably 40 hydrants will be required. Monroe S. Wood, Town Clk.

Hammonton, N. J.—The contract for furnishing and laying water pipe, with 5 10-in., 1 8-in., 12 6-in. and 12 4-in. gate valves, and 48 fire hydrants, has been awarded to Wm. John Smith, of Spring Lake, N. J., at a total of $17,888. His detail bid on C. I. pipe was as follows: 2,800 ft. 10-in., at $1.21; 300 ft. 8-in., at 92 cts.; 9,800 ft. 6-in., at 66 cts., and 8,600 ft. 4-in., at 47 cts.
The contract for constructing a steel standpipe, 12 ft. inside diameter and 115 ft. above top of foundations, has been awarded to E. Keeler & Co., of Williamsport, Pa., at his bid of $5,714, including foundations.

Boston, Mass.—The following bids were opened July 25 by the Metropolitan Water & Sewerage Bd. for laying cast-iron water pipe in Weston and Newton, including the construction of a coffer dam and the laying of 3 lines of pipes, each 350 ft. in length, under Charles River: Ward & Cummings, Boston, $33,564 (awarded); Metropolitan Cont. Co., Boston, $34,155; E. W. Everson & Co., Roxbury, $37,625; Dennis F. O'Connell, Dorchester, $45,023; Bruno, Salomone & Petitti, E. Boston, $47,626; Moore & Co., Boston, $52,801. The detail bid of Ward & Cummings was as follows: Building and maintaining coffer dam and pumping and draining, $14,887. Laying C. I. pipe—60-in. west of Sta. 16x55, 1,509 lin. ft., $3.25; 60-in. C. I. pipe east of Sta. 16x55, crossing Charles River, 1,060 ft., $4.85; 48-in., 80 lin. ft., $3; 36-in., 20 lin. ft., $2.90; 16 and 20-in. for blow-offs, 190 lin. ft., $1.50; rock excav., 200 cu. yds., $4; earth excav. for grading, 1,300 cu. yds., 80 cts.; setting 2 air valves, $10; chamber for 36-in. valve, $98; 8 chambers for blow-offs, air valves and manholes, $65; concrete masonry, 800 cu. yds., $7.

Tupelo, Miss.—Weatherford & Hildebrand, of Memphis, have been engaged to make a survey and estimates for a system of water works.

SEWERAGE AND SEWAGE DISPOSAL.

Avon, N. Y.—Village Clk. B. F. Salley writes that on June 28 it was voted to rebuild the W. Main St. sewer.

Monticello, Ind.—City Clk. W. J. Gridley writes new bids for constructing sewers 8, 9 and 10 will be received Aug. 22 by the Bd. of City Trustees.

Mansfield, O.—See "Paving."

Torrington, Conn.—Bids are wanted Aug. 12 for furnishing material and constructing sewers and appurtenances in numerous streets. Engineer's estimate, 9,220 lin. ft. 6 to 12-in. vitrified pipe; 252 lin. ft. 8 to 12-in. cast-iron pipe and 47 manholes. F. F. Fuessenich, Chmn. Bd. of Sewer Comrs.

Sioux City, Ia.—Local press reports state that about $16,000 will be expended by this city for storm sewers.

Washington, D. C.—The Dist. Comrs. have allotted $50,000 for the construction of sewers.

Yazoo City, Miss.—See "Water."

Hoboken, N. J.—City Clk. John Haggerty writes the proposed sewer system to drain Hoboken meadows will probably cost about $300,000. The Advisory Com. reported in favor of pumping system. Thos. H. McCann, Engr., Hoboken.

Elizabeth, N. J.—The City Council is considering a report by City Surv. Luster on the flooded districts of the city, in which he recommends the construction of certain sewers.

Orange, Tex.—The City Council has granted Col. W. D. Bettis and associates a franchise for constructing a sewer system.

St. Cloud, Minn.—City Engr. Chute has been directed to prepare plans and specifications and estimate the cost in extending the St. Germain St. sewer, which is to be of pipe 22-in. in diameter.

Lorain, O.—It is proposed to build 3 short outfall sewers at an estimated cost of $12,000; but bids will not be asked before Sept. Chas. S. Fergurson, City Engr.

Davenport, Ia.—Bids are wanted Aug. 5 for the construction of certain 10 and 15-in. pipe sewers. Thos. Murray, City Engr.

St. Paul, Minn.—Bids are wanted Aug. 7 for constructing a ditch in Aitkin County. Geo. A Ralph, Engr. for State Drainage Comn., Crookston. P. E. Hanson, Secy. Comn., St. Paul.

Johnstown, Pa.—City Clk. Geo. E. Hamilton writes that the city proposes to introduce a new sewer system in the near future, but the matter is still pending in the Councils.

Oakland, Cal.—The City Council has adopted plans and specifications prepared by the City Engr. for the 4th Ave. outfall sewer.

Indianapolis, Ind.—The Crown Hill Cemetery Asso. has agreed to pay $24,000 toward the cost of constructing Northwestern Ave. sewer. Total cost, $73,-000.

Altoona, Pa.—Local press reports state that City Engr. Harvey Linton will construct an experimental septic tank and rapid filter along the creek which carries away the sewage of the eastern end of the city, with a view to constructing, if experiment is successful, tanks and filters at a cost of $50,000.

Decatur, Ind.—The City Council has passed a resolution for the construction of the Gregory sewer, which is to be 10 and 15-in. tile.

Grafton, N. D.—City Aud. B. A. Provoost writes that the contract for constructing a sewer system, including 15,493 ft. 18 to 8-in. pipe sewer, 35 manholes and 87 catch basins, average cut 8 ft., has been awarded to Jas. Kennedy, of Fargo, N. D., at his bid of $14,501, submitted on July 26.

Grand Rapids, Mich.—The Common Council has passed a resolution for the construction of a sewerage system in the 12th Ward. L. F. Lamoreaux, City Clk.

Glenville, O.—Plans adopted by the Village Council provide for a storm sewer, 6-ft. near the outlet, for Garfield, Ludwig and Robinson Sts.

Erie, Pa.—The Council has passed an ordinance providing for the issue of $28,000 bonds for the main brick sewer in East Ave.

Dedham, Mass.—At a special town meeting held July 23 it was voted to appropriate $53,000 for the completion of the system of sewers now being constructed.

Omaha, Neb.—Bids will be received by the Bd. Pub. Wks. until Aug. 8 for constructing pipe sewers in Sewer Dist. No. 277. Andrew Rosewater, Chmn.

Geneva, O.—It is stated that bids are wanted Aug. 29 for constructing sewage disposal works and a pumping plant. B. F. Hunt, Village Engr.

Lawton, Okla. Ter.—Bids are wanted by the City Council until Aug. 15 for constructing a system of sewerage. L. P. Ross, Chmn. Council Com.

St. Louis, Mo.—Bids are wanted Aug. 15 for constructing brick and pipe sewers in several sewer Dists. Hiram Phillips, Pres. Bd. Pub. Improv.

Watertown, Mass.—Bids will be received by Chas. W. Stone, Town Treas., until Aug. 11 for $10,000 drainage bonds.

Morris Plains, N. J.—Prof. McMillen, of Princeton, is stated to have recommended a plan for the purification of the sewage of the Insane Hospital in this place, at an estimated cost of $40,000.

Jersey City, N. J.—Ch. Engr. Van Keuren has estimated the cost of proposed sewers as follows: Bay St., $14,210; Division St. relief sewer, $19,660; and reconstruction of Van Vorst St. sewer, at $8,000.

Grand Haven, Mich.—The City Council has ordered the Bd. of Pub. Wks. to secure estimates of the cost of platting the city for a system of sewers.

Gainesville, Ga.—This city has sold $50,000 bonds to be used as follows: $20,000 for beginning sewerage system, $20,000 for school and $10,000 for street improvements.

Cincinnati, O.—City Engr. Stanley has been directed to co-operate with the Millcreek Sewering Com. of the 25th Ward Improv. Asso. in adopting means of diverting sewage, which is now allowed to empty into the creek into other channels.

Boise, Idaho.—The City Council has passed an ordinance ordering sewers in Dists. Nos. 15, 17, 18 and 19.

Philadelphia, Pa.—Local press reports state that among the sewer contracts recently awarded was the contract for extending Cohocksink sewer, which was given to Geo. A. Vare, at $36 per ft.; total about $100,000.

Taylor, Pa.—An ordinance passed by the Council provides for the issue of $14,000 bonds for the construction of sewers. Wm. P. Giffiths, Burgess.

Brooklyn, N. Y.—The Bd. of Estimate has approved a resolution recommended by the Bay Ridge Local Bd., authorizing the initiation of proceedings to construct main sewers in 92d St. and vicinity at an estimated cost of $655,000.

Lestershire, N. Y.—The Village Bd. has engaged Knight & Hopkins, of Rome, to prepare plans and specifications for sewers.

Quakertown, Pa.—The Quakertown Sewerage Co. has been organized with John V. Ommeren as Pres. and W. H. Davis as Secy.

Bronxville, N. Y.—Engr. in Charge Chas. W. Leavitt, Jr., of New York City, writes that the following bids were opened July 21 for the construction of a sewerage system and septic tank, including 4,120 ft. of 18 to 8-in. pipe sewers, and 17 manholes. The trench to average 8 to 9 ft. in depth and be excavated mostly in sand with some rock; Robt. W. Smith, Newark, $16,950; Bellew & Merritt, Tuckahoe, N. Y., $14,998; Piro & Mottola, Mt. Vernon, $13,997; J. Maybury & Son, Passaic, N. J., $12,404; Besch & Flynn, 83 Third St., Troy, N. Y., $11,900 (awarded).

Montreal, Que.—City Engr. John R. Barlow writes that contracts for sewer construction, bids opened July 11, have been awarded as follows: To Jos. Menard, Montreal, Cuvillier St. for a distance of 200 ft., 2x3-ft. brick sewer, including excavation and refilling, $5.95 per lin. yd.; rock excavation, $2 per cu. yd. To J. Toussaint and C. Sauriot, of Montreal, Bertrand St., 2x3-ft. brick sewer, including excavation and refilling, $6.25 per lin. yd.; rock excavation, $1.50 per cu. yd.; Hotel de Ville Ave., 2x3-ft. brick sewer, including excavation and refilling, $6.24 per lin. yd.; rock excavation, $3.15 per cu. yd.; St. James St., 2x3-ft. brick sewer, including excavation and refilling, $14.70 per lin. yd.; rock excavation, $2.57 per cu. yd.

Des Moines, Ia.—City Engr. John W. Budd writes that the lowest bid received July 24 for Highland Park lateral sewers (27,300 lin. ft. 12-in. pipe, average cut 11 ft. in clay and gravel, 84 manholes), was from C. C. Loomis at 92 cts. per lin. ft.

The contract for sewers in 17th, 18th and other streets (bids opened July 21), in all 8,715 ft. of 18 to 24-in. pipe sewers, with 25 manholes, has been awarded to Kehoe & Son, of Des Moines, at $1.23 per lin. ft. Average cut, 11 ft. in clay and sand.

Bids opened July 22 for Highland Park intercepting sewer ranged from: Wm. Horrabin, of Iowa City, at $2.59 per lin. ft.; to O. P. Herrick, of Des Moines, at $2.97 per lin. ft. The contract calls for 5,136 ft. of 15 to 18-in. pipe and 48 to 36-in. brick sewer, with 33 manholes. Average cut, 11.5 ft. in clay and gravel.

Washington, Pa.—Boro. Engr. J. M. McAdam writes that the following bids were opened July 7 for sewer construction; the trench to be, according to profile, from 5 ft. fill to 22 ft. cut, and to be excavated in limestone soil, little rock: A, Wm. Pickett & Co., Washington, Pa., $24,593; B, Dickson & Applegate, Sewickly, Pa., $32,107; C, J. B. Sheats & Co., E. Pittsburg, Pa., $26,102; D, J. H. M. McQuaide, 5th Ave., Pittsburg, Pa., $23,929; E, Jno. Dell & Co., Braddock, Pa., $29,064; F, Rosser & Maloney, Bellaire, O., $21,-326; G, R. T. Hallam & Sons, Washington, Pa., $26,-989; H, Sweeny & Huston, 32d St., Pittsburg, Pa., $23,311; I, W. H. Herr, Altoona, Pa., $18,721 (awarded). For detail bids see accompanying table:

Bidders.	11,638 ft. 20-in. tile.	369 ft. cast iron pipe.	100 ft. 6-in. sewer.	200 yds. concrete.	60-in. wr't iron pipe.	13 manholes.
A	$1.78	$3.90	$.09	$6.50	$9.50	$43.00
B	2.25	8.00	1.00	7.50	12.00	50.00
C	1.74	8.00	.50	7.00	15.50	[illegible]
D	1.65	5.75	.35	7.50	7.00	50.00
E	2.00	7.00	.40	8.00	18.50	35.00
F	1.45	5.00	.15	7.00	13.35	30.00
G	1.98	4.50	.20	6.50	8.50	35.00
H	1.59	4.95	.90	7.50	14.50	40.00
I	1.30	5.00	.15	5.00	7.00	24.00

Topeka, Kan.—The following bids were opened July 7 by City Clk. J. H. Squires for constructing sewers in Sewer Dist. No. 22:

Items and Quantities.	Ramsey & Ramsey.	Wall & Hanley.
Pipe—11,385 lin. ft. 8-in.	$.80	$.65
2,006 lin. ft. 10-in.	.86	.86
1,194 lin. ft. 12-in.	1.33	1.15
2,500 lin. ft. 15-in.	1.60	1.50
1,640 lin. ft. 21-in.	2.25	3.15
Flush tanks, 5	60.00	60.00
1,400 lin. ft. 1-in. galv. iron pipe	.25	.25
Catch basins, 6	28.00	27.00
Manholes, 35	45.00	45.00
Inlets, 27	15.00	15.00
Lumber, 15 M. ft.	25.00	10.00

Contract awarded to Wall & Hanley, 426 W. Gordon St.

BRIDGES.

Peru, Ind.—The Union Traction Co. and the Miami County Comrs. are said to be considering the construction of a 60-ft. girder bridge across Wabash River at Broadway. Total estimated cost, $40,000.

Muncie, Ind.—Press reports state that contracts have not yet been awarded for an iron bridge which the Lake Erie & Western Ry. proposed to build across White River to replace the wooden structure now used by the Ft. W., C. & L. Div. E. A. Handy, Ch. Engr., Cleveland, O.

Canajoharie, N. Y.—According to press reports, the cost of the Canajoharie-Palatine River bridge, including temporary bridges, abutments and grading, will be $72,000.

Craig, Mont.—The contract for constructing across Missouri River a steel bridge having 3 spans, each 136 ft. in length, is reported to have been awarded to the Elkhart Bridge Co., of Elkhart, Ind., for $9,999.

Camden, N. J.—The Special Com. of the City Council appointed to consider the abolishing of the grade crossing at Broadway and Bulson St. has decided to accept the plan of City Engr. Farnham, which provides for the elevation of the tracks over an arched bridge.

Waupaca, Wis.—Local press reports state that plans have been prepared for a stone arch bridge to be built on State St.

Chisholm, Minn.—Press reports state that contracts are about to be let for a bridge to be built across Longyear Lake.

Webster, Pa.—It is proposed to build a joint County bridge across Monongahela River to connect Webster and Donora.

Joliet, Ill.—The Highway Comrs. have been petitioned to make provision as soon as possible for a viaduct to cross the F., J. & E. tracks at Maple St.

Williamsport, Pa.—Citizens of this place and Berkley County, W. Va., are interested in the proposed construction of a bridge across Potomac River. Estimated cost, $35,000.

Deerpark, N. Y.—The Owego Bridge Co., Owego, is said to have received the contract for building a bridge 240 ft. long, with 16-ft. roadway, across Neversink River for $6,500.

Akron, O.—According to press reports the Council has authorized the preparation of plans for a $100,-000 viaduct to eliminate the railroad crossing on Mill St.

Chateauguay, Que.—Plans and specifications are said to have been prepared for a $13,000 bridge at Allan's Corners.

Columbus, O.—The Franklin Co. Comrs. have passed resolutions of intention to replace the bridge now crossing the P., C., C. & St. L. Ry. and B. & O. Ry. tracks at Cleveland Ave.; also the bridge now crossing the N. & W. Ry. and C., A. & C. Ry. Co.'s tracks at Cleveland Ave., with new steel bridges. L. E. Jones, Co. Aud.

Dayton, O.—The Bd. of City Affairs has awarded the Main St. bridge contract to H. E. Talbott & Co., of Dayton, at their bid of $123,170 for a concrete-steel structure; also the contract for temporary bridge at said point, for $6,800. Bonds for this bridge to the amount of $140,000 were sold recently.

Des Moines, Ia.—The Bd. of Pub. Wks. has received for approval plans of the proposed viaduct over the Keokuk & Western R. R. at 18th St.

Cincinnati, O.—The Bd. of Pub. Service has recommended the approval of plans prepared by City Engr. Stanley for the Delta Ave. viaduct.

Columbus, O.—Local press reports state that the Pennsylvania R. R. Co. proposes to build a new bridge over Scioto River in place of bridge now used by trains of the Little Miami Div.

New York, N. Y.—The Bd. of Estimate & Apportionment has approved plans for the widening of Delancey St. at a cost of several million dollars, in order to make a plaza-like approach to Williamsburg bridge; appropriations of $1,627,000 for Blackwell's Island bridge and $2,920,000 for Manhattan bridge were also authorized by said Bd. on July 25.

Cleveland, O.—It is said that the Wheeling & Lake Erie intends to build 10 new bridges on its main line between Wheeling and Toledo, besides 3 on the Steubenville branch. W. S. Newell, Ch. Engr., Cleveland, O.

Indianapolis, Ind.—Bids are wanted Aug. 8 for constructing a stone arch bridge over Pogues Run. Harold C. Megrew, Chmn. Bd. of Pub. Wks.

Bassett, Neb.—Bids are wanted by Rock Co. Comrs. until Aug. 18 for constructing a bridge across Niobrara River. G. A. Hillburg, Co. Clk.

Paulding, O.—Bids are wanted by the City Aud. Aug. 12 for the purchase of $20,000 bridge bonds.

Harrisburg, Pa.—The Harrisburg Bridge Co. is reported to have asked certain concerns to bid on the construction of a steel bridge to cross Susquehanna River.

Troy, N. Y.—The stockholders of the Vischer's Ferry Bridge Co. are stated to have decided to rebuild the bridge destroyed during the freshet last spring. Estimated cost, $12,000.

Ft. Benton, Mont.—Co. Clk. E. Sayre writes that the contract for building a bridge across Milk River near Zurich Station has been awarded to O. E. Peffard, of Missoula, Mont., for $6,374 and $200 for approaches.

Marshalltown, Ia.—City Engr. Bremner estimates that the cost of building a viaduct according to its location as follows: S. Third Ave., $46,000; Center St., $60,000; or Third St., $22,000.

Ellicott City, Md.—Howard Co. Comrs. have been petitioned to appropriate half the cost of a bridge to be built over Patuxent River on the road leading from Long Corner to Damascus in Montgomery Co.

Bridgeport, O.—Village Clk. Frank L. Rice writes that a proposition is before the Council for the construction of a bridge.

Pittsburg, Pa.—Judge Marshall Brown, of Common Pleas Court No. 1, has handed down an opinion deciding that the West Side Belt R. R., which is controlled by the Wabash System, has the right to build a viaduct over the line of the Pittsburg & Castle Shannon R. R.

Philadelphia, Pa.—Press reports state that the Pennsylvania R. R. proposes to rebuild the Port Perry bridge, at a cost of about $100,000. W. H. Brown, Ch. Engr.

Mishawaka, Ind.—A. J. Hammond, of South Bend, Ind., Engr. in Charge, writes that the proposed bridge to cross St. Joseph River at this place is estimated to cost $45,000.

Nashville, Tenn.—Press reports state that Stewart & Co. have secured the contract to construct the masonry work on the bridge to be built by the Tenn. Central R. R. across Cumberland River, in this city. Cost said to be between $35,000 and $50,000.

Menominee, Mich.—It is stated that surveys are being made for the extension of the Ann Arbor R. R. (now part of the Wabash system), in this city. Among the improvements contemplated is the construction of a bridge across the river.

Milwaukee, Wis.—Local press reports state that the Council's Finance Com. has directed the City Engr. to prepare plans for a bascule bridge to Jones Island.

Williamsport, Md.—The construction of a $10,000 stone bridge across Potomac River, from Williamsport, Md., to Berkely Co., W. Va., is said to be contemplated.

Anton Chico, N. Mex.—Press reports state that a $12,000 county bridge in this city has been washed away and almost completely wrecked.

Souris, Manitoba.—Bids will be received by J. W. Breakey, Secy.-Treas. Municipality of Glenwood, until Aug. 9 for constructing the substructure of a bridge across Souris River, in Souris.

Mauch Chunk, Pa.—It is stated that bids are wanted Aug. 7 for constructing 2 single arch stone bridges, and 1 double arch stone bridge. John B. Breslin, Chmn. Bd. Co. Comrs.

Brooklyn, N. Y.—Bids will be received by the Boro. Pres., J. Edw. Swanstrom, until Aug. 13 for furnishing material and constructing a bridge across Gerrettson's Creek at Ave. U.

Ft. Scott, Kan.—It is stated that bids are wanted Aug. 16 for constructing 2 100-ft. span steel truss bridges and 1 60-ft. span low truss bridge. Welton Neal, Chmn. Co. Comrs.

Anadarko, Okla. Ter.—It is stated that bids are wanted by Chas. H. Jones, Co. Surv., until Aug. 18 for constructing a steel bridge, to have 4 60-ft. spans, 1 70-ft. and 1 80-ft. span. Estimated cost, $14,223.

Erie, Pa.—The city of Erie and the P. & E. R. R., Thos. A. Roberts, Supt., Renovo, Pa., are considering the construction of a $50,000 bridge to cross the tracks on East Ave. B. E. Briggs, City Engr.

Pittsfield, Mass.—Bids are wanted Aug. 12 for furnishing and erecting a steel highway bridge, 133 ft. clear span, 32-ft. roadway, and 2 5-ft. sidewalks. J. L. Bacon, Chmn. Bd. Pub. Wks.

Buffalo, N. Y.—Bids opened July 22 for bridge construction were as follows: For temporary crossing or means of crossing the City Ship Canal during the construction of So. Michigan St. bridge: D. E. Horton, $14,500; F. V. E. Bardol, $16,000; Henry P. Burgard, Buffalo, $4,000.

For constructing the superstructure of a bridge over Cazenovia Creek on So. Park Ave.: Owego Bridge Co., Owego, N. Y., work complete on or before Dec. 13, 1902, $9,900; same on or before June 1, 1902, $9,400.

For substructure and approaches of a bascule bridge on So. Michigan St. over City Ship Canal: Henry P. Burgard, $53,900 (awarded); Daniel E. Horton, $58,315; Buffalo Dredging Co., $71,000; McKeown & Johnson, $85,639; Brown & Stabell, $67,452; Wm. H. Schmidt, $74,000; F. V. E. Bardol, $59,475. The So. Michigan St. contract calls for 2,700 cu. yds. of concrete, 543 cu. yds. 1st class masonry, 23,000 lin. ft. piles, 72,600 ft. B. M. timber cribs, 585 rubble and 10,300 lin. ft. fender and cluster piles.

PAVING AND ROADMAKING.

Pittsburg, Pa.—The Co. Comrs. are stated to have awarded road improvement contracts as follows: To Wm. E. Howley, for Greensburg pike from Wilkinsburg to Turtle Creek, at $59,945; to J. C. McSpadden, for about 4 miles of Freeport road, at $42,070.

New York, N. Y.—Mayor Low on July 21 signed the resolution providing $1,052,000 for the laying out of the Grand Boulevard and Concourse in the Bronx.

Des Moines, Ia.—Bids are wanted Aug. 15 for paving 3 streets and 2 alleys with brick. J. E. Stout, Chmn. Bd. of Pub. Wks.

Cincinnati, O.—Bids are wanted Aug. 7 for paving one street with brick, and until Aug. 21 for macadamizing one street. Robt. Allison, Pres. Bd. of Pub. Service.

Centerville, Ind.—Res. Engr. J. T. Frame writes that the contract for constructing cement or brick sidewalks, bids opened July 24, has been awarded to Wm. Rehling, of Richmond, Ind., as follows: 14 cts. per sq. ft. finished for brick or cement walk; prices per lin. ft. for 4, 5, 6 and 10-ft. brick or cement walks were respectively 56 cts., 70 cts., 84 cts. and $1.40. Total, $5,000.

Morristown, N. J.—Bids will be received by the Bd. of Chosen Freeholders at Morristown until Aug. 12 for furnishing crushed trap rock for use on the Co. State Aid Roads. In all about 10,000 tons will be needed annually. S. A. Becker, Dir. of Bd.

Mansfield, O.—Bids are wanted Aug. 23 for paving with brick or asphalt on Mulberry St.; also on portions of Bowman St. with brick or block; also for constructing 8-in. sanitary sewers in Washington Ave. and West Arch St. D. S. Koontz, City Clk.

Detroit, Mich.—The Common Council has passed resolutions providing for the paving of 4 streets with cedar block, at a total estimated cost of $64,822.

Napoleon, O.—Village Engr. C. N. Schwab writes that the contract for paving Perry St. and Oakwood Ave., bids opened July 22, has been awarded to Cartwright & Hennessey, of Troy, O., for $27,069; the contract calls for 18,000 sq. yds. of Logan or Met. block pavement with cement filler.

Menasha, Wis.—According to press reports the Council will expend $20,000 in street improvements.

Auburn, N. Y.—City Clk. E. H. Herrling writes that the following bids were received for asphalt paving on one street, estimated to cost $30,000: Barber Asphalt Paving Co., $1.99 per sq. yd.; Warner-Quinlan Asphalt Paving Co., Syracuse, $1.84½ per sq. yd.

Belle Vernon, Pa.—Bonds to the amount of $10,000 have been voted for street paving and fire apparatus.

Charlottesville, Va.—The Street Improv. Com. has reported, giving the estimated cost of paving Main St. with brick as $50,000 and the cost of macadamizing certain cross and parallel streets at $26,600. The Com. recommends that bonds to the amount of $80,000 be issued for said improvements.

Leavenworth, Kan.—The Council has ordered a portion of 4th St. paved with brick. Estimated cost, grading and curbing, $1,984; artificial stone curbing, $4,498; paving, $28,033.

Lowell, Mass.—The Bd. of Aldermen has adopted the order to borrow $38,950 for paving.

Watertown, N. Y.—The Bd. of Pub. Service is reported to have awarded to Warren Bros. Co., of New York, the contract for a bituminous macadam pavement in State St. for $40,661.

Spokane, Wash.—The City Council has ordered Main Ave. to be paved; probably asphalt will be used.

San Francisco, Cal.—The Bd. of Supervisors has ordered Beale St. repaved with basalt block at a cost of $10,000, and Mission St. paved with bituminous rock at a cost of $10,000.

New Orleans, La.—The Dock Bd. is having plans and specifications prepared for an additional amount of Georgia granite paving along the wharfs; about 25,000 sq. yds.

Three Rivers, Mich.—At the special election held July 28 it was voted to issue $39,000 bonds for paving Flint Ave. and St. Joe St.

Trenton, N. J.—Mayor Katzenbach has signed ordinances for the repaving of State St., and authorizing a bond issue of $35,000 for repaving with asphaltum over Belgian block on Hanover, Bank and other streets.

Chester, W. Va.—Recorder J. S. D. Mercer writes that at the election held July 28 it was voted to issue $20,000 bonds for street improvements.

Portsmouth, Va.—The City Council has appropriated $50,000 additional for street improvements, making a total of $100,000 to be expended this year. Bascom Sykes, City Engr.

St. Clair, Mich.—Willis F. Brown, Consulting Engr., Toledo, O., is preparing plans and specifications for 30,000 yds. of brick paving, for which bids are about to be received.

Chase City, Va.—See "Water."

Lorain, O.—Bids are wanted Aug. 25 for 13,000 ft. of 5x24-in. stone curbing and 24,000 sq. yds. of brick paving on 6-in. concrete foundation. Chas. S. Ferguson, City Engr.

Harrisburg, Pa.—City Clk. Chas. A. Miller writes that the City Solicitor is now preparing an ordinance to pave with sheet asphalt about 360,000 sq. yds.

Brooklyn, N. Y.—Bids are wanted Aug. 6 for 62,860 sq. ft. of bluestone flagging for sidewalks in numerous streets. J. Edw. Swanstrom, Pres. Boro. of Brooklyn, New York City.

Long Island City, N. Y.—Bids are wanted Aug. 7 for 3,350 sq. yds. of granite block pavement, with 9,600 sq. ft. of new flagging on a portion of 9th Ave. Jos. Cassidy, Pres. Boro. of Queens, New York City.

Frederick, Md.—Bids are wanted Aug. 9 for paving approximately 3,800 sq. yds. with vit. brick or block on East Church St.; also 1,600 ft. of stone curbing. Geo. Edw. Smith, Mayor.

Milwaukee, Wis.—Local press reports state that all bids opened July 22, for paving 16th St. viaduct with creosoted pine block, in all 17,000 sq. yds., have been rejected and that new bids will be asked. The lowest bid received was from Paul Froemming, of Milwaukee, at $2.67 per sq. yd.

Asphalt paving contracts have been awarded to the Barber Asphalt Paving Co. as follows: 4 streets, in all 13,092 sq. yds., at $2.30 per sq. yd., and 1 street, 4,214 sq. yds., at $2.40 per sq. yd.

York City, Pa.—The Common Council has passed an an ordinance directing the Highway Com. to cause a portion of Susquehanna Ave. to be macadamized, with brick and stone gutter.

Tuscola, Ill.—The City Council has passed ordinances providing for 23 blocks of brick pavement, for which contracts are to be let at once, according to local press reports.

Pentwater, Mich.—The Council has directed the City Engr. to prepare estimates of the cost, and plans for paving Oakland Ave. and Jackson St.

Crawfordsville, Ind.—The City Comrs. have completed their final report on the paving of Main and Green Sts. Total estimated cost, $55,122.

Bloomsburg, Pa.—The Council has instructed the Town Engr. to prepare specifications for the paving of a portion of Main St.; probably brick will be used on a concrete foundation.

Syracuse, N. Y.—The City Engr. has recommended the paving with brick of several streets at a total estimated cost of about $65,000.

Marinette, Wis.—The County Bd. has under consideration the building of 17 miles of road.

Wilmette, Ill.—Bids will be received by the Bd. of Local Improv. until Aug. 7 for curbing, paving with brick, and otherwise improving portions of West Ave. V. B. Roberts, Engr., Reaper Blk., Chicago. Henry B. Gates, Chmn.

Mechanicville, N. Y.—Bids will be received by the Village Bd. of Trus. until Aug. 6 for constructing vitrified block pavement on a concrete foundation for Main and Railroad Sts. C. E. Hicks, Village Engr.

Niagara Falls, N. Y.—Geo. F. Diermer, City Clk., writes that bids will be received about Sept. 1 for paving on 4th, 5th, 11th and 13th Sts. Probable cost, $25,000.

St. Louis, Mo.—Bids are wanted Aug. 8 for paving with vitrified brick on portions of numerous streets. A 6-year guarantee to accompany each bid. Hiram Phillips, Pres. Bd. Pub. Improv.

Baltimore, Md.—Bids are wanted Aug. 6 for grading, curbing and recurbing and paving with vitrified brick on a portion of Park Ave. B. T. Fendall, City Engr.

Albany, N. Y.—The Bd. of Supervisors on July 22 passed resolutions providing for the improvement of numerous Albany Co. highways.

Brooklyn, N. Y.—Bids are wanted Aug. 7 for repaving with asphalt on old asphalt foundation the northerly portion of Coney Island Concourse; also for furnishing and laying hexagonal asphalt tiles on Coney Island Concourse. Wm. R. Willcox, Comrs. of Parks, New York City.

New Brighton, S. I., N. Y.—Bids are wanted Aug. 8 for grading and paving with asphalt (6,700 sq. yds., including binder course,) and granite block (1,500 sq. yds. with cement joints), with cement foundation, a portion of Richmond Road; for asphalt pavement, 5,400 sq. yds., with concrete foundation, on a portion of Richmond Terrace; for asphalt block pavement, 2,200 sq. yds. with concrete foundation, on a portion of Water St.; for granite block pavement, 2,650 sq. yds., with concrete foundation or another portion of Richmond Terrace; and for granite block pavement 4,600 yds., with concrete foundation on a portion of Jersey St. Geo. Cromwell, Pres. Richmond Boro., New York City.

Milwaukee, Wis.—Bids are wanted Aug. 5 for furnishing material, grading and paving with asphalt on a concrete foundation, a portion of 2d Ave. Chas. J. Poetsch, Chmn. Comrs. Pub. Wks.

Warren, O.—Bids are wanted Aug. 25 for furnishing material and paving with asphalt block, brick or macadam on portions of several streets. A. L. Jameson, City Clk.

Weehawken, N. J.—Bids will be received by the Township Com. Aug. 5 for regulating and paving with asphalt a portion of Angelique St. Thos. Carroll, Township Clk.

Rome, N. Y.—Bids will be received by the Common Council until Aug. 8 for paving with asphalt, Warren's bituminous macadam waterproof, and brick on a portion of W. Embargo St. Jay Capron, City Engr.

Omaha, Neb.—Bids will be received by the Bd. Pub. Wks. until Aug. 8 for curbing and paving with either asphaltum, vitrified brick, stone block or vitrified block in Street Improv. Dist. No. 803. Andrew Rosewater, Chmn.

Brooklyn, N. Y.—Bids will be received by the Boro. Pres., J. Edw. Swanstrom, until Aug. 13 for furnishing material and paving with asphalt on portions of numerous streets, in all about 67,100 sq. yds.

Medford, Wis.—It is stated that bids are wanted Aug. 15 for 3,300 ft. of cement curb and gutter, and 14,000 sq. yds. of macadam pavement. W. G. Kirchoffer, Engr., Baraboo, Wis.

Fall River, Mass.—Local press reports state that the Supt. of Streets will receive bids for 150,000 granite paving blocks.

New York, N. Y.—Bids are wanted Aug. 12 for regulating and repaving with asphalt on portions of numerous streets. Jacob A. Cantor, Boro. Pres.

Long Island City, N. Y.—Bids are wanted Aug. 14 for regulating and repaving with asphalt on portions of several streets. Joseph Cassidy, Boro. Pres.

Michigan City, Ind.—H. M. Miles, City Engr., writes that bids will be received until Aug. 18 for paving with asphalt and constructing combined curb and gutter on W. 7th St. Estimated cost, $10,000.

City Engr. H. M. Miles writes that the following bids were opened July 21: *a*, asphalt paving, per sq. yd.; *b*, curbing and gutter; *c*, grading, per cu. yd.; *d*, total: Western Construction Co., Indianapolis, Ind., *a* $1.89, *b* 60 cts., *c* 29 cts., *d* $13,080; Barber Asphalt Paving Co., Indianapolis, Ind., *a* $1.95, *b* 65 cts., *c* 30 cts., *d* $13,632.

Long Island City, N. Y.—The following bids were opened July 24 by Jos. Cassidy, Boro. Pres., for repaving with asphalt on relaid block pavement and repaving with granite block on sand: A, Continental Asph. Pavg. Co.; B, Interstate Pavg. Co.; C, Asph. Const. Co.; D, Barber Asph. Pavg. Co.; E, Uvalde Asph. Pavg. Co.; F, M. T. Meagher; G, Green River Asph. Pavg. Co.:

Borden and Jackson Avenues.

Bidders.	Asph., 32,400 sq. yds.	Granite, 2,400 sq. yds.	Relay, 32,400 sq. yds.	New curb, 8,500 ft.	Old curb, 1,300 ft.	Total.
A ...	$1.20	$1.85	$.30	$.65	$.30	$58,915
B	1.05	2.10	.20	.45	.40	49,885
C ...	1.45	2.25	.40	.55	.45	70,600
D ...	1.09	1.98	.32	.55	.49	55,748
E ...	1.35	2.05	.33	.65	.20	65,137
F	1.35	1.90	.25	.75	.30	63,165

Fulton and Flushing Aves. and Main St.

Bidders.	Asph., 13,600 sq. yds.	Relaying, 13,600 sq. yds.	New curb, 9,000 ft.	Old curb, 200 ft.	Total.
F....	$1.35	$.35	$.75	$.40	$29,950
G....	1.35	.35	.67	.20	29,190
B....	1.05	.20	.45	.40	21,130
D....	1.17	.32	.55	.49	25,312
A....	1.25	.33	.65	.35	27,408
C....	1.40	.35	.75	.20	30,590

Brooklyn, N. Y.—The Cranford Co. has been awarded 15 contracts for asphalt paving, according to bids received July 23 by the Boro. Pres., all but one on concrete foundation, and amounting all told to $207,-658. The work involves 105,000 sq. yds. of pavement and 35,000 cu. yds. concrete. The Brooklyn Alcatraz Co. was awarded four contracts amounting to $70,832.35. The detail of the largest contract, Congress St., is as follows: A, Brooklyn Alcatraz Co.; B, Cranford Co.; C, Green River Co.; D, Uvalde Co.:

	Asph., 17,200 sq. yds	Relay, 160 sq. yds.	Concrete, 2,980 cu. yds.	New curb, 10,200 ft.	Old curb, 240 ft.	Covers, 46.	Total.
B	$1.00	$.30	$4.40	$.65	$.30	$3	$37,200
C	1.15	.20	4.75	.65	.20	4	40,829
A	.95	.35	4.40	.69	.35	5	36,860
D	1.10	.10	4.50	.65	.20	3	39,162

New York, N. Y.—Bids were opened July 18 by Jacob A. Cantor, Boro. Pres., for 18 contracts for asphalt paving on present pavement relaid as foundation. The detailed bids of the largest two are as follows: A, Continental Asph. Pavg. Co.; B, Barber Asphalt Pavg. Co.; C, Sicilian Asph. Pavg. Co.; D, Uvalde Asph. Pavg. Co.; E, Century Constn. Co.:

Sullivan St. from Canal to W. 3d.

Bidders.	Asph., 10,200 sq. yds	Relay 10,300 sq. yds.	New curb, 5,500 ft.	Old curb, 80 ft.	Manhole covers, 39.	Total.
A..	$2.165	$.02	$.05	$.30	$21	$23,407
B..	1.80	.51	.85	.37	20	29,098
C..	3.05	.45	1.00	.50	21	42,104
D..	1.50	.45	.83	.37	20	25,310
E..	1.58	.20	.95	.20	21	24,236

Thompson St. from Canal to W. 3d.

Bidders.	Asph., 9,950 sq. yds.	Relay, 10,000 sq. yds.	New curb, 6,600 ft.	Old curb, 20 ft.	Manhole covers, 48.	Total.
A..	$2.265	$.02	$.05	$.30	$21	$24,081
B..	1.80	.55	.85	.37	20	29,987
C..	3.05	.45	1.00	.50	21	42,466
D..	1.45	.45	.83	.37	20	25,373
E..	1.58	.20	.95	.30	21	25,005

The Continental Asph. Pavg. Co. has been recommended for award of contracts of the letting of the above date amounting to $65,835; the Asphalt Construction Co., for contract awards amounting to $40,-427.

Canton, O.—City Engr. Phil. H. Weber writes that the following bids were opened July 21 for furnishing, f. o. b. Canton, a quantity of "first quality" salt-glazed vitrified shale sewer pipe. The bids were received in form of a discount from price list of The Eastern & Western Mfgrs.' price list of Dec. 19, 1901:

Bidders and addresses.	Double strength. 18-in., 7,500 ft.	15-in., 2,000 ft.	All standard strengths.*
Munter-Williams Coal Co., Canton.	70	73	76
American Sewer Pipe Co., Pittsburg	70	73	76
Buckeye Summit S. P. Co., Akron..	70	73	76
Granite Clay Co., Magadove, O.....	70	73	76

*The standard strength pipe includes 800 ft. of 12-in., 6,000 ft. 10-in., 45,000 ft. 8-in. and 8,500 ft. 6-in.

Washington, D. C.—The following bids were opened July 26 by the Comrs., D. C., for four classes of pavement, each involving 47,000 sq. yds. sheet asphalt and 7,000 sq. yds. vitrified block, the unit prices and total of bid being given in each case:

	Barber Asph. Paving Co.	Cranford Paving Co.	Andrew Gleesen.	Brennan Const. Co.
A	$1.56	$1.64	$1.74	$1.63
	1.09	1.20	1.07	1.14
Total	$80,950	$85,480	$89,270	$84,590
B	1.59	1.65	1.74	1.79
	1.12	1.20	1.07	1.20
Total	$82,570	$85,950	$89,270	$92,530
C	1.64	1.71	1.74	1.94
	1.17	1.25	1.07	1.25
Total	$85,270	$89,120	$89,270	$99,930
D	1.59	1.69	1.74	1.75
	1.13	1.25	1.07	1.18
Total	$82,640	$88,180	$89,270	$90,510
Cement gutters.	1.99	2.27	2.22	1.81

Bids opened at the same time for laying asphalt block pavements were as follows: *a*, with gravel base; *b*, with natural cement concrete base: Washington Asphalt Block & Tile Co., *a* $1.66 per sq. yd., *b* $2 per sq. yd.; Brennan Const. Co., *a* $1.76 per sq. yd.; *b* $2.19 per sq. yd.

POWER PLANTS, GAS AND ELECTRICITY.

Great Barrington, Mass.—P. A. Russell, Jr., of the Great Barrington Electric Light Co., writes that the company has leased the water power and will install machinery, steam and water, to furnish light and power. C. Parish, Engr. Bids will be received at once.

Buffalo, N. Y.—The City Hall Trus. have determined to ask the Council and the Bd. of Superv. to appropriate $50,000 for installing in the building an electric light plant.

Yazoo City, Miss. See "Water."

Amsterdam, Holland. Bids are wanted until Sept. 8 for the supply, delivery and laying of a complete underground high tension and low-tension cable system, comprising about 150 kilometer 3-phase current cables, 70 kilometer direct current cables and 25 test and telephone cables. Copies of Dutch specifications, with German translation, can be obtained from the City Printing Office, of Amsterdam, on payment of 5s. Van Leeuwen, Burgemeester en Wethouders.

East St. Louis, Ill.—Clark Bros., of Philadelphia, are reported to have purchased the Citizens Electric Light & Power Co.'s plant for $600,000.

Port Carbon, Pa.—Bids are wanted Aug. 6 for lighting the streets and public buildings of the Boro. with electricity for 1 or 5 years. John P. McCord, Sr., Chmn. Light Com.

Bessemer, Ala.—Chas. McCrery, Vice-Pres. of the Tenn. Coal, Iron & R. R. Co., Birmingham, writes that plans are now being made for the electric light plant which it is proposed to build at Bessemer.

Hillsboro, Tex.—The Hillsboro Electric Co. is reported incorporated by M. B. Templeton, W. C. Ross and others. Capital stock, $50,000.

Berkley, Va.—It is stated that H. C. Tunis is interested in the concern to be known as the Hampton Roads Power & Development Co., the 5,000 H. P. power plant of which is soon to be constructed near the Tunis Lumber Co.'s plant.

McKeesport, Pa.—The City Council has passed the ordinance for a $60,000 bond issue for a city light plant.

Indianapolis, Ind.—It is stated that contracts will soon be let for constructing a $300,000 plant for the Merchants' Heat & Light Co. W. H. Schott, of Chicago, is the Co.'s Engr.

Kingsriver, Cal.—The Kingsriver Power Co. (capital $150,000) has been incorporated. Directors: F. W. Gregg, San Bernardino; Henry Fisher, Redlands, and others.

Cedar Falls, Ia.—City Clk. Jackson wishes to correspond with parties who desire to receive from the city a gas franchise or who wish to make the city a proposal.

Augusta, Ga.—A 5-year contract for street lighting has been let to the Augusta Ry. & Electric Co. at $68 per light.

Philadelphia, Pa.—It is stated that the Welsbach Street Lighting Co. has secured a charter at Dover, Del., for lighting streets and parks; capital, $25,000.

Los Angeles, Cal.—It is stated that an issue of $60,000 bonds of the Pomona & Ontario Light & Fuel Co. has been disposed of, the money to be used in improvements and installation of new gas plant for production of fuel gas by the Lowe method.

Taunton, Mass.—It is stated that the city has bought a $6,000 plot of land near the works of the Evans Nickel Plating Co. as a site for the municipal lighting plant.

Jersey City, N. J.—It is stated that the Granite City & Venice Light & Power Co. has been incorporated in Ill.; capital in Illinois, $160,000.

New Orleans, La.—It is stated that two bids have been received for the municipal lighting plant, one for an outright plant from Mr. Bullard, of Cincinnati, for $1,369,000, and one from the New Orleans & Carrollton R. R. Co. on the 10-year basis, for $2,648,449, to be paid in ten annual instalments.

The Budget Com. decided that $225,000 should be set aside as the annual lighting appropriation.

Washington, Ia.—It is stated that this place has voted to build an electric plant, plans to be prepared by Prof. G. W. Bissell, of Ames, Ia.

Coulterville, Cal.—Press reports state that a masonry dam is to be constructed on Merced River near McCabe's Flats, a 9-mile flume and a power house built to develop 5,000 H.-P. Cost, $1,000,000.

Northville, N. Y.—It is stated that John A. Cole, of Northville, is interested in a plan for a large water power plant on the Sacandaga River near here.

Fostoria, O.—A Yaryan heating plant, it is stated, will be established here at once. Capital, $100,000. Those interested are R. C. Longfellow, David Asire, J. G. Black and others.

Beatrice, Neb.—It is stated that W. P. Wickstrum will erect an electric light power station, according to plans prepared by Geo. A. Berlinghof.

San Francisco, Cal.—The Brandy Creek Water, Light & Power Co. has been incorporated, with a capital stock of $25,000. Incorporators: W. A. Hall, J. M. Gardner, and others.

Howell, Ind.—The Bd. of Trus. have decided to grant a franchise to the Evansville Gas & Electric Light Co.

Kewanee, Ill.—It is stated that the Independence Electric Light Co. has been incorporated, with a capital stock of $5,000. Incorporators: G. A. Anthony, J. P. Brady and Julius Vancoutren.

Rockford, Ill.—The City Council has granted to J. A. Walker, F. K. Houston and Geo. S. Briggs a 25-year hot water and steam heating franchise.

Seattle, Wash.—It is stated that tests are being made preparatory to making plans for the proposed dam for a municipal light plant.

Peru, Ill.—It is stated that the Peru & La Salle Gaslight & Power Co. has changed its name to the Citizens' Lighting Co., and increased its capital stock from $130,000 to $250,000.

Baltimore, Md.—The Bd. of Estimates is reported to have granted permission to the Woman's College to use certain streets for conduits for its proposed $30,-000 electric light and heat plant.

Rayne, La.—See "Water."

Annapolis Royal, N. S.—It is stated that bids are wanted Aug. 8 for extending the electric plant, including dam, flume, water wheels, power house, etc. F. W. Harris, Town Clk.

Eureka, Cal.—C. Alvin Baird, of Eureka (owner of water rights), writes that the North Pacific Investment Co. proposes to construct a power plant on Van Duzen River, to consist of water wheels, generators, overhead wires and underground conduits, for both power and lighting. Preliminary work only has been done.

ELECTRIC RAILWAYS.

Cleveland, O.—Bids will be received by the Clk. of Bd. of Control, until Aug. 25 for a franchise to construct and operate a double-track street railway from Seneca St. and Scranton Ave. southerly through Seneca St. to South St. $10,000 security required with each bid. C. W. Toland, City Clk.

Lehigh, Ind. Ter.—The Laufketter-Bendit Mercantile Engineering Co., St. Louis, Mo., have been retained as Consulting Engrs. and will shortly be in the market for about 20 miles of rails, power house equipment, etc., for railway power house, etc., to be built by the Choctaw Construction Co. for the Lehigh Traction Co.

Monterey, Cal.—The sale of the Monterey & Pacific Grove St. Ry. to the Monterey Gas & Electric Co. for $50,000 is reported, electric power to be installed at once.

Reynoldsville, Pa.—The Boro. Council is reported to have granted a franchise over the streets of this Boro. to the Punxsutawney St. Ry. Co., which will pass through Eleanora, Soldier and Rathmel; $80,000 stock and $100,000 bonds. Clark, Kaiser & Kipp, of Punxsutawney, are said to be interested.

Kansas City, Kan.—It is stated that John McDaniel and Edwin Taylor have been granted a franchise by the Wyandotte Co. Comrs. to build and operate an electric road from Armstrong, Kan., to the Co. line at Loring.

Malaga, Spain.—The Malaga Suburban Rys., Ltd., has been organized to build an electric traction system through the province of Malaga. Total length, 120 miles. Capitalization, $2,500,000. Directors are Sir Richard J. Cartwright, Canadian Minister of Commerce; Peter Ryan, Registrar of Toronto, Can., and others.

Camden, N. J.—The Delaware & Magnetic Spring Ry. Co. (capital $200,000) is reported incorporated.

Norwalk, O.—The City Council has granted a franchise to the Lake Shore Electric Ry. Co. to extend its lines on certain streets.

Oakland, Cal.—The Oakland Transit Co. has applied to the City Council for franchises to connect Emeryville with Oakland.

Vincennes, Ind.—Press reports state that a company has been formed in this city and Linton to build an electric railway between the two cities.

Saratoga Springs, N. Y.—The State R. R. Comn. has granted the application of the North River Ry. Co. to construct a road in the village.

New Iberia, La.—John A. McIlhenny and F. F. Myles are reported to have been granted a franchise for an electric railway in this city, to run to Morgan City.

Columbus, O.—The Central Market St. R. R. Co., of this city, it is stated, will use a $1,000,000 increase of capital for extensions and improvements.

Norton, Mass.—It is reported that Boston capitalists are back of a plan by which the Norton & Taunton St. Ry. Co. is to make large extensions between Providence and Brockton this summer. C. E. Short, Ch. Engr.

Canton, O.—The Canton-New Philadelphia Ry. Co., of Canton, has been incorporated, with $600,000 capital stock, by E. C. Louis, J. E. Reeves, and others, to construct an electric ry. from Navarre to New Philadelphia.

Washington, N. J.—The Easton & Washington Traction Co. has been incorporated by T. A. H. Hay, W. Hay, of Easton, Pa., and R. M. Petty, of Washington, with $1,000,000 capital. The company proposes to build lines from Washington to Easton, Pa., to Hackettstown, to Belvidere and to Clinton; total length of track, 57 miles.

Dayton, O.—The Cincinnati & Northeastern Traction Co., of Dayton, has been incorporated, with $15,-000 capital, by Dennis Dwyer, Albert Emanuel, and others, to construct an electric road between Cincinnati and Dayton.

Florin, Pa.—A charter is reported granted for a trolley line from Florin to Elizabethtown. H. K. Blough, H. C. Lewis and H. H. Nissley, of Elizabethtown.

Frankfort, Ind.—The Indianapolis, Lebanon & Frankfort Traction Co. has been granted a franchise in this city.

Milwaukee, Wis.—The Wisconsin Traction, Light & Power Co. (John I. Beggs, Pres.), is reported to have increased its capital stock from $10,000 to $1,000,000.

Pueblo, Colo.—The Rapid Transit Co. has been granted a franchise to construct a trolley line between this city and Beulah.

The Pueblo Traction & Lighting Co., it is stated, contemplates spending $400,000 in improvements next year. E. M. Brown, Ch. Engr.

Napoleon, O.—An electric railway is being agitated here to extend from Toledo to Cincinnati, with spurs reaching to Columbus and Ft. Wayne.

Montgomery, Ala.—The Montgomery Traction Co. has been incorporated ($1,000,000 capital), to build lines in the city and to Pickett Springs. B. L. Holt, W. H. Ragland, and others, incorporators.

Grand Rapids, Mich.—It is stated that Chas. S. Marr, of Muskegon, is interested in a 60-mile electric road to connect Grand Rapids, Muskegon and Newago.

Malden, Mass.—The Maplewood & Danvers St. Ry. Co. has been organized, with $190,000 capital, to build a line from Malden through Saugus and Danvers to Boxford. Directors: Geo. H. Chase and Geo. F. Marshall, of Malden, and others.

Winnsboro, S. C.—The Winnsboro & Rock City Electric Ry. Co. (capital $50,000), is reported incorporated by Thos. H. Ketchin, W. R. Rabb, and others.

Rochester, N. Y.—The Rochester & Sodus Bay Ry. Co. has absorbed the Irondequoit Park R. R. Co. Total capital, $1,850,000. Thos. J. Nicholl, Pres.

Anderson, Ind.—The Union Traction Co., of Indiana, is reported to have leased the Indianapolis Northern Traction Co. for 50 years. It is stated that the latter company will use $3,500,000 in construction and equipment of the road from Indianapolis to Logansport.

RAILROADS.

Birmingham, Ala.—The Donelson Const. Co. is reported to have received the contract for building the Eastern Ry. of Alabama. Cost, about $100,000. Length of proposed road, 10 miles from Talladega to Pyrites, Clay County.

Danville, Ky.—The New River Coal Co. (capital $50,000) is reported incorporated, and will build a 17-mile R. R. E. L. Porch, Galveston, Tex.; D. E. Bryant, Danville, incorporators.

Portland, Ore.—The Belt Line Ry. Co. has been incorporated to build a Ry. from the north to the south side of Coos Bay. Incorporators: W. L. Green, J. W. Cook and J. K. Kollock. Capital, $1,000,000.

New Whatcom, Wash.—It is stated that Nelson & White, of Seattle, have received the contract for clearing, grubbing, grading and culvert work on 10 miles of extension of the Bellingham Bay & British Columbia Ry. Contract is said to amount to about $100,000.

Denver, Colo.—The Colorado & Utah Const. Co. (capital $2,000,000) is reported incorporated to build R. Rs. in Colorado and Utah. Sylvester T. Smith, Chicago, Pres., and A. C. Ridgway, Gen. Mgr.

The Denver & Northwestern R. R., it is reported, will award the contract for 18 miles of track to A. A. Utley & Co., of Rock Springs, Wyo., which company is said to be backed by the Utah Construction Co.

New Orleans, La.—The New Orleans Rys. Co. is reported as willing to expend not less than $75,000 for improvements at West End, including bulkhead and revetment levee, if it can purchase or lease the property from the city. H. H. Pearson, Jr., Pres.

Canton, S. D.—The capital stock of the Interstate Ry. Co., recently incorporated to build a line from Superior, Wis., to Galveston, Tex., is said to be $50,000,000. Headquarters, Canton, S. D.

Ardmore, Ind. Ter.—It is reported that the Frisco system will build a line from Ardmore to Hope, Ark., a distance of 225 miles. B. L. Winchell, Gen. Mgr., St. Louis.

Eldorado, Ark.—The Arkansas Southeastern R. R. has been chartered (capital stock $200,000) to build a 25-mile road from Eldorado to the La. State line.

Newport, N. H.—It is reported that the Newport & Sunapee R. R. will issue $60,000 stock and $60,000 bonds to build a 7-mile road between those places.

Memphis, Tenn.—It is stated that the survey for the Memphis, Helena & Louisiana R. R., from Memphis to New Orleans, has been completed. B. B. Gordon, Asst. Engr., Greenville, Miss.

Hoboken, N. J.—The Hoboken Manufacturers' R. R. Co. is reported incorporated, to connect the Hoboken R. R. Warehouse & Steamship Connecting Co. with the D. L. & W. R. R. Capital, $500,000.

Redwater, Tex.—The Northeastern Tex. Ry. Co. proposes to build a line from Redwater, 17 miles, to Cussetta. Capital stock, $250,000. Directors: G. Munz, J. J. King, of Texarkana; H. C. Storey, of Redwater, and others.

Schenectady, N. Y.—The matter of the elevation of R. R. tracks in this city at an estimated cost of $1,000,000 is being agitated.

Baltimore, Md.—According to press reports the Baltimore & Ohio R. R. is to spend $4,000,000 in rebuilding the Pittsburg & Western line between Pittsburg and Akron, O. J. M. Graham, Ch. Engr.

Maryville, Tenn.—It is stated that surveys are being made under the direction of Mr. Nichols, of Coudersport, Pa., for a R. R. from here 25 miles into the mountains of Monroe Co.

Harlan, Ky.—It is stated that surveys for the Southern Ry. are nearly completed to Harlan Courthouse, and contract for construction will soon be let. W. H. Wells, Engr. of Cons., Washington, D. C.

Montgomery, Ala.—The Autauga R. R. Co. has been incorporated. Capital, $100,000. S. M. Dinkins, of Montgomery, Pres., and M. M. Smith, of Autaugaville, Vice-Pres.

Concord, N. C.—A charter covering a period of 60 years has been granted to the North Carolina Central R. R., which will extend from Concord, N. C., to Fayetteville, N. C. Capital, $2,000,000. The following are Directors: Edw. W. Shedd and J. Herbert Shedd, of Providence, R. I.; Wm. T. Pratt, of New York, and others.

Des Moines, Ia.—The Clarinda, College Springs & Southern R. R. Co. has been incorporated in Iowa, with a capital of $100,000. The road will be 150 miles long and run from Des Moines into Northern Mo., with a probable Southern terminus at Tarkio, Mo. Among the incorporators are J. Dwight Atwater, New York; Sidney A. Dunham, Buffalo, N. Y., and A. P. Tukey, Omaha.

Los Angeles, Cal.—It is stated that the Interior Dept. at Washington has approved maps of the San Pedro, Los Angeles & Salt Lake R. R. through Nevada and most of Utah and California. H. Hawgood, Ch. Engr.

Memphis, Tenn.—It is reported that the Union Belt Line is to issue $1,000,000 bonds to build a new road, work on which will begin by Sept. W. H. Fleming, Ch. Engr.

The City Council has granted franchises in Memphis to the Illinois Central R. R. for 80 years, stated to include the building of new shops, erection of a union depot and a subway at Iowa Ave., the paving of certain streets, and ultimately the elevation of the river front tracks. W. J. Harahan, Ch. Engr.

Columbus, O.—The Columbus & Southern Ry. Co., of Lancaster, has been incorporated, with $2,000,000 capital stock, by Livingston Curling, John G. Peeves, and others. It is proposed to construct a railroad having its termini in Columbus and Wellston, with branches from Lancaster, Hampden and Allenville.

Baker City, Ore.—A press report states that articles of incorporation have been filed for the Oregon & Idaho Central Ry. (capital $6,000,000), to build a road from Baker City by way of Eagle and Pine Valleys to Seven Devils, Idaho.

Shreveport, La.—Epple & Hayes are reported to have secured the contract for a 20-mile extension of the Shreveport & Red River Valley R. R. from Mansura to Water Valley.

Boston, Mass.—It is reported that the Boston Elevated R. R. will increase its capital by $5,000,000, for purposes of new construction, equipment, etc.

El Paso, Tex.—It is reported that the El Paso & Southwestern R. R. Co. has been incorporated in New York, with a capital of $2,000,000, by Wm. E. Dodge and others, of New York, and Jos. Van Vleck and others, of El Paso.

Portsmouth, Va.—It is reported that the Seaboard Air Line will control the South & Western R. R., which will extend 268 miles from the Virginia coal fields to Lincolnton, N. C. W. W. Gwathmey, Jr., Ch. Engr.

PUBLIC BUILDINGS.

Lake Village, Ark.—E. Cook, Pine Bluff, Ark., is preparing plans for proposed improvements to the Chicot Co. court house to cost $25,000.

New York, N. Y.—Plans are said to have been received by Supt. Helmle, of the Bureau of Pub. Bldgs. & Offices, from Archt. R. L. Daus, New York, for the extension to the Hall of Records.

Springfield, O.—The Hospital Bd. is stated to have adopted plans prepared by Robt. C. Gotwald, Springfield, for a hospital to cost $50,000.

Paterson, N. J.—Archts. Carrere & Hastings, of New York City, write that the contract awarded to Peter Vanderhoof & Sons Co., 283 Broad St., Newark, for work on the City Hall amounted to $87,000, and included stone work, iron work, rough carpentry, plumbing and heating.

Montclair, N. J.—Andrew Carnegie has offered to give an additional $10,000 to the $30,000 already given for a library.

Benton, Ark.—The contract for constructing a court house for Saline Co. has been awarded to John S. Odom, of Little Rock, for $31,000.

Remsen, Ia.—Harry Tappendorf, of Rock Island, Ill., is said to have the contract for the erection of a R. C. Church to cost $46,000.

Sioux City, Ia.—Pass & Schippel, of Mankato, Minn., are reported to have prepared plans for a Dutch Reformed Church to cost $150,000.

Wilkesbarre, Pa.—The contract for building Luzerne Co. court house has been let to the Jos. Hendler Construction Co., of Wilkesbarre, for $597,000, the building to be of Ohio River sandstone.

Jackson, O.—The Bldg. Com. is said to have on file plans and specifications for the improvement of the court house.

San Diego, Cal.—The Co. Superv. have adopted plans of Wm. Quayle for the county hospital, estimated to cost $80,000. The building to be 2 stories and basement and 300 ft. in length.

Woodland, Cal.—The Yolo Co. Superv. have decided to reject bids recently opened for the proposed court house at Woodland, the lowest being $139,833, and to submit to the voters the question of issuing bonds for said building.

New York, N. Y.—Bids are wanted Aug. 7 by the Fire Dept., Thos. Sturgis, Pres., for erecting a building on the White Plains Road, Boro. of Bronx. Security required, $15,000.

Des Moines, Ia.—Hallett & Rawson, 615 Walnut St., are stated to have completed plans for the First Church of Christ (Scientist), to be built of brick and stone, on 8th St., between Crocker and School Sts. Estimated cost $25,000.

New York, N. Y.—Wm. M. Aiken, Consulting Engr. of the Boro. of Manhattan, has been authorized by the Bd. of Estimate to prepare plans for the alterations and repairs in the New York Co. Court House in place of plans, recently rejected. Estimated cost of improvement, $500,000.

Clinton, Ia.—John Lake & Son are stated to have received the contract to erect the First M. E. Church for $24,000.

New York, N. Y.—R. W. Gibson, 76 Wm. St.; Hunt & Hunt, 28 E. 21st St.; Grosvenor Atterbury, 18 W. 34th St.; Howell & Stokes, 100 William St., and 18 W. 34th St.; Howell & Stokes, 100 William St., and Stoughton & Stoughton, 96 5th Ave., have been selected to prepare competitive plans for an armory, to be constructed for the 69th Regiment, said plans to be submitted to the Armory Bd. before Sept. 15. Appropriation $550,000.

Columbus, O.—Local press reports state that contracts for improvements at the Institution for the Blind have been awarded as follows: Heating and plumbing to the Huffman-Conklin Co., at $14,428 and $2,850, respectively; electric light plant building and equipment, to J. A. Erner & Co., at $13,465, and stokers to the American Stoker Co., for $2,900.

Woodville, Pa.—The Poor Directors have, according to reports, awarded to Wm. Miller & Sons the contract to erect an additional wing to cottage No. 1 and lay new flag and concrete walks and erect an iron fence about the grounds of the Allegheny Co. Hospital for Insane at Woodville, for $42,900.

Ada, Minn.—Bids are wanted Aug. 8 for erecting the Co. Court House, both including and not including the heating and plumbing. Louis Pfund, Chmn. Co. Comrs.

Newark, O.—Bids are wanted Aug. 18 for erecting a laundry at the Children's Home Farm in Madison Township. A. R. Pitser, Co. Aud.

Galveston, Tex.—Bids are wanted Aug. 26 for building the iron frame sewer piling quarantine station at Galveston. Geo. R. Tabor, M. D., State Health Officer, Austin, Tex.

Newark, N. J.—Local press reports state that a new building to cost $70,000 is to be erected for Baptist Home for Aged on the site of present building, 285-291 Roseville Ave.

Oswego, N. Y.—Plans are stated to have been prepared by J. Mills Platt, of Rochester, for a new hospital.

Chicago, Ill.—A. F. Hughes, 437 W. 69th St., is said to be the architect for buildings to be located at Hermitage Ave. and 36th St. for the parish of Our Lady of Good Counsel. Auditorium to cost $60,000; parsonage, $15,000, and church, $100,000.

Cleveland, O.—J. Milton Dyer has been chosen as architect for the $200,000 church to be erected by the First M. E. Society. Rev. Chas. B. Mitchell, Pastor.

Sublette, Ill.—Fisher & Gault, of Chicago, are the architects of a R. C. Church, one story, 46x115 ft., to be built at a cost of $20,000.

Waukesha, Wis.—Plans prepared by Claude & Starck, of Madison, Wis., for the new city hospital are said to have been accepted by the city, and contracts will probably soon be let.

Mansfield, O.—The Bd. of Managers of the Ohio Reformatory is reported to have let the contract for 100 cells to the Champion Iron Co., of Kenton, O., at its bid of $44,636.

New Albany, Ind.—The School Bd. is said to have adopted plans for the $35,000 Carnegie Library, as prepared by Paul E. Mosemiller, of Louisville, Ky.

Houston, Tex.—The Market Com. has reported in favor of immediate action by the Council on the resolution authorizing the Mayor to ask for plans and specifications for the erection of a new market building and city hall, cost not to exceed $100,000.

Philadelphia, Pa.—Martin, Hetzel & Co. are said to have been granted a permit to build the Ashmead Schafer Memorial Lutheran Church on Allen Lane, opposite Main St., Germantown. Cost, $40,000. J. Franklin Miller, 46 N. 12th St., is the architect.

Wm. W. Ren's Son has been granted a permit for the erection of the parish house and Sunday school for the Church of the Holy Apostles, at 21st and Christian Sts. The building will be 3 stories in height and 106x40 ft. The plans were drawn by Duhring, Okie & Ziegler, of Philadelphia, and the cost is placed at $50,000.

St. Joseph, Mo.—The Buchanan Co. Bd. is said to have under consideration the issue of $100,000 jail bonds.

Pittsburg, Pa.—Neil & Rowlands are planning the $35,000 church to be built at Ellsworth and Morewood Aves. by the First Unitarian Congregation.

Secaucus, N. J.—Bids will be received by the Co. Bd. of Chosen Freeholders until Aug. 7 for erecting 2 additions to the Hudson Co. Hospital for the Insane at the Co. Farm, Secaucus. John P. Egan, Clk., Jersey City.

Watertown, N. Y.—Bids are wanted Aug. 7 for the construction and plumbing in connection with repairs and improvements of the State Armory. Comdg. Brig. Gen. James McLear, Chmn. Armory Comrs., Albany.

Niagara Falls, N. Y.—Bids will be received by R. A. Taylor, Secy. of Library Bd., until Aug. 11 for furnishing material and erecting a library.

Syracuse, N. Y.—Bids are wanted Aug. 5 for installing high pressure steam main and conduits, plumbing, etc., at the Syracuse State Inst. for Feeble Minded Children. G. L. Heins, State Archt., Albany.

Brooklyn, N. Y.—The Bd. of Estimate & Apportionment has authorized Comr. Woodbury, of the Street Cleaning Dept., to have plans prepared for a department stable to be erected near the Crow Hill Co. Bldgs., the cost not to exceed $70,000.

Schenectady, N. Y.—Press reports state that Metz & Meyer, of Buffalo, have secured the contract to erect the Union Presbyterian Church at Park Ave. Probable cost, $45,000.

Jackson, Miss.—McGee & Humphreys, of this city, are reported to have received the contract to erect the St. Andrew's Episcopal Church, for $30,000.

Poughkeepsie, N. Y.—Peter Keeler, of Albany, is stated to have secured the contract for the carpenter work, roofing, elevators, etc., for the new court house and jail for Dutchess Co. Contract price said to be about $40,000.

Grand Island, Neb.—Local press reports state that the Co. Comrs. have accepted the bid of J. J. Hanigan, of Omaha, for plumbing and heating the court house, at $12,997.

Redlands, Cal.—Local press reports state that the Clk. of the Bd. of Superv. has been authorized to receive plans and specifications for a Court House. Reports also state that bids will be received by the Bd. of Superv. until Sept. 1 for $150,000 Court House bonds.

Mason, Mich.—Bids will be received by the Court House Bldg. Com. until Aug. 18 for erecting a Court House. E. A. Bowd, Archt., Dodge Bldg., Lancaster. F. B. Phillips, Secy.

Burlington, Vt.—Bids will be received by the Library Comrs. until Aug. 16 for erecting a library. W. R. B. Willcox, Archt. F. O. Sinclair, Secy.

Bath, N. Y.—Bids will be received by the Bd. of Trus. until Aug. 14 for the following work at the N. Y. State Soldiers' and Sailors' Home at Bath: For reconstructing and repairing the electric and steam plants; for a ventilating and heating system and for altering and improving the plumbing in the hospital; for metal casings for heating stacks and fresh air ducts, etc. Geo. W. Dunn, Pres.

Clyde, N. Y.—Bids will be received by the Village Bd. until Aug. 21 for furnishing material and making repairs and improvements to the town hall. Leon H. Lempert & Son, Archts., Rochester, N. Y.

Rahway, N. J.—Bids will be received by the New Jersey State Reformatory Com. until Aug. 6 for plumbing in the Domestic Bldg., N. J. State Reformatory. Raymond F. Almirall and Clinton Mackenzie, Assoc. Archts., 51 Chambers St., N. Y. City. Address Thos. M. Gopsill, Secy.

Clear Lake, Ia.—Bids will be received by the Library Trustees until Aug. 8 for erecting a library.

Wilkesbarre, Pa.—The lowest bidder having refused to accept the contract for building Luzerne Co. Court House at his bid of $597,000, the Co. Comrs. have awarded the contract to Wilson J. Smith, of Wilkesbarre, the next lowest bidder, at $682,000.

Trenton, N. J.—Bids are wanted Aug. 26 for furnishing material and erecting a Senate Chamber in the State Capitol. J. Willard Morgan, Compt. & Secy. State House Com. Security required. $50,000.

Springfield, O.—Bids will be received by the Bd. of Co. Comrs. until Aug. 25 for furnishing material and erecting a county office building; probable cost, $68,000. A. K. Hahn, Co. Aud.

Logansport, Ind.—I. E. Crain is preparing plans for a $15,000 M. E. Church to be built of stone on Market St.

BUSINESS BUILDINGS.

Chicago, Ill.—Chauncey G. Hellick, of the Construction Dept. of the Chicago Telephone Co., has, according to reports, prepared plans for 2 2-story pressed brick and stone branch stations; 1 to be built at Laflin and 19th Sts., at a cost of $30,000, and the other at Chicago Heights, to cost $16,000.

Norfolk, Va.—It is stated that plans have been prepared for a 7-story building which the Virginia Club will erect in place of the structure recently destroyed by fire. Probable cost, $100,000.

Pittsburg, Pa.—W. F. Wood, of this city, is reported to have secured the contract to erect a warehouse for R. P. Duff on Penn Ave. Contract price said to be $100,000.

Chicago, Ill.—F. Foltz, 69 Dearborn St., is reported to be preparing plans for a 6-story brick and stone warehouse, to be erected by Thos. S. Chalmers, at 307-309 Wabash Ave. Estimated cost, $60,000.

Rockford, Ill.—It is stated that Frost & Granger, of Chicago, are preparing plans for a 2-story freight-house, 250x45 ft., to be erected by the Chicago & Northwestern R. R., at Rockford. Probable cost $40,000.

Mason City, Ia.—J. G. Nelson is stated to have secured the contract to erect a 6-story bank and office building, for the Commercial Block Co., at $75,000.

Indianapolis, Ind.—Local press reports state that plans are being prepared for a $1,000,000 terminal station for the Indianapolis St. Ry. Co. H. J. McGowan, Gen. Mgr.

Houston, Tex.—Bids are wanted until Aug. 20 for the erection of the Houston Post Bldg., 4 stories and basement, fireproof. Cost, about $100,000. Olle J. Lorehn, of Houston, Superv. Archt.

Brooklyn, N. Y.—The Brooklyn Catholic Sisters of the Poor of St. Francis have purchased 10 acres of land in Woodhaven on which it is proposed to erect a $200,000 building as a home for aged men and women.

Oka, Que.—The monastery of the Trappists is reported to have been destroyed by fire. Insurance, $100,000.

Little Rock, Ark.—Frank W. Gibb, Little Rock, has received the contract to prepare plans for the $50,000 Y. M. C. A. building to be erected at 5th and Scott Sts. S. C. Bossinger, Chmn. Bldg. Com.

Springfield, O.—Local press reports state that Robt. C. Gotwald is preparing plans for a car barn and repair shop, to be erected by the D. S. & U. R. R. on W. North St. Estimated cost, $50,000.

Cincinnati, O.—J. H. Day, of the J. H. Day Co., Harrison Ave. and Bergen St., writes that additions to be made to the present plant are a foundry 120x150, which will contain a cleaning room 40x80 and a fireproof storage room for patterns 36x120; and a 2-story addition for storage and shipping 65x130.

New York, N. Y.—Plans are said to have been accepted by the New York Dressed Beef Co. for an abattoir to cost $1,000,000, and to be built at 11th Ave. and 39th to 40th Sts.

Estherville, Ia.—It is stated that the Rock Island R. R. proposes to build a $25,000 depot at this place.

Bakersfield, Cal.—Havens & Toepke, San Francisco, are the architects for a $70,000 opera house, to be built at Railroad and Chester Aves.

Richmond, Ind.—Stephen O. Yates, 322 N. 16th St., has prepared plans for a $10,000 athletic colosseum, to be built soon.

Clare, Mich.—Haug & Scheurman, Saginaw, Mich., have prepared plans for a $10,000 business block for J. W. Collins; 2 stories and basement, brick and stone.

Savannah, Ga.—The Germania Bank, of this city, is having prepared plans for a bank and office building, to be started this fall.

Ft. Smith, Ark.—Ed. Stahle will erect a 3-story business building this summer at a cost of about $20,000.

Milwaukee, Wis.—Kirchoff & Rose, 201 Grand Ave., are the architects for a $60,000 solid brick building 6 stories in height, 100x110, to be built for the Pritzlaff Hdw. Co., on Fowler St., near W. Water St.

Davenport, Ia.—Local press reports state that the Davenport Outing Club proposes soon to build a new club house at a cost of about $20,000.

Los Angeles, Cal.—Local press reports state that contracts on the Union Trust Co.'s 12-story block, to be built at 4th and Spring Sts., have been awarded as follows: steel structure to Baker Iron Works, at $125,534; general concrete and brick work, terra cotta work and the revolving sashes to Paul Haupt, for $60,000; concrete foundations to Chas. Leonardt for $11,000.

Deadwood, S. D.—The Bldg. Com. of the Deadwood Hotel Co. is reported to have awarded the contract for erecting a $100,000 building to Mullen & Munn of Deadwood.

Madison, Minn.—Pass & Schipple, of Mankato, are preparing plans for a $20,000 modern, 3-story brick hotel, to be erected at Madison by H. L. Henry.

Chickasha, Ind. Ter.—J. H. Griffin writes that he proposes to build a $30,000 hotel at this place, including steam heating apparatus, and cold storage; also an electric light plant for same.

Ft. Hancock, N. J.—T. S. Gladding is stated to have given $15,000 for a Y. M. C. A. Bldg. to be built here.

Depew, N. Y.—Wm. N. Tobin, of Syracuse, is said to have received the contract for heating and ventilating the new and old shops of the N. Y. Central R. R. at Depew. Amount of contract about $60,000.

Atlanta, Ga.—R. Coely Anderson is said to have a project on foot to build a $150,000 theater.

Wausau, Wis.—Press reports state that plans for a $30,000 addition to the Bellis House are to be made by J. H. Jeffers & Co.

Clarksburg, W. Va.—Local press reports state that Judge Goff proposes to erect a modern 7-story fireproof office building at Main and Court Sts. Cost, $20,000.

San Antonio, Tex.—Bids are wanted Aug. 15 for erecting a fireproof bank and office building for the City National Bank. Coughlan & Ayres, Lockwood Bank Bldg., Archts.

Philadelphia, Pa.—Hales & Ballinger, Engrs. and Archts., 1200 Chestnut St., are reported to have awarded to A. Raymond Raff, 1635 Thompson St., the contract for a $40,000 building, to be erected for the Oakdale Baking Co. at 10th St. and Susquehanna Ave.

Chas. E. Oelschlager, 1502 Market St., has prepared plans for a business building to be erected for the Geo. DeB. Keim Saddlery Co. at 610-612 Market St. Total cost, $60,000.

Architects Milligan & Webber, 520 Walnut St., are reported to have won the competition for the $100,000 Lu Lu Temple, to be built on Spring Garden St., below Broad.

DWELLINGS.

Buffalo, N. Y.—Philip S. Smith has filed plans for a 2-story brick dwelling which he proposes to build at 264 Summer St. Cost, $14,000.

Bryn Mawr, Pa.—The contract for building a $30,000 stone residence, 3 stories in height, for J. H. Yocum, is reported to have been awarded to Burd P. Evans, of Philadelphia. Archt., C. E. Schermerhorn, Philadelphia.

Saginaw, Mich.—B. F. Boergert, of Saginaw, has prepared plans for a 3-story apartment house to be erected on Washington Ave. Cost, $12,000.

Pittsburg, Pa.—Allison & Topp, of Pittsburg, have been selected to prepare plans for the C. K. Hill residence, which is to be of brick and terra cotta and located on Morewood Ave. Cost, $50,000.

Duluth, Minn.—C. A. Congdon is said to be preparing to erect a $50,000 residence in the east end.

SCHOOLS.

Ames, Ia.—The Bd. of Trustees of the Iowa State College has awarded to Proudfoot & Bird, of Des Moines, the contract for the preparation of plans and supervision of construction of the new main building to be erected at the school. Cost, about $300,000.

Muscatine, Ia.—The School Bd. has sold $25,000 building bonds.

Centralia, Kan.—Architect Stewart is said to have completed plans for a school to be 80x120 ft. and cost $33,000.

Chickasha, Ind. Ter.—The City Council is reported to have sold $70,000 school bonds.

Salt Lake City, Utah.—Local press reports state that plans are being prepared for a 60x120 ft. brick and stone building, to be erected on Second South St., at a cost of $60,000 for All Hallows College. Father Guinan, Pres. of College.

Brooklyn, N. Y.—Bids are wanted Aug. 7 for alterations and repairs in several public schools, Boro. of Brooklyn. C. B. J. Snyder, Supt. School Bldgs., Dept. of Educ., New York City.

San Francisco, Cal.—The Bd. of Educ. has under consideration the erection of schools to cost in the aggregate $300,000, and has requested the Bd. of Pub. Wks. to employ an architect to prepare plans and superintend the construction of schools to be built during the fiscal year.

Richmond Hill, L. I., N. Y.—The following bids were opened July 23 by the Supt. of Bldgs., Dept. of Educ., New York City, for the general construction of addition to and alterations in School 51, Boro. of Queens: Wm. P. McGarry, 236 Huron St., Brooklyn, $56,969; Geo. Hildebrand, $59,287; John R. Sheehan & Co., $68,400; Tolmie & Kerr, $61,800.

Reading, Pa.—Hiram S. Head, 536 Penn St., has prepared plans for a $14,000 school. Mr. Roland, Secy. School Bd.

Fritztown, Pa.—Wm. A. Fink, of Reading, is the architect for the rebuilding of a school at a cost of $12,000. Mr. Ruth, Secy. Spring Township School Bd.

Oxford, Mass.—Barker & Nourse, of Worcester, are the architects for a brick high school to be built by this town.

Poughkeepsie, N. Y.—Percival M. Lloyd, 33 Market St., has prepared plans for a gymnasium 62 ft.x115 ft. for the Riverview Military Academy, the building to be steel frame, with trussed roof, and local brick with terra cotta trimmings. Cost, $20,000.

Mobile, Ala.—The contract for erecting a school on Academy Square is reported to have been awarded to Cook & Laurie, of Montgomery, for $33,600.

Monterey, Mex.—Mackin & Dillon, of Monterey, are stated to have the contract for erecting a normal school for the State of Nuevo-Leon; cost, $87,000.

Nacogdoches, Tex.—The proposition to issue $32,500 bonds for schools is stated to have carried.

Danville, Ky.—It is reported that plans are about completed for the erection of a new building for Caldwell Female College, to cost about $16,000. Prof. J. C. Acheson is Pres.

Hingham, Mass.—Bids will be received by the School Bldg. Com. until Aug. 5 for addition and alterations to the Hingham High School; also for installing a ventilating and heating system in said school. J. Sumner Fowler, Archt., 19 Milk St., Boston; Walter L. Bouve, Chmn. Com.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. of School Bldgs., until Aug. 11 (extension of date) for erecting school No. 65, Boro. Bronx; also for installing electric elevators in the Wadleigh High School, Boro. Manhattan.

Columbus, O.—Architects Stribling & Lum, 85 N. High St., write that contracts for work on the State School for Blind (bids opened July 14) have been awarded as follows: To J. A. Erner & Co., Columbus, for electric light machinery and wiring, at $12,190; to Hoffman Conklin Co., Columbus, steam heating, at $14,428, and plumbing, at $2,850; W. I. Carruthers, Columbus, building for electric light machinery, at $1,275.

Chicago, Ill.—Bids will be received by the Bd. of Educ. until Aug. 8 for improving the Normal Practice School, work to include fireproofing, plumbing, gasfitting, etc. Bids will also be received by the Bd. of Educ. until Aug. 15 for improving South Division High School, work to include masonry, cut stone, sheet metal, steel ceilings, structural iron, etc. W. B. Mundie, Archt. of Bd.

Milwaukee, Wis.—Local press reports state that plans and specifications will be received by the Statutory Com. for a 16-room school to be erected in the First Ward.

Duluth, Minn.—I. V. Hill, of Duluth, is preparing plans for a building for the R. C. Church, which will include a school, club house and theater, to be located at 4th St. and 2d Ave., W. Probable cost, $75,000.

Chicago, Ill.—W. B. Mundie, Chicago, is said to have completed plans for the William McKinley High School, to be erected in Adams St., between Hoyne and Seeley Aves., at a cost of $300,000.

Richland Center, Wis.—It is stated that a $20,000 school is to be built.

Golden, Colo.—W. W. Atkinson, of Colorado Springs, has the contract to build the school for metallurgy at the School of Mines, Golden, for about $35,000.

Manistique, Mich.—The sum of $12,000 has been voted for a school.

Norway, Mich.—It is stated that $15,000 has been voted for a school.

South Norwalk, Conn.—The Special Com. is considering plans for a school to cost about $22,000.

Jackson Center, O.—Bids will be received by the Bd. of Educ. until Aug. 19 for furnishing material and erecting a school. F. E. Pool, Clk.

Rapid City, S. D.—Bids are wanted Aug. 16 for furnishing material and erecting a school in Dist. No. 20. Chas. A. Marshall, Chmn. Bd. of said Dist.

Iowa City, Ia.—The Bd. of Regents of the State University of Ia. is stated to have awarded the contract for 2 College of Medicine Bldgs. to Jas. Rowson & Son, of Iowa City, at $84,630 for the laboratory and $44,250 for the Anatomy Bldg.

Pittsburg, Pa.—Thompson Bros. are stated to have secured the contract to install a ventilating and heating plant and make alterations and repairs to the Newton Girls' Grammar School, at $25,900.

Pittsburg, Kan.—It is stated that Dieter-Wenzel, of Joplin, Mo., have received the contract to erect the Manual Training & High School in this city, for $32,000.

Abilene, Tex.—The question of issuing $20,000 school bonds is reported to have carried.

Allegheny, Pa.—It is stated that H. A. Kunz, of Allegheny, has received the contract to erect St. Peter's Convent on Arch St., for $30,000.

Boston, Mass.—The Morrill & Whiton Const. Co., Boston, has received the contract for building a primary school on Westville St., Dorchester Dist., for $122,178. This is the first of 8 new schools for which the School House Comn. is having plans prepared.

Orange, N. J.—Local press reports state that the Bd. of Educ. has accepted the plans of Geo. E. Poole, of Chatham, N. J., for Tremont Ave. School. Bids for erecting same will be received until Aug. 20. Probable cost, $30,000.

Gainesville, Ga.—See "Sewerage and Sewage Disposal."

New York, N. Y.—Bids are wanted Aug. 15 for sanitary work, also for installing electric light wiring fixtures, electric bell system, etc., in Morris High School, Boro. of Bronx; also for erecting School No. 110 and for sanitary work (contract No. 2) in new High School of Commerce, Boro. of Manhattan. C. B. J. Snyder, Supt. of School Bldgs.

Brooklyn, N. Y.—Bids are wanted Aug. 15 for alterations and repairs to annex of the Manual Training High School; also for erecting new building and changing position of present building, alterations, etc., to School No. 91 and for erecting School No. 130, all in the Boro. of Brooklyn. C. B. J. Snyder, Supt. of Bldgs., Dept. of Educ., N. Y. City.

New York, N. Y.—The following bids were opened July 23 by the Supt. of Bldgs., Dept. of Educ., for the general construction of addition to and alterations in School No. 92, Boro. of Manhattan: Thos. Dwyer, $107,150; Pat. Sullivan, $112,323; Thos. B. Leahy, $106,743; John H. Goetschius, $111,600; Luke A. Burke, $92,770; John R. Sheehan & Co., $109,000; P. Gallagher, 11 E. 59th St., $87,000.

Bids opened July 25 for the general construction of school 190, Boro. of Manhattan: Wm. & Thos. Lamb, $152,104; P. J. Walsh, $157,000; P. J. Brennan, 63 W. 22d St., $149,000; Luke A. Burke, $154,770; Thos. B. Leahy, 9 E. 42d St., $149,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Fulton, N. Y.—The Bd. of Health has under consideration the question of garbage disposal.

Marion, O.—The City Council is said to have under consideration the question of installing a garbage disposal plant.

Waterloo, Ia.—The City Council is considering the advisability of erecting a crematory for the disposal of garbage.

New York, N. Y.—Bids are wanted Aug. 4 for furnishing and delivering 60 ash carts, for Boroughs of Manhattan and Bronx. John McG. Woodbury, Comr. of Street Cleaning.

Harrisburg, Pa.—The Bd. of Trade urges the Council to grant a franchise to the United States Garbage Reduction Co. for the establishment of a garbage plant.

Brooklyn, N. Y.—Two bids were received July 28 by J. McG. Woodbury, Comr. Street Cleaning, N. Y. City, for the final disposition of ashes, street sweepings and rubbish and light refuse, as follows: M. T. Meagher, 8 cts. per cu. yd.; H. Milton Kennedy, 35 cts. per cu. yd. The period of the contract is 5 years; the amount of materials disposed of during 1901, all of which are collected by the Dept., is as follows: Ashes, 508,280 cu. yds.; sweepings, 202,263 cu. yds.; paper and refuse, 330,100 cu. yds. The maximum day's collection is: ashes, 2,632 cu. yds.; swpgs., 1,110 cu. yds.; paper, etc., 702 cu. yds.

New York, N. Y.—The following bids were opened July 25 by J. McG. Woodbury, Comr. of Street Cleaning, for the disposal of garbage in the Borough of the Bronx for a period of five years: Decarie Mfg. Co., Minneapolis, $16,000 per yr.; Horace J. Subers, 25 Broad St., N. Y. City, $22,200 per yr.; M. T. Meagher, $34,500 per yr.; Melrose Sanitation Co., 39 Cortlandt St., N. Y. City, $68,000 per yr.; N. Y. Sanitary Utilization Co., 30 Burling Slip, N. Y. City, $17,500, if a plant is erected in the Boro, and $14,000 if the garbage is disposed in present plant.

GOVERNMENT WORK.

Butte, Mont.—The following bids were opened July 28 at the Treasury Dept., Washington, for the construction (except elevators, heating apparatus, electric wiring and conduits) of the U. S. Post Office at Butte: Congress Const. Co., Chicago, Ill., $208,724; Jas. Welsh, Butte, $255,980; Smith & Goddard, Butte, $256,268; Shackelton & Whileway, Butte, $223,304.

Boston, Mass.—See "Water."

Bremerton, Wash.—Bids are wanted Sept. 6 for constructing 600 ft. of concrete quay wall at the Navy Yard, Bremerton. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Aberdeen, S. D.—The following bids were opened July 30 at the Treasury Dept., Washington, for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Aberdeen: E. Miller & Co., Aberdeen, $94,850; Butler Bros., St. Paul, $91,722; P. M. Hennessey, $97,475; Congress Const. Co., Chicago, $105,136.

Cincinnati, O.—Bids are wanted Aug. 25 for furnishing material for repairing and reconstructing abutments and miter-sill for guard gates at head of canal at Lock No. 7; also repairing with concrete about 200-ft. in length dam No. 7, Muskingum River, O. Maj. Ernest H. Ruffner, Corps Engrs., U. S. A.

Ft. Wright, Wash.—Bids are wanted Aug. 23 for erecting Quartermaster's storehouse. Address Capt. W. C. Wren, 17th Infantry, U. S. A., Ft. Washington.

Philadelphia, Pa.—Bids are wanted Aug. 28 for constructing certain brick and steel buildings, Frankford Arsenal. Maj. Frank Heath, Ord. Dept., Commanding.

Pipestone, Minn.—Bids are wanted at the Dept. of Interior, Office of Indian Affairs, Washington, D. C. (A. C. Toner, Acting Comr.), until Aug. 21 for the construction of an addition to the stone dormitory, with plumbing, gasoline gas piping and steam heat, at the Pipestone Indian School.

New Brighton, Pa.—Bids are wanted by Jas. Knox Taylor, Supervising Archt., Treasury Dept., Washington, D. C., until Aug. 20, for completing the approaches to the U. S. Post Office at New Brighton.

Washington, D. C.—Bids are wanted Aug. 23 for furnishing the steel work and fireproofing for a storehouse at the Navy Yard. Estimated cost, $24,400. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept.

Ft. Barrancas, Fla.—Bids are wanted Aug. 22 for sinking 2 wells at this post. Address W. E. Cole, Q. M.

Ft. Strong, Mass.—Bids are wanted Aug. 28 for erecting a fire apparatus building at this post. Address A. M. Palmer, Depot Q. M., Boston.

Ft. Snelling, Minn.—The Secy. of War has authorized an expenditure of $168,000 at Ft. Snelling during the current year.

Pittsburg, Pa.—Capt. W. L. Sibert, Res. Gov. Engr. for the Pittsburg district, has received word from the War Dept. that preliminary plans for new dams and locks at Port Perry, known as Lock No. 2, have been approved. Cost, about $625,000.

Hampton, Va.—Bids are wanted Aug. 22 by W. H. H. Peck, Treas., National Soldiers' Home, Va., for furnishing and setting in place at the Southern Branch, N. H., D. V. S., near Hampton, 3 steam boilers.

MISCELLANEOUS.

Des Moines, Ia.—The City Council has under consideration the construction of a levee along the river front.

Harrisburg, Pa.—City Clk. Chas. A. Miller writes that there is now pending in Councils an ordinance for the creation of a Bd. of Park Comrs.; they have the power to purchase land for park purposes not exceeding $365,000.

Augusta, Ga.—City Engr. Nisbet Wingfield writes that surveys are now being made for proposed levee and riprap work along the river front to keep the high water in Savannah River out of low points in the city. Probable cost of work, $100,000.

Osterville, Mass.—Bids will be received by the Bd. of Harbor and Land Comrs., Boston, until Aug. 7 for dredging about 21,000 cu. yds. of material from the West Bay, Osterville. Amount of money available for work is $7,500. Woodward Emery, Chmn.

New York, N. Y.—The Bd. of Estimate & Apportionment has voted $140,000 to Brooklyn and Queens and $285,000 to Manhattan and Bronx to be used on small parks.

Buffalo, N. Y.—Bids are wanted Aug. 9 for removing Main St. bridge over Hamburg Canal, filling Canal and repaving the approaches at Main, Quay, Scott and Lake Sts. Francis G. Ward, Comr.

Baltimore, Md.—The Bd. of Estimate on July 22 approved the $1,000,000 subway extension loan ordinance.

Tallulah, La.—Bids will be received by the Bd. of Levee Comrs. 5th Louisiana Levee Dist., at the office of the Bd. of State Engrs., Cotton Exchange Bldg., New Orleans, until Aug. 12, for constructing Otter Bayou levee, in East Carroll Parish, approximately 200,000 cu. yds.; also Hard Times levee, approximately 25,000 cu. yds., and Harper levee, approximately 150,000 cu. yds., both in Tensas Parish. A. T. Lane, Secy.

Syracuse, N. Y.—Bids are wanted Aug. 7 for $40,000 Onondaga Creek improvement bonds. E. J. Mack, City Compt. Local press reports state that bids for this work will be received about Aug. 11.

New York, N. Y.—Bids are wanted Aug. 6 for furnishing, erecting and maintaining for a period of 3 years, 6,000 enameled metal street signs, 1,200 street sign boxes for gas and electric lights, and 2,000 street sign boxes with a reflector attachment. Jacob A. Cantor, Manhattan Boro. Pres.

Brooklyn, N. Y.—Bids are wanted Aug. 7 for building granite boundary wall on southerly side of Coney Island concourse. Wm. R. Willcox, Comr. of Parks, New York City.

Brooklyn, N. Y.—Bids will be received by the Boro. Pres., J. Edw. Swanstrom, until Aug. 13 for furnishing and delivering 4,000 enameled street signs and 1,000 illuminated street sign boxes.

New York, N. Y.—Bids will be received by the Comr. of Street Cleaning until Aug. 13 for furnishing and delivering 20 dumping trucks in Boroughs Manhattan and Bronx.

New York, N. Y.—The Dept. of Docks has planned improvements along the North River front from Canal to 30th Sts., to cost about $12,000,000. The consent of the War Dept. will be necessary before said improvements, which provide for a series of piers, each at least 800 ft. long, can be made.

Buffalo, N. Y.—Press reports state that the Lackawanna Steel Co. has awarded the contract for a concrete reinforced ore dock, to The Lathrop-Shea-Henwood Co., of Scranton, Pa. The contract is said to amount to about $800,000.

Brattleboro, Vt.—Local press reports state that it is proposed to build a dam across Connecticut River at Brattleboro, and that F. W. Bateman, of Clinton, Mass., has been engaged to survey the river from Brattleboro to Walpole bridge, some 20 miles. W. H. Vinton and C. A. Harris are said to be interested.

Buffalo, N. Y.—Bonds to the amount of $100,000 have been sold for the abatement of the Ohio basin slip nuisance.

Martinez, Cal.—The Supervisors of Alameda and Contra Costa Counties have adopted plans for the tunnel to be built connecting the two counties by means of a wagon road on an easy grade. The tunnel will be about 1,100 ft. long, and the estimated cost is $33,259 to Alameda Co. and $46,456 to Contra Costa Co.

Portland, Ore.—Consulting Engr. Jas. E. Blackwell, Dexter Horton Bldg., Seattle, Wash., writes that the following bids were opened July 25 by the Port of Portland Comrs. for the construction of a wooden drydock: *a*, amount as per specification; *b*, amount if top and bottom chords are in 2 pieces only; *c*, time to complete: Robt. Wakefield, Portland, *a* $160,000, *b* $165,000, *c* 12 mos.; J. E. Bennett, Portland, *a* $162,500, *b* $167,750, *c* 12 mos.; J. B. Bridges, Portland, *a* $166,750, *b* $171,250, *c* 12 mos.; N. J. Blagen, Portland, *a* $170,000, *b* $176,000, *c* 12 mos.; Bringham & Hoska, Seattle, *a* $174,500, *b* $178,500, *c* 12 mos.; Jos. Pacquet, Portland, *a* $174,900, *b* $178,000, *c* 13 mos.; Portland Ship Bldg. Co., Portland, *a* $220,000, *c* 12 mos.

New York, N. Y.—The following bids were opened July 24 by the Dept. of Parks for improving the northern portion of the Botanical Garden in Bronx Park:

Items and Quantities.	Wm. J. Moore.	Bartholomew Dunn.
Earth excavation	$1.00	$.30
Rock excavation	.....	1.50
Filling 56,000 yds.	.40	.66
Pavement	1.00	1.00
Pipe, 10-in.	1.00	.45
Pipe, 1,000 ft. 8-in.	1.00	.35
Pipe, 2,958 ft. 6-in.	1.00	.25
Land tile, 500 ft. 5-in.	.10	.16
Tile, 700 ft. 4-in.	.10	.13
Tile, 3,100 ft. 3-in.	.10	.10
Tile, 12,600 ft. 2-in.	.10	.08
Water pipe, 500 ft. 4-in.	1.00	.80
Iron pipe, 7,200 ft. 2-in.	.13	.12
Walk basins, 40	50.00	40.00
Street washers, 200	5.00	7.00
Brick culvert, 200 ft.	8.00	6.75

New bids for this work will be opened Aug. 7. Wm. R. Willcox, Comr. of Parks.

NEW INDUSTRIAL PLANTS.

The Clearfield, Pa., Steel & Iron Co. has contracted for the erection of buildings measuring 360x220 ft. The power plant required will be about 1,500 H.-P.

The Bostwick Steel Lath Co., Niles, O., is erecting a new plant, the main building to be 60x250 ft. The capacity of the power plant has not been decided.

Contracts will soon be let for the new plant of the Cleveland, O., Pneumatic Tool Co.

W. L. Hill, Sharon, S. C., expects to establish a brick plant to have a daily capacity of 30,000 to 40,000. It is also his intention to make tile.

The Arcadia Mills, Spartanburg, S. C., will erect a mill to contain 10,000 to 12,000 spindles, and about 300 looms. C. R. Makepeace & Co., Providence, R. I., archts.

The Atlanta, Ga., Car Wheel & Mfg. Co. will erect a plant to have a daily capacity of about 200 wheels. The main building will be 230x119 ft.

The Brylgon Foundry, Reading, Pa., has outgrown its present plant and contemplates the erection of a larger.

The Menasha Paper Co., Ladysmith, Wis., will erect a 1-machine mill, including a 40x208-ft. machine room, 40x56-ft. beater room, 30x47-ft. boiler house and a 40x64-ft. finishing room. The capacity of the power plant will be 525 H.-P.

The Standard Roller-Bearing Co., 2326 Market St., Philadelphia, is erecting a 200x100 ft. factory and an 80x50-ft. case-hardening and tempering plant. A 200-H.-P. engine will be installed.

The Colonial Foundry & Machinery Co., So. Norwalk, Conn., will erect a 40x125-ft. machine shop, 90x108-ft. foundry and a warehouse 40 ft. square. A power plant of about 30 H.-P. will be installed.

The Malleable Iron Fittings Co., Branford, Conn., is ready to begin work on a 200x118-ft. addition to its annealing department, and has plans for a 2-story, 150x80-ft. core shop, both buildings to be of fireproof construction, with steel beams and cement floors and roofs. The company also contemplates the erection of another foundry and steel furnace.

The Atmospheric Products Co., Gluck Bldg., Niagara Falls, N. Y., is erecting a 2-story, 125x50-ft. machine shop and experimental laboratory.

The People's Ice & Cold Storage Co., Columbus, Miss., is in the market for a 15-ton ice machine.

The Burnside, Ky., Electric Light & Power Co. expects to install a 15-ton ice plant.

Walker Bros., Viola, Ore., will erect a 24x150-ft. saw mill to have a 100-H.-P. power plant.

Wm. Edwards, Plymouth, Fla., is considering the installation of a small ice plant.

The Emerson Electric Mfg. Co., 714-718 St. Charles St., St. Louis, Mo., has let a contract for a 6-story and basement, 108x150-ft. building, to be equipped with two passenger and two freight elevators, two 50-Kw. generators, engines, boilers and sprinkler system.

The mill of Billings, Beals & Co., Avoca, N. Y., recently burned, will probably be rebuilt to its former size. The mill's capacity was 50 bbls. wheat, 50 bbls. buckwheat and 25 tons feed, and it was run by a gas engine.

The Griswold Mfg. Co., Erie, Pa., intends to erect a power plant of 300 to 400 H.-P. capacity, using electrical distribution, and a foundry.

The American Spinning Co., Greenville, S. C., will erect a 104x141-ft. addition to contain 25,000 spindles.

The Classic Corset Co., 189 Fifth Ave., Chicago, is in the market for a gas engine to generate 60 H.-P. electricity, dynamo and motors.

BUSINESS NOTES.

The Cleveland, O., Pneumatic Tool Co. has opened offices at 411 Park Bldg., Pittsburg, where it will be represented by Chas. L. Nelson, and at 34 Lemoine St., Montreal, Can., where it will be represented by N. J. Holden & Co.

The Springfield, Mass., Street Ry. has placed its third order for Green economizers.

The Allis-Chalmers Co., Chicago, has declared a fifth consecutive quarterly dividend of 1¾ per cent., payable Aug. 1 out of net earnings.

The Buffalo Forge Co. reports the following among its recent orders: Two 70-in. fans for heating and ventilating, direct-connected to Buffalo engines, and a 130-in. pulley fan for mechanical draft for Copenhagen; an induced draft plant and a 23-H.-P. engine for electric lighting in Dutch Guiana; five 45-H.-P. engines for driving generators and a 38-H.-P. engine for a pumping equipment for Manzanillo, Cuba; a 20-H.-P. vertical engine to Geestemunde, Germany; a 15-H.-P. double vertical single-acting engine to Gothenburg, Sweden; a 60 in. fan to Glasgow; a 140-in. fan with heaters to Barrow-in-Furness, Eng.; an 80-in. fan and heater and a 90-in. pulley fan and a 30-H.P. horizontal engine to London; a 120-in. fan and six 60-in. fans to Manchester, Eng.; an 80-in. fan for mechanical draft, to Victoria, B. C.; a 110-in. fan for mechanical draft to Halifax, N. S.; a 70 and a 100-in. fan to Portland, Ore.; a 40-in. fan to College Station, Tex.; a 100-in. fan direct-connected to a Buffalo engine to San Francisco; two 60-in. fans to New Orleans, La., and a 25-H.-P. horizontal engine to Gretna, La. The company has also received an order from the Continental Coal Co., Glouster, O., for three 250-in. fans for ventilating in its mines. They have three-quarter housing and are of the special width of 72 in. The sides are built of extra-heavy steel plate and are thoroughly braced with angle irons to prevent all vibration. The blast wheels of these fans are of the usual centrifugal type. The radial blades or vanes with backwardly curved tips are supported by two spiders of wrought-iron tees springing from cast-iron hubs and are further stiffened by the conical side plates. The fan shaft is supported independently of the housing by two standard Buffalo outboard bearings mounted on masonry pedestals. This plant is similar in many respects to that of the Modoc Coal Mining Co. at the same place, recently installed by this company.

Wm. B. Shaffer, Nazareth, Pa., is interested in the erection of a 10-kiln plant for the Superior Portland Cement Co. at Martin's Creek, Pa. All contracts have been let.

The Joseph Dixon Crucible Co. is installing in its plant at Jersey City, N. J., an engine built by the Ball Engine Co., Erie, Pa., direct connected to 100-Kw. generator.

The National Color Type Co., Chicago, is installing an electric plant for power and light. The engines will be furnished by the Ball Engine Co., Erie, Pa.

Westinghouse, Church, Kerr & Co. report the following among orders recently received: Two 6,000-H.-P. vertical 3-cylinder compound engines for the New York Edison Co.; Rapid Transit Subway Construction Co., New York, three 1,250-Kw. turbo-generator sets and two 400-H.-P. vertical marine type cross-compound engines; Stanley Rule & Level Co., New Britain, Conn., a 600-H.-P. vertical cross-compound direct-connected marine type engine; Baldwin Locomotive Works, Philadelphia, a 700-H.-P. vertical cross-compound marine type direct-connected engine; Syracuse Ry. Construction Co., Auburn, N. Y., two 1,000-H.-P. cross-compound horizontal Corliss engines; Springfield, Mass., St. Ry. Co., a 3,000-H.-P. vertical cross-compound Corliss engine; Illinois Steel Co., So. Chicago, Ill., a 1,750-H.-P. horizontal cross-compound engine; Hartford, Conn., St. Ry. Co., a 1,750-H.-P. horizontal cross-compound Corliss engine direct connected to Westinghouse railway generator and switchboard; DeBeers Consolidated Mines Ltd., So. Africa, 1,000-Kw. turbo-generator outfits; Cleveland, Elyria & Western Ry. Co., Elyria, O., 1,000-Kw. turbine outfits; West Penn Ry. & Lighting Co., three 1,000-Kw. turbo-generator outfits; Roslyn, L. I., Light & Power Co., two 400-Kw. turbo-generator units; Consolidated Rys., Light & Power Co., Wilmington, N. C., a 400-Kw. outfit; Johnston Harvester Co., Batavia, N. Y., a 400-Kw. unit; E. F. Goodrich Co., Akron, O., a 400 and a 750-Kw. unit; seven turbines aggregating 41,000 H.-P., the largest unit being 5,000 Kw., for furnishing power for an underground train service in London, Eng.; Land Title Bldg., Philadelphia, four 160-H.-P. compound single-acting engines; Great Northern Steamship Co., four 125-H.-P. direct-connected engines; Chicago, St. Paul, Minneapolis & O. Ry. Co., St. Paul, Minn., two 250-H.-P. direct-connected compound engines and a 30-H.-P. standard direct-connected engine; Boston & Albany R. R., Boston, a 350-H.-P. compound engine; City of Owensboro, Ky., a 350-H.-P. direct-connected compound engine, switchboard and Roney stokers; Trumbull St. Pumping Station, Washington, D. C., 200-H.-P. direct-connected compound single-acting engine.

PRCPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Aug. 6.	Roundlake, Minn.	Aug. 2
Aug. 7.	Columbus, Ind.	Aug. 2
Aug. 7.	Mains, New York, N. Y.	Aug. 2
Aug. 7.	Elyria, O.	July 26
Aug. 7.	Pump, Yonkers, N. Y.	July 19
	Adv., Eng. Record, July 19.	
Aug. 7.	Pipe, etc., Yonkers, N. Y.	July 19
Aug. 8.	Dam, Columbus, O.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 8.	Baldwins, L. I., N. Y.	Aug. 2
Aug. 8.	St. Louis, Mo.	July 26
Aug. 10.	Henry, Ill.	Aug. 2
Aug. 11.	Well, Ft. Caswell, N. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 12.	Allegheny, Pa.	Aug. 2
Aug. 12.	Enfield, N. H.	Aug. 2
Aug. 12.	Tell City, Ind.	July 26
Aug. 12.	Pumping plant, etc., Wash., D. C.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 13.	Engines, Chicago, Ill.	June 14
	Adv., Eng. Record, June 21, 28.	
Aug. 14.	Well, Niles, O.	July 19
Aug. 14.	Cement, Cheyenne, Wyo.	Aug. 2
Aug. 15.	Lawton, Okla. Ter.	Aug. 2
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
	Adv., Eng. Record, July 12, 19.	
Aug. 16.	Freeport, O.	Aug. 2
Aug. 16.	Pipe, Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 18.	Blakely, Ga.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 18.	Whatcom, Wash.	July 19
Aug. 20.	Ithaca, N. Y.	July 26
Aug. 21.	Chimney, Cleveland, O.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 21.	Dam, Cheyenne, Wyo.	Aug. 2
Aug. 21.	Manning, Ia.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 22.	Ft. Barrancas, Fla.	Aug. 2
Aug. 28.	Danville, Ill.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Sept. 5.	Engine and boiler, Milwaukee, Wis.	July 19
Sept. 6.	Gates, valves, Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Dec 1.	Pumps, Seguin, Tex.	July 26

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 4.	Ft. McKinley, Me.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 5.	Davenport, Ia.	Aug. 2
Aug. 5.	Waterbury, Conn.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 6.	Elkhart, Ind.	July 26
Aug. 6.	Westfield, Mass.	July 26
	Adv., Eng. Record, July 26.	
Aug. 6.	Appleton, Wis.	July 19
Aug. 6.	Abilene, Kan.	July 12
	Adv., Eng. Record, July 12 to 26.	
Aug. 7.	St. Paul, Minn.	Aug. 2
Aug. 7.	Newark, N. J.	July 19
	Adv., Eng. Record, July 19, 26.	
Aug. 8.	Omaha, Neb.	Aug. 2
Aug. 8.	Beloit, Wis.	July 26
Aug. 9.	Pipe, Galveston, Tex.	July 26
Aug. 11.	Toledo, O.	July 19
Aug. 12.	Torrington, Conn.	Aug. 2
Aug. 12.	Waterbury, Conn.	July 26
Aug. 12.	Machinery, New Orleans, La.	June 7
	Adv., Eng. Record, July 7 to Aug. 2.	
Aug. 12.	Construction, New Orleans, La.	June 7
	Adv., Eng. Record, July 7 to Aug. 2.	
Aug. 13.	Norristown, Pa.	July 19
Aug. 13.	Cincinnati, O.	July 19
Aug. 14.	Cincinnati, O.	July 26
Aug. 15.	Lawton, Okla. Ter.	Aug. 2
Aug. 15.	St. Louis, Mo.	Aug. 2
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
	Adv., Eng. Record, July 12, 19.	
Aug. 18.	New Britain, Conn.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 21.	Berkley, Va.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 22.	Monticello, Ind.	Aug. 2
Aug. 23.	Mansfield, O.	Aug. 2
Aug 29	Geneva, O.	Aug. 2

BRIDGES.

Aug. 6.	Atlantic City, N. J.	July 26
Aug. 7.	Mauch Chunk, Pa	Aug. 2
Aug. 8.	Indianapolis, Ind.	Aug. 2
Aug. 9.	Souris, Manitoba	Aug. 2
Aug. 12.	Pittsfield, Mass.	Aug. 2
Aug. 12.	Sonyea, N. Y.	July 26
Aug. 13.	Brooklyn, N. Y.	Aug. 2
Aug. 15.	Providence, R. I.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 16.	Ft. Scott, Kan.	Aug 2
Aug. 18.	Bassett, Neb.	Aug. 2
Aug. 18.	Anadarko, Okla. Ter.	Aug. 2
Aug. —	Rutledge, Tenn.	July 26
Aug —	Columbus, O.	June 28
Sept. 3.	Substructure, Chicago, Ill.	July 19
	Adv., Eng. Record, July 19.	
Sept. 3.	Superstructure, Chicago, Ill.	July 19
	Adv., Eng. Record, July 19.	
Sept. 5.	Milwaukee, Wis.	July 19
Sept. 9.	Caldwell, Idaho	July 12
Sept. —	Bridge plans, St. Petersburg, Russia.	Sept. 21

PAVING AND ROADMAKING.

Aug. 5.	Weehawken, N. J.	Aug. 2
Aug. 5.	Milwaukee, Wis.	Aug. 2
Aug. 5.	Chanute, Kan.	July 26
	Adv., Eng. Record, July 26, Aug 2	
Aug. 6.	Baltimore, Md.	Aug. 2
Aug. 6.	Brooklyn, N. Y.	Aug. 2
Aug. 6.	Mechanicville, N. Y.	Aug. 2
Aug. 7.	Long Island City, N. Y.	Aug. 2
Aug. 7.	Cincinnati, O.	Aug. 2
Aug. 7.	Brooklyn, N. Y.	Aug. 2
Aug. 7.	Wilmette, Ill.	Aug. 2
Aug. 7.	Ashland, Wis.	July 26
Aug. 8.	St. Louis, Mo.	Aug. 2
Aug. 8.	New Brighton, N. Y.	Aug. 2
Aug. 8.	Omaha, Neb.	Aug. 2
Aug. 8.	Rome, N. Y.	Aug. 2
Aug. 8.	Washington, D. C.	July 26
	Adv., Eng. Record, July 26.	
Aug. 9.	Frederick, Md.	Aug. 2
Aug. 9.	St. Marys, O.	July 26
Aug. 9.	Bricks, Galveston, Tex.	July 26
Aug. 11.	Toledo, O.	July 12
Aug. 12.	Morristown, N. J.	Aug. 2
Aug. 12.	New York, N. Y.	Aug. 2
Aug. 12.	Ft. Sheridan, Ill.	July 26
Aug. 12.	Crookston, Minn.	July 19
Aug. 12.	Cincinnati, O.	July 19
Aug. 13.	Brooklyn, N. Y.	Aug. 2
Aug. 13.	Cleveland, O.	July 26
Aug. 13.	Cincinnati, O.	July 19
Aug. 14.	Long Island City, N. Y.	Aug. 2
Aug. 15.	Des Moines, Ia.	Aug. 2
Aug. 15.	Medford, Wis.	Aug. 2
Aug. 15.	Fulton, N. Y.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 15.	Vincennes, Ind.	July 26
Aug. 18.	Michigan City, Ind.	Aug. 2
Aug. 19.	Cincinnati, O.	July 26
Aug. 19.	Newport, Ind.	July 26
Aug. 21.	Cincinnati, O.	Aug. 2
Aug. 23.	Mansfield, O.	Aug. 2
Aug. 24.	Centerville, Ind.	July 19
Aug. 25.	Lorain, O.	Aug. 2
Aug. 25.	Warren, O.	Aug. 2
Sept. 1.	Niagara Falls, N. Y.	Aug. 2

POWER, GAS AND ELECTRICITY.

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Aug. 1.	Power house, dam, etc., Redding, Cal.	July 19
Aug. 6.	Port Carbon, Pa.	Aug. 2
Aug. 7.	Romeo, Mich.	July 26
Aug. 8.	Annapolis Royal, N. S.	Aug. 2
Aug. 8.	Franchise, Paducah, Ky.	July 26
Aug. 11.	Franchise, Willows, Cal.	July 26
Aug. 15.	Rushford, Minn.	July 26
Aug. 18.	Blakely, Ga.	July 26
	Adv., Eng. Record, July 26.	
Aug. 21.	Koala Zumpur, Malay.	July 19
Aug. 29.	Detroit, Mich.	July 26
Sept. 8.	Amsterdam, Holland	Aug. 2

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Aug. 4.	Ft. McKinley, Me.	July 19
	Adv., Eng. Record, July 19.	
Aug. 5.	Brunswick, Ga.	June 21
	Adv., Eng. Record, June 21, 28.	
Aug. 6.	Levee work, Memphis, Tenn.	July 19
Aug. 6.	Wiring, etc., Freeport, Ill.	July 12
	Adv., Eng. Record, July 12, 19.	
Aug. 7.	Hospital, Winthrop, Mass.	July 12
Aug. 9.	San Francisco, Cal.	July 5
Aug. 11.	Artesian well, Ft. Caswell, N. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 12.	San Francisco, Cal.	July 26
Aug. 12.	Road work, Chicago, Ill.	July 19
Aug. 12.	Denver, Colo.	June 28
	Adv., Eng. Record, June 28, July 5.	
Aug. 13.	Freeport, Ill.	July 5
	Adv., Eng. Record, July 5, 12.	
Aug. 14.	Wiring, etc., P. O., Hot Springs, Ark.	July 19
	Adv., Eng. Record, July 19, 26.	
Aug. 14.	Cleveland, O.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 14.	Dredging, New York, N. Y.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 14.	Pneu. tube mail serv., Wash., D. C.	July 12
Aug. 15.	Dredg. Erie Harbor, Buffalo, N. Y.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 15.	Dredging, Milwaukee, Wis.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 15.	Ft. Slocum, N. Y.	July 26
Aug. 15.	Cleveland, O.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 16.	Boat house, West Point, N. Y.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 18.	Bldgs., Ft. Leavenworth, Kan.	July 26
Aug. 18.	Piers, Cleveland, O.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 18.	Ft. Howard, Md.	July 26
Aug. 18.	Fergus Falls, Minn.	July 12
	Adv., Eng. Record, July 12, 19.	
Aug. 19.	Wheeling, W. Va.	July 26
Aug. 19.	Denver, Colo.	July 19
	Adv., Eng. Record, July 19, 26.	
Aug. 20.	Levee work, Memphis, Tenn.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 20.	New Brighton, Va.	Aug. 2
Aug. 21.	Pipestone, Minn.	Aug. 2
Aug. 21.	Newport, Vt.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 21.	Dredging, Philadelphia, Pa.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 22.	Boilers, Hampton, Va.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 22.	Ft. Barrancas, Fla.	Aug. 2
Aug. 22.	Dredging plant, Buffalo, N. Y.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 23.	Fireproofing, Washington, D. C.	Aug. 2
Aug. 23.	Ft. Wright, Wash.	Aug. 2
Aug. 23.	Trestle and tank, Ft. Myer, Va.	Aug. 2
	Adv., Eng. Record, Aug 2.	
Aug. 25.	Cincinnati, O.	Aug. 2
Aug. 25.	Harbor work, Savannah, Ga.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 25.	Ft. Des Moines, Ia.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 25.	Post Office, Ellsworth, Me.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 25.	Ft. Riley, Kan.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 25.	Bulkhead, Philadelphia, Pa.	Aug. 2
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Aug. 27.	Metal lathing, etc., Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 27.	Repair steamer, Pittsburg, Pa.	Aug. 2
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Aug. 28.	Philadelphia, Pa.	Aug. 2
Aug. 28.	Harbor work, Cleveland, O.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 28.	Breakwater, Cleveland, O.	Aug. 2
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Aug. 28.	Vaults, Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 28.	Ft. Strong, Mass.	Aug. 2
Aug. 28.	Dredging, Wheeling, W. Va.	Aug. 2
Sept. 4.	Post Office, Lockport, N. Y.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Sept. 3.	Dam, Charleston, S. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Sept. 6.	Bremerton, Wash.	Aug. 2
Sept. 10.	Post Office, Anniston, Ala.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Sept 13.	Dock, Norfolk, Va.	July 26
	Adv., Eng. Record, Aug. 2.	

BUILDINGS.

Aug. 5.	School, Hingham, Mass.	Aug. 2
Aug. 5.	State Instl., Syracuse, N. Y.	Aug. 2
Aug. 6.	Court house, Marquette, Mich.	July 19
Aug. 6.	Pub. bldg., Rahway, N. J.	Aug. 2
Aug. 7.	Hospital, Secaucus, N. J.	Aug. 2
Aug. 7.	State Armory, Watertown, N. Y.	Aug. 2
Aug. 7.	Fire Dept. Bldg., New York, N. Y.	Aug. 2
Aug. 7.	Schools, Brooklyn, N. Y.	Aug. 2
Aug. 8.	Court House, Ada, Minn.	Aug. 2
Aug. 8.	Library, Clear Lake, Ia.	Aug. 2
Aug. 8.	School, Chicago, Ill.	Aug. 2
Aug. 8.	School, Merrill, Wis.	July 26
Aug. 8.	Htg. court house, Van Wert, O.	July 26
Aug. 11.	Library, Niagara Falls, N. Y.	Aug. 2
Aug. 11.	School, New York, N. Y.	Aug. 2
Aug. 11.	Jail, Salt Lake City, Utah.	July 26
	Adv., Eng. Record, July 26.	
Aug. 11.	Bus. bldg., Montezuma, Ia.	July 26
Aug. 11.	School, Waterbury, Conn.	July 26
Aug. 12.	Armory, Buffalo, N. Y.	July 26
Aug. 12.	Pub. bldg., Sonyea, N. Y.	July 26
Aug. 12.	Church, Goderick, Ont.	July 19
Aug. 13.	College bldg., Columbus, O.	July 26
Aug. 13.	Hospital, Toledo, O.	July 19
Aug. 14.	Pub. bldg., Bath, N. Y.	Aug. 2
Aug. 14.	School, Jackson, Ia.	July 26
Aug. 14.	Court house, Greensburg, Pa.	July 26
Aug. 14.	Hospital improv., Toledo, O.	July 19
Aug. 14.	Hospital, Shreveport, La.	July 19
Aug. 15.	Bank, San Antonio, Tex.	Aug. 2
Aug. 15.	School, Chicago, Ill.	Aug. 2
Aug. 15.	School, New York, N. Y.	Aug. 2
Aug. 15.	School, Brooklyn, N. Y.	Aug. 2
Aug. 16.	School, Rapid City, S. D.	Aug. 2
Aug. 16.	Library, Burlington, Vt.	Aug. 2
Aug. 16.	Hospital, Toledo, O.	July 26
Aug. 16.	Dwellg. plans, Cheyenne, Wyo.	July 5
Aug. 18.	Pub. Bldg., Newark, O.	Aug. 2
Aug. 18.	Court house, Mason, Mich.	Aug. 2
Aug. 18.	School, Springfield, O.	July 26
Aug. 18.	Library, New Brunswick, N. J.	July 26
Aug. 19.	School, Jackson Center, O.	Aug. 2
Aug. 19.	Hospital, Columbus, O.	July 26
Aug. 19.	Library improv., Cincinnati, O.	July 26
Aug. 20.	Bus. bldg., Houston, Tex.	Aug. 2
Aug. 20.	School, Orange, N. J.	Aug. 2
Aug. 20.	Hospital, Massillon, O.	July 26
Aug. 21.	Town hall, Clyde, N. Y.	Aug. 2
Aug. 22.	Hospital, Athens, O.	July 26
Aug. 25.	Pub. bldg., Springfield, O.	Aug. 2
Aug. 26.	Quarantine station, Galveston, Tex.	Aug. 2
Aug. 26.	Pub. bldg., Trenton, N. J.	Aug. 2
Aug. —	Asylum, Jersey City, N. J.	July 26
Oct. 7.	Capitol work, St. Paul, Minn.	Mar. 22

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Aug. 6.	Street signs, New York, N. Y.	Aug. 2
Aug. 7.	Bronx Park work, New York, N. Y.	Aug. 2
Aug. 7.	Granite wall, Brooklyn, N. Y.	Aug. 2
Aug 7.	Osterville, Mass.	Aug. 2
Aug. 8.	Cement, Columbus, O.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 8.	El. ry. franchise, Paducah, Ky.	July 26
Aug. 9.	Canal work, Buffalo, N. Y.	Aug. 2
Aug. 11.	R. R. work, Pittsburg, Pa.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 11.	Syracuse, N. Y.	Aug. 2
Aug. 11.	Sea wall, Galveston, Tex.	June 28
Aug. 12.	Levee work, Tallulah, La.	Aug. 2
Aug. 13.	Brooklyn, N. Y.	Aug. 2
Aug. 13.	New York, N. Y.	Aug. 2
Aug. 14.	Garb. disp., Reading, Pa.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 14.	El. ry. fran., San Bernardino, Cal.	July 26
Aug. 16.	Garb. crematory, Racine, Wis.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 18.	El. ry., San Jose, Cal.	July 26
Aug. 19.	El. ry. franchise, Riverside, Cal.	July 26
Aug. 25.	St. Ry. franchise, Cleveland, O.	Aug. 2
Sept. 6.	Washington, D. C.	July 19
	Adv., Eng. Record, July 19.	
Sept. 30.	Harbor, Port Adelaide, S. A.	July 5

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Development in the Design and Construction of High Dams.

The advances made in the demands connected with irrigation enterprises and hydraulic power plants, no less than those which have grown out of the necessities of great public water supplies for large cities, have made it imperative to seek new and economical features of design for high dams. The long and even ancient use of masonry of good quality is sometimes considered to have placed masonry structures in a certain measure among those not capable of further development for the purposes of modern engineering, but nothing is much further from the facts of the case. Engineers are accustomed to phenomenally rapid evolution in various types of design and in the methods of production of iron and steel structures. While it is highly probable, if not certain, that correspondingly rapid advances cannot be expected in the design of structures which have heretofore been built in masonry, it is a fact that the latter material has partaken in a large measure of the progress which characterizes recent engineering practice. This observation is true both of masonry bridges and high dams, indeed it is true of every structure or portion of a structure in which masonry has come to be used. This is not more pronounced in any branch of engineering work than in the construction of high dams, which have been brought to that stage in which they are no longer always of masonry.

The large irrigation enterprises of the Western States and Pacific coast of this country have in their evolution produced some very interesting instances of construction, if indeed they may not be considered epoch-making in the design and construction of dams. Whenever stone and concrete have been employed in the construction of dams it has usually been one of the fundamental principles of design so to use them as to make the mass monolithic, and the principle is undoubtedly a sound one. In the structures where rock-fill constitutes a large part of the mass, however, there is obviously no application of this fundamental maxim. In many respects the rock-fill feature of a dam is apparently a blunt violation of some of the soundest principles of construction, and yet it has been found to have its legitimate field of use. It is certainly economical, indeed, that is its raison d'etre. The building of great dams for irrigation reservoirs in the West could only have been accomplished by a degree of economy in design heretofore unknown or never even dreamed of in this class of engineering works. One of the most marked instances of this class of dams is that of the plant of the Pike's Peak Power Company, near Victor, Colo. It was fully described in the columns of The Engineering Record of July 19, 1902. The height of this dam is 70 feet and the rock-fill portion is used to support on its up-stream side a continuous riveted plate steel face varying from one-half inch thick in its lowest portions to one-fourth inch in its highest. The joints of these steel plates are so constructed with steel angles as to give it ample capacity for expansion and contraction. The lower edge and ends of the steel face are solidly embedded in concrete filled rock trenches. Calked as in boiler work, the face forms an absolutely impervious curtain across the entire gorge or valley in which the dam is located. The supporting face of the rock-fill is laid as a smooth pavement but does not receive the steel plates direct, a six-inch layer or cushion of sand, gravel and sedimentary deposit being provided between. This entire structure is certainly a most marked and interesting development in the design of what may properly be called high dams. Most Continental and British engineers, even at present, would probably consider such designs at least rash, but experience already gained in connection with similar works shows that it is legitimate engineering construction, admirably adapted to meet the demands of the enterprise which it is to serve.

There are other high dams which show that even earth embankments may be safely and economically used where anything short of a costly masonry structure would have been generally thought ill-judged and unsound engineering but a few decades ago. Three such structures are the Druid Lake dam for the Baltimore water-works, the San Leandro dam of the water supply of Oakland, Cal., and the Tabeaud dam of the Standard Electric Company, of California, near Jackson in that State. The last has a crest about 123 feet above the natural surface and sustains water pressure from a maximum depth of about 92 feet. The other two, however, are but little less in height and sustain but little less depth of water. All three of these structures may be considered as demonstrating the applicability of properly founded and properly constructed earth embankments as dams of practically any height. A reference to the methods of construction of these dams will disclose a great respect for certain fundamental principles of design. In the first place, their foundations, like those of masonry structures, are carried down to bed rock or its equivalent, so that the seepage or passage of water through or underneath those foundations is rendered impossible. Wherever necessary or possible ample drainage of the foundations is always provided. Again, the character of material forming the mass of the embankment was chosen under the closest inspection and put in place with scrupulous care so as to produce as near as possible an absolutely impermeable mass. The Tabeaud dam possesses the characteristic of being designed without any core wall of either masonry or clay puddle, except for a small elevation above the foundation bed. The material of the embankment, however, was specified to contain about 70 per cent. of clay and 30 per cent. of gravel less than 2 inches in diameter and to be spread and compacted in final position so as to produce the best possible results.

It will be remembered in the discussion of the proposed great dam at Bohio on the Panama canal route by the French engineers of the New Panama Canal Company, that they considered an earth dam of somewhat less than 70 feet in height about the limit of safe construction. The present and preceding presidents of the Institution of Civil Engineers have also, in their presidential addresses, placed the seal of their disapproval on earth embankments designed as dams for greater heights than about 100 feet. These interesting and successful incidents of American dam construction show that the limits thus conservatively placed upon this class of engineering works are not necessarily final. Indeed, with reasonable care in founding an earth embankment upon such solid and impervious foundation bed as rock or its equivalent for such a purpose, and with other features so designed as to shut off absolutely the flow of water underneath and with a practically impervious bank, which it is perfectly practicable to attain, guarded with pavements on both the upstream and downstream sides if advisable, there seems to be no basis as yet on which a limiting height of earth dam may be placed. The design of these structures has been born of conditions under which they have been imperative as the expense of solid masonry work would have been prohibitive. They have served sound engineering purposes and they point the way to further economical development of high dam construction under circumstances where earth embankments, or even earth embankments combined with rock fill and other accompanying features of design, are justifiable by the canons of the best engineering practice.

Large Gas Engines.

A steady increase in the size of gas engines has taken place since the machine was put on the market in this country, about twenty-five years ago, and now units of over 100 effective horse-power are seen so frequently as to excite no special interest. It is a fact to be regretted, however, that some of the erroneous ideas concerning these machines, derived from ignorance during the introductory period of small engines, still cling to the modern engine and materially impede its progress. The worst of these fallacies is probably the one which credits the gas engine with ability to take care of itself. For all the evils following the application of such an idea to engine room practice, the builders are no doubt largely responsible, inasmuch as the circular of a few years ago generally assured the prospective purchaser that the engine described required no care beyond starting, occasionally oiling, and stopping. The almost invariable result was that the engine was left to fulfill the promises of the builder under the care of a man, who, if not totally unacquainted with machinery, knew very little about the action of the gas engine.

When the engine was small and the services of a good machinist available in cases of emergency, the engine generally gave good results by virtue of its real merit; but when the same engine room policy came to be applied to larger engines, trouble usually resulted, and dissatisfied users originated the common opinion that gas engines are all right in small size, but large ones are not reliable.

The extremely cheap natural gas in some parts of the country and costly steam fuel in others have led a fair number of good concerns to brave public opinion by installing large gas engines for important duty. In almost every case of this kind, in which careful judgment has been exercised in the selection of the engine, results have been good. These large engines represent a considerable outlay of capital, and as a rule competent men are placed in charge, the wages of such men being easily justified by the increased reliability and economy of the plant.

If a gas engine has work to do which is of any importance, it will always pay the owner to assure himself that the man who operates the engine is familiar with every detail of its construction, and operation. All adjustments should be made as soon as needed, not postponed until the engine stops nor until it fails to start from lack of adjustment of important parts. Certain parts of every gas engine are subject to wear and are not adjustable. Duplicates of such parts should be kept on hand so far as possible. There are, also, some of the more delicate parts, including springs, which are liable to break, and should always be kept on hand.

When a plant is of considerable size it would be well to have indicator diagrams taken at certain intervals, in order to observe the internal action of the engine. By this means a reliable record can be kept of ignitor and valve adjustments, and it is very little, if any, more difficult to obtain than one from a steam engine. If indicator diagrams are insisted upon when the engines are bought, the purchaser can always compare the running condition of his engine with its condition when on the manufacturer's test stand. It is perhaps needless to say that no reputable manufacturer would be likely to ship an engine from his shop without first testing it with both the brake and indicator, and the records of such tests should be open to examination by the purchaser.

The simplicity of the gas engine and the apparent ease with which it can be constructed have led many men to believe that they could improve it. A few have, perhaps, succeeded in some details, and if the remaining part of the engine is good, their efforts are generally successful. These cases are the exception rather than the rule, as a man may be a very good mechanic and machine designer, and yet fail hopelessly from lack of knowledge of the principles underlying the action of the gas engine. An engine which is correct theoretically and shows lack of mechanical skill, is just as bad. Familiarity with the modern practice, knowledge of the theory, and a high order of mechanical skill are absolutely necessary for the production of a well designed gas engine of large size, and the idea that any ordinary machinist can produce such a machine is dangerous. In order to produce a reliable, uniform product at a moderate price, special machinery must be used to a certain extent, and it is well to look into the shop methods of any builder before purchasing an engine from him. A fairly good idea can be formed as to the interchangeability of parts and this feature is very important.

An Undiscovered Leak in a 10-inch water pipe, which caused considerable damage, is described as follows in the 1901 report of Superintendent R. C. P. Coggeshall, of the New Bedford Water Board: The break was probably due to settlement, as the pipe was found broken square across. The leak had undoubtedly been running some time when discovered. It was bitter cold and the ground was frozen several inches deep. Its first appearance was at a considerable distance from the break; meanwhile the water had forced an entrance into the sewer, carrying with it a lot of earth filling, which was deposited more or less inside the sewer. When the frozen surface was broken through, an immense cavity was discovered. It was startling to know that such a hole could exist so near the surface without giving evidence of its existence.

Power Plant of the Central Lard Company, Jersey City, N. J.

The Central Lard Company has recently completed on Seventeenth and Coles Streets, Jersey City, N. J., a new factory which is particularly interesting as regards power production and transmission. The factory comprises a four-story brick building 200 feet long and 66 feet wide with an ell at one end 68 feet wide extending backward 65 feet, a 28x63-foot concrete-steel building enclosed by the ell and a 70x87-foot brick power house. A considerable amount of heating, cooling and pumping is required in the process of manufacture, and all of this, in addition to various other power demands, general lighting and water supply, is furnished by the power plant. The heating is by steam, the cooling by brine, the lighting and the pumping, except in a number of instances where considerable regulation is necessary, by electricity, and the water supply by means of the air lift. The power plant accordingly contains generating sets, refrigerating machinery and air compressors. Of the power equipment, special mention may be made of the steam and boiler-feed connections at the boilers and the unusual method of utilizing as far as possible the heat contained in the exhaust steam, the engines being run non-condensing.

The power house contains a boiler and an engine room, each the full length of the building, the former about 38 feet wide and the latter 27 feet. The engine room floor is at street grade level, and 8 feet above the boiler-room floor, which is of waterproofed concrete construction, the power house being located, as is the whole factory, on made ground. The foundations are mainly composed of piling and concrete, but under the engine room and a portion of the boiler room, brick arches of about 8 feet span were built on the piles and the concrete laid on these. There is no basement under the engine room, and steam lines are carried overhead into it and exhaust pipes laid in trenches formed in the concrete. The engine room contains the generating units, the air compressors and the refrigerating machinery. The feed pumps and feed-water heater are located in the boiler room. Coal is stored in a vault built against the outside boiler-room wall, the coal being shoveled from cars on a siding into the vault, which has a capacity for 10 days' operation of the plant. There are twelve openings from it into the boiler room with slide doors and three larger openings for the passage of wheelbarrows.

The boiler equipment consists of four Babcock & Wilcox water-tube boilers, set in two batteries with space for a third; the boilers are fitted with American automatic stokers and supplied with natural draft from a concrete-steel chimney, constructed according to the Ransome system, as described in detail in The Engineering Record of November 30, 1901. The stoker hoppers are filled by hand from the coal vault and are supplied with forced draft from a Sturtevant 5x2¾-foot centrifugal blower chosen large enough to provide for the ultimate boiler plant. The fan is operated at 460 revolutions per minute by a 40-horse-power Sprague motor. Each boiler contains 126 tubes 4 inches in diameter and 18 feet long, set 14 wide and 9 high, and two 36-inch drums 20 feet 4 inches long. Two steam mains are provided, one for 150 pounds pressure, supplying the engines, compressors, boiler feed pumps and heating coils in tanks requiring high temperature, and the other for 100 pounds pressure, for the refrigerating apparatus and for heating purposes in the factory. The method of making the steam connections is shown in the accompanying plan of the station and cross-section of boiler room. The steam connections into the 100-pound or auxiliary main are fitted with non-return valves and the header has two pop safety valves, one set for 110 pounds and the other for 115 pounds, the demands for steam being very intermittent, so that the pop valves serve as a warning to the firemen as well as a preventive of too high a pressure.

The exhaust steam from the engine room and the pumps in the boiler room is collected in a 10-inch line which carries it to a 1,000-horse-power Wainwright feed-water heater, built by the Taunton Locomotive Works. This was installed under a guarantee to heat 30,000 pounds of water per hour within 8 degrees of the steam temperature. It is not provided with a by-pass, but all the steam has to pass through it, and the exhaust main beyond subdivides into two 7-inch pipes, one leading to an exhaust head above the roof and the other to a special terminal submerged in the hot well about 1 inch below the water level. Each 7-inch branch has a stop valve. The hot well was described in connection with the chimney, in the issue mentioned, and consists of a four compartment concrete-steel basin resting on the chimney foundation, the compartments being separated by baffles and being respectively the receiving end, the oil skimming chamber, the settling chamber and the pumping chamber. The exhaust terminal is a pan of ¼-inch wrought iron, 2x3 feet in size, with 2½-inch sides turned downward. In the sides there are 62 1¼-inch holes spaced on 1¾-inch centers, and the total area of the holes aggregates double that of the exhaust pipe. The hot well will thus receive the condensation in the exhaust pipes and of such of the exhaust steam as will become condensed in issuing through the holes in the terminal box; the well also receives the water from the various tank heating coils in the factory and the exhaust from factory steam pumps, except as this is required for warming in winter.

The feed water is drawn from the hot well so far as possible, and additional fresh water is obtained from the city mains. There are three boiler feed pumps installed, built by the Buffalo Steam Pump Company, one for the 150-pound system and the others for the 100-pound system. They are, however, cross-connected and may all draw from the hot-well and deliver to the auxiliary main and vice-versa. The pumps for the higher pressure discharge through the feed-water heater on the way to the boilers. One of the latter pumps is arranged to receive the discharge from the low-pressure pump, working in tandem with it in delivering to those boilers working under the higher pressure. The two main feed lines are carried across the boilers as indicated in the drawings, and the interesting manner in which the connections to the drums are made is there shown. The 100-pound feed piping is provided with non-return valves to protect it against the higher pressure system. The high-pressure feed pipes are painted red; the low-pressure, white; and the exhaust, black.

The water supply for general cooling in factory and refrigerating apparatus is obtained by means of the air lift from three driven wells on the premises, the wells being located in the corners of a triangle, the shortest distance between any two being about 75 feet. One well is 500 feet deep and two 300 feet, and all are 8 inches in diameter to rock and 7 inches through rock. The air lift apparatus was furnished by the Pneumatic Engineering Company, of New York, and consists of two steam-driven, central crank and double flywheel, Rand Drill Company air compressors automatically regulated to maintain the desired pressure in two air reservoirs in the engine room.

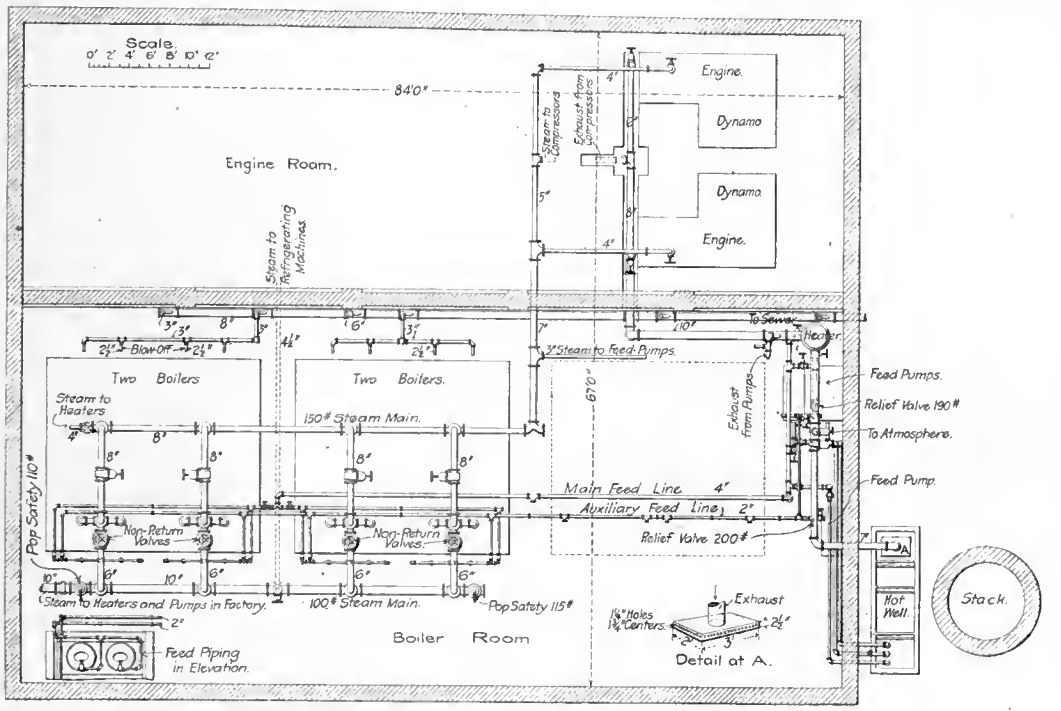
One compressor is operated ordinarily to compress to 20 pounds for factory purposes, and the other, drawing from the 20-pound pressure reservoir to compress to 110 pounds for the air lift. The air reservoirs are 3 feet in diameter and 8½ feet high. The water is delivered into two tanks in the factory basement and pumped therefrom by a 300-gallon double-acting Stilwell-Bierce & Smith-Vaile triplex pump. In connection with this system are three storage tanks on the fourth floor, and the water can be pumped to these for a gravity supply to the factory.

In the electric generating equipment compound non-condensing engines and 230-volt generators are employed, both light and power being supplied at this pressure. The engines are 9½ and 17x12 inches in cylinder dimensions, made by the Phoenix Iron Works Company, and the generators direct-connected Bullock machines rated at 283 amperes at 275 revolutions per minute. The feeders are controlled from a five-panel switchboard, two panels for the generator connections, one for power, one for power in the power house, including power-house lighting and the motor for the stoker blower, and the fifth for light. The generator switches are three-pole single-throw, thus including the equalizer connection with the main switch, while the feeder switches are double-pole. The feeders, as well as the generator leads, have circuit breakers. Stanley indicating instruments are used, and Thomson recording wattmeters are provided on the different main feeders, both for light and for power. The board was built and installed by the General Incandescent Arc Light Company.

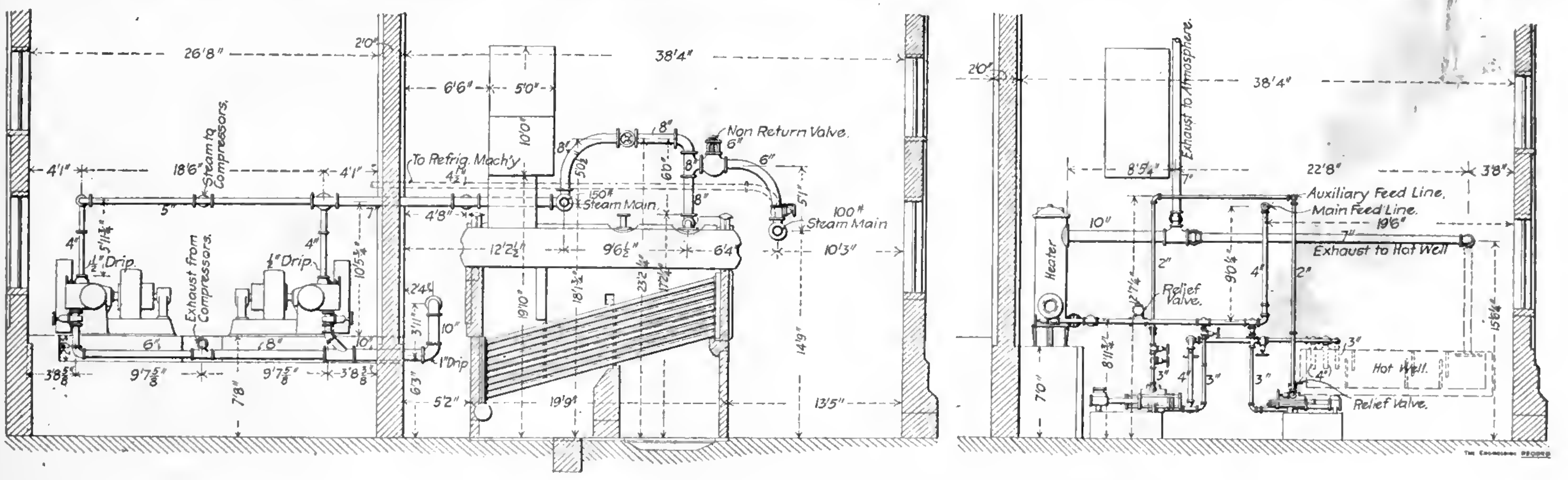
For refrigeration, the ammonia absorption type of apparatus has been installed, and the plant has a capacity of 120 tons of refrigeration. The installation, which was made by the Isbell-Porter Company, of Newark, is in duplicate, consisting of two generators, two absorbers, four condensers, two rectifiers and two ammonia and two brine circulating pumps, the pumps being furnished by the Foster Pump Works, of Brooklyn. The brine cooler is also located in the engine room, and the brine circulating system consists of a 5-inch circuit passing through the four stories of the factory ell connecting with a tank on the fourth floor. The brine is passed through lard coolers on the second floor, the piping to these coolers being on a shunt controlled, as desired, by a back pressure valve in the loop or shunt. On the fourth floor are a number of chill rooms from which the brine passes into the brine tank and thence back to the brine cooler in the engine room. The brine tank has also a connection from the main brine pipe in the fourth story, this connection likewise fitted with a back-pressure valve for bypassing the chill rooms.

Throughout the factory, as already stated, a large amount of pumping is required, involving some 5 miles of piping. The pumping units are largely 150 and 250-gallon Foster rotary pumps driven through speed reducing gearing by Sprague motors. There are also 10 steam actuated pumps, of both the Stilwell-Bierce & Smith-Vaile and Worthington type, where varying quantities of pumpage are desired at different times. There are three freight electric elevators running through the building, of 2,500 pounds capacity at 75 feet per minute, built by the Baltimore Machine Works. On account of the amount of moisture evolved in the different processes, the electric wiring is double-braided and waterproof sockets are used. The factory building is protected against fire by the Grinnell sprinkler system with a 13,500-gallon roof storage tank supplied by a 6-inch main from the city water system, which has a pressure sufficient to fill the tank.

The entire equipment of the factory was designed by Mr. Henry Floy, of New York City, and installed under the direction of Messrs. W. A. Gordon and C. E. Breckenridge, his assistant and inspector, respectively. The Structural Engineering Company, of New York, was the architect for the building.



PLAN OF POWER HOUSE.



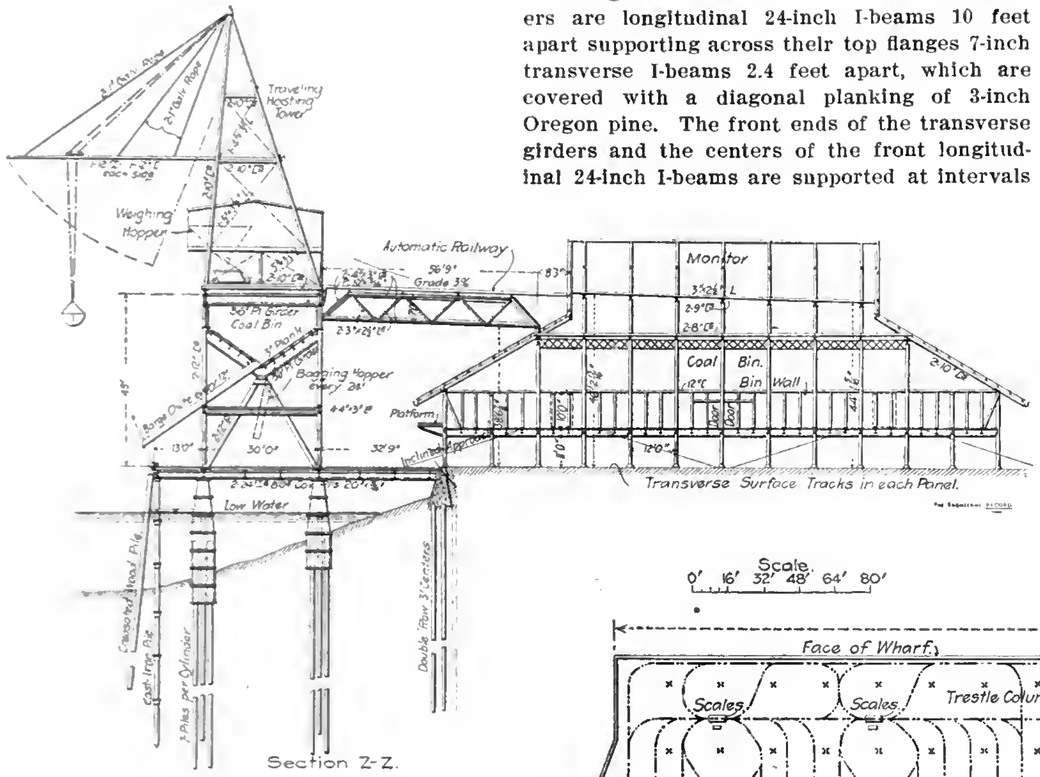
CROSS-SECTIONS OF POWER HOUSE, CENTRAL LARD COMPANY'S WORKS.

The Sangley Point Coaling Plant.

There is now under construction for the United States Government, a naval coal depot at Sangley Point, Manila Bay, Philippine Islands. It is designed for the storage and handling of large quantities of coal for naval and other vessels, and includes a dredged approach from the bay, a large iron wharf, the coal sheds, handling and weighing apparatus, power plant and fire service. The general plans and specifications were prepared by the Bureau of Equipment, Navy Department, Washington, Rear-Admiral R. B. Bradford, Chief of Bureau, and bidders were invited to present details to conform to the requirements. The type of sheds and system of operation proposed in the specifications were retained, but special details of foundations and structural iron work were submitted and approved and the general contract was awarded to The Atlantic, Gulf & Pacific Company, engineers and contractors, New York, for a total price of about $553,000, including the coal handling plant and operating machinery which is installed by the C. W. Hunt Company according to one of their standard systems.

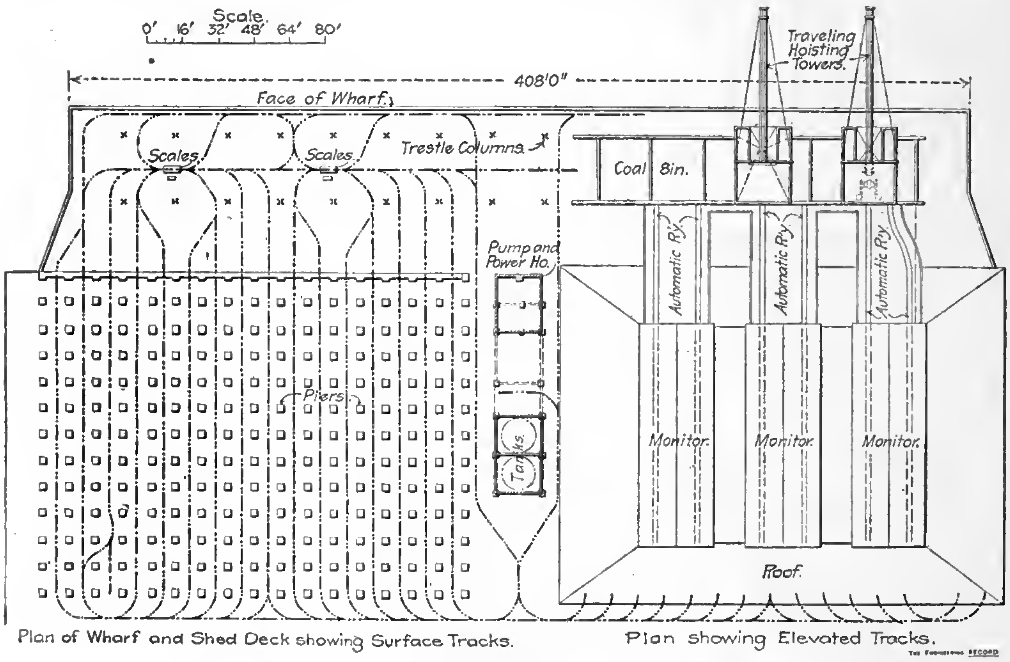
The magnitude and character of the work is indicated by the quantities involved, which include 40,000 yards of dredging, 25,000 yards of filling and grading, 3,236 piles, 222,000 feet timber, 7,246 yards of concrete, about 5,500,000 pounds structural steel, 1,200,000 pounds cast iron piles and pile cylinders, $100,000 worth of machinery and an $11,000 fire and power plant.

The plant is proportioned for the storage in sheds of 25,000 tons of coal and of 2,500 tons in open bins on the wharf front, for simultaneously unloading 50 tons of coal per hour from each of two vessels or lighters, and for transferring, storing, distributing or reloading the coal at an equal speed. The bottom in front of the wharf will be dredged to a uniform depth of 20 feet and width of 50 feet. The wharf has a front of 410 feet and a depth of 75 feet, and has a floor of pine plank on steel beams and girders supported 12 feet above low water on iron and concrete piers and piles. The shore side of the wharf is practically continuous with the discharge tracks under the coal sheds, which extend 150 feet farther back from the shore. A track 45 feet high and 30 feet wide extends across the front of the wharf parallel with the shore line and on it there are two traveling hoisting towers with movable booms which project 40 feet beyond the face of the wharf. There are two 193½ x 145½-foot two-story coal sheds, 46½ feet apart in the clear,



which are connected with the tower track by elevated lattice girder bridges of about 56 feet span. The two sheds are duplicates, about 59 feet in extreme height above the wharf floor and are built entirely of steel and concrete. Coal is delivered to them on tracks in the monitors, is stored on the second floor and is discharged through valves in the floor to cars on a system of tracks at the wharf level, by which it can be taken to any part of the wharf and transferred or delivered to vessels. Between the sheds is a steel and concrete house for the fire pumps and boilers, and back of the house is a twin tank tower of 50,000 gallons capacity. The arrangement of the plant, location of tracks and operation of tower hoists are indicated on the general plan and sections of the wharf and coal sheds. Coal is unloaded from ships or lighters by clam-shell buckets suspended from trolleys on the tower booms; is hoisted up, traversed back over the wharf, dumped in a hopper and thence into dump cars. The dump car stands on a weighing platform, and after weighing, can dump the coal into the wharf bin. Usually, however, the dump car runs by gravity on one of twelve tracks at right angles to the tower track, which extend through the monitors of the coal sheds. As the cars descend into the sheds they raise attached counterweights and when they are dumped at any required position the counterweights return the cars automatically to the foot of the tower ready for another load. In the floor of each coal shed there are 192 24-inch valves through which the coal can be drawn into surface cars in the lower story of the sheds, and thence transferred to any point on the dock front to be loaded into ships by the traveling towers, or to be used for filling the wharf bin. The contents of the wharf bin can be loaded directly through chutes into vessels alongside, or can be discharged into cars on the surface tracks and transferred.

The wharf is mainly supported on cylinder piers 24 feet apart in two longitudinal rows 30 feet apart. The front row of piers is 13 feet back of and parallel to the face of the wharf and the rear row is 30 feet from the face of the bulkhead wall under the front of the coal shed. The piers support on their center lines, transverse girders made of pairs of 24-inch 80-pound I-beams and 20 x ¾-inch cover plates 75 feet long over all. Web-connected to the girders are longitudinal 24-inch I-beams 10 feet apart supporting across their top flanges 7-inch transverse I-beams 2.4 feet apart, which are covered with a diagonal planking of 3-inch Oregon pine. The front ends of the transverse girders and the centers of the front longitudinal 24-inch I-beams are supported at intervals



The Naval Coaling Plant at Sangley Point, P. I.

of 12 feet by cast-iron sectional piles about 12½ inches in outside diameter and 70 feet long. They are made as shown in the detail drawing, in 12-foot sections, with turned hub and spigot joints locked together with through bolts. The lower ends are fitted with driving points and the upper ends are capped with cast-iron seats for the beams and girders. The former have vertical lugs to receive connection bolts through the beam webs, as shown, and the latter have horizontal base plates on which the bottom flanges of the girders are bolted. Both have vertical lugs for the connection pins of the 2-inch X-brace rods in the vertical plane between two lines of longitudinal struts 8 feet apart, which connect the tops of the piles above low water. The piles are strengthened by two 30-pound rails inside and are filled with 1:5 Portland cement mortar. To the 24-inch longitudinal girder in the face of the wharf are secured by 3 x ¾-inch U-straps the tops of inclined creosoted fender piles 6 feet apart on centers.

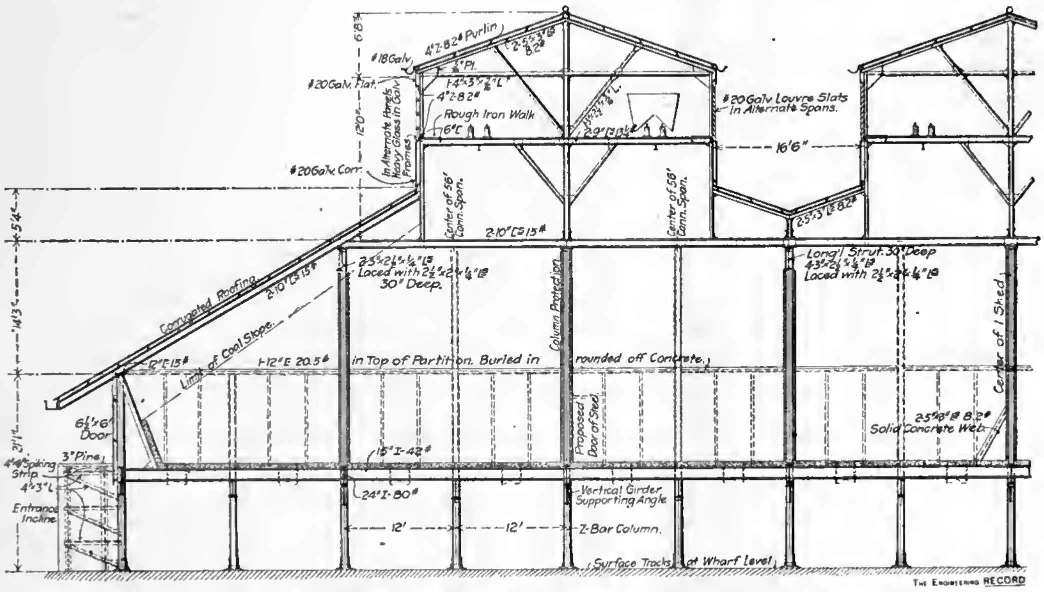
In each of the main wharf piers there are seven Oregon pine piles driven to 1-inch penetration under a 20-foot blow of a 2,000-pound hammer and calculated for maximum loads of 15 tons each. Six of the piles are cut off 5 feet below low water, the center one is cut off 6 feet higher, and all are enclosed in a sectional cast-iron shell filled with 1:2½:5 Portland cement concrete. The shells extend about 9 feet below the bottom of the bay for protection against the teredo, and are made up of flanged sections 4 feet 8 inches long, fastened together with 1-inch galvanized iron bolts about 12 inches apart. The shells are all one inch thick and the lower sections are cylinders 6 feet in diameter inside, while the three upper sections taper to a diameter of 3 feet at the top. Radial vertical lugs are cast on the foot of the second section from the top to receive the connection pins for the diagonal struts which brace the outer row of piers with the cast-iron piles in the face of the wharf. The concrete filling is crowned up an inch or two above the top flange of the shell and supports the transverse girders directly on a base plate bedded on concrete; only the bulkhead wall of the coal sheds supports the shore ends of the transverse girders. It is 10 feet high, 5¼ feet thick at the base, and 12 inches thick on top, battered on both sides and stiffened with buttresses 6 feet wide at the foot and 12 feet apart on centers. The wall rests on two rows of piles with two extra piles under each buttress.

The main piers of the wharf support on their centers the vertical posts of the steel trestle for the tower track. The bents are transversely braced, as shown in the sectional elevation of the wharf, and are connected longitudinally by two lines of horizontal plate girders. In the upper part of the trestle there is a coal bin about 22 feet clear of the wharf. This bin is fitted with swinging barge and bagging chutes 12 and 24 feet apart, respectively, and is connected with the upper parts of the coal sheds by lattice girder deck spans which carry the automatic coal tracks. All bolts and bracing in the wharf up to a height of 8 feet above low water level are galvanized. The minimum thickness of the structural steel is ⅜-inch, except below high water, where it is 9/16 inch, all sections being made thus extra thick to allow for loss by corrosion. The wharf is designed for a wind pressure of 50 pounds per square foot of exposed surface and for a uniformly distributed load of 350 pounds per square foot, besides the weights of towers, hoppers, coal bins, etc. The steel is designed with a factor of safety of 4, and the fender piles and walling pieces are creosoted.

The coal sheds are twin rectangular steel structures symmetrical with the transverse center line of the dock. They are each 193½ feet wide, parallel with the wharf front, and 145½ feet long, and are very simply constructed with numerous steel columns, beams and struts, without trusses or heavy girders. Under each shed there are thirteen longitudinal and seventeen transverse rows of columns 12 feet apart on centers in both directions. Each column has a separate pyramidal concrete pier 3 feet square on top and 10 feet high, with a pile foundation. Most of the piers have four piles and are 6 feet square at the base. Special piers have six or eight piles and there are altogether 2,480 piles under both sheds. Between the piers the ground is filled in up to the column bases to make a solid first floor under the sheds at the level of the wharf deck.

The columns in the coal sheds are each made with a web plate and four Z-bars and support directly the floor and roof beams and the monitor frames. Where the columns are in contact with the earth filling they are protected by concrete on wire lathing. Each row of columns which is transverse to the wharf front carries a line of 20-inch 65-pound or 24-inch 80-pound I-beam girders, which are connected to them by web angles and are seated on shelf angles with horizontal flanges reinforced by vertical distributing angles. These girders carry lines of 15-inch 45-pound I-beams 4 feet apart on centers, which are two panels long, are web connected to the girders at their ends and at their centers rest across the top flanges of the intermediate girders. The top flanges of the transverse beams are covered by a slab of 1:2½:5 Portland cement concrete 5 inches thick with a steel reinforcement embedded in it 2 inches above the bottom and covered with a granolithic surface 1 inch thick. The steel reinforcement consists of a galvanized wire netting with meshes 4 inches wide in both directions. In the direction of the stress the wires are No. 3 gauge, and in the opposite direction they are No. 10 gauge, electrically welded at all intersections. The concrete slabs thus formed bear the weight of the coal and were tested satisfactorily under direction of Mr. Felix Freyhold, engineer of the Bureau of Equipment. The electrically welded netting with different size rods in longitudinal and transverse directions is manufactured specially by the Clinton Wire Cloth Company, New York, and has the additional advantage that it can be procured in continuous lengths over 8 feet wide and 200 feet long, thus simplifying the splices and making economical laying.

The coal floor occupies the whole area of the coal shed and is about 12 feet high from the ground to the upper side of its floor. It has a capacity of 25,000 tons when filled to the maximum depth of 20 feet. The sides are inclined about 5:13 from the vertical and are constructed of reinforced concrete slabs like those in the floor, which are supported on inclined members made of two 6x4-inch angles riveted to the tops of the longitudinal beams and to a 12-inch wall-channel with its web in the plane of the rafter beam. Each coal bin is divided in four equal chambers by center longitudinal and transverse partitions 10 feet high, having double walls 3 inches thick, one on each side of the columns on the center lines of the building. The framework of the partition consists of a single 12-inch horizontal channel on top and 8-inch vertical I-beams, 4 feet apart. The 12-inch channel is protected by a convex layer of concrete in which it is embedded.



HALF-TRANSVERSE SECTION OF ONE OF THE COAL SHEDS.

Steel doors in the sides of the bin give access to it and the intermediate columns which pass through it are protected with concrete jackets. The coal is supported directly by the horizontal beams and girders, and as there is no horizontal thrust except on the low side walls, there is no lateral or horizontal bracing. About 23 feet above the floor of the bin there are beams composed of two 10-inch channels across the tops of the longitudinal columns to support the monitor frames. The monitor frames are built of channels and angles with riveted connections, and have horizontal transverse beams to support the wooden stringers of the inclined coal - delivering tracks. There are two tracks in each monitor and under the center of each track there is an I-beam carrying a pair of trolleys to support a movable deflection board which can be moved from place to place to receive the coal from a car in any position.

The three monitors in each shed occupy a total area of about 128x98 feet, on all four sides of which the hipped roof slopes uniformly to the eaves, which overhang the wall columns about 7 feet. Between the monitors there are valleys 16½ feet wide with flat slopes supported on pairs of 5x3-inch angles. In the center of each valley a space about 14 inches wide is filled solid with concrete flush with the roof surface to form a gutter pitched to the hip roof at each end of the monitor. All purlins in the main rafters, monitors and valleys are 4x3x3-inch Z-bars 4 feet apart. Horizontal Z-bars, like the purlins, are attached to the outer faces of the wall columns and the walls and roofs are covered with No. 20 galvanized corrugated iron, lapped two corrugations at joints. The roof leaders are 8 inches in diameter, made of No. 18 galvanized iron, and discharge into 12-inch glazed terra-cotta drain pipes emptying into the bay at least 30 feet from the face of the shed. The monitors have alternate side panels of glazed windows and galvanized iron louvres.

The outer solid wall covering terminates 2 feet below the tops of the columns and the remaining space is filled with small panels, every third one of which is movable so that it can be opened for ventilation. There is an exterior vertical roller-hung door to each division of the coal bin and two doors to each division facing the wharf, all of them having inside flash boards to keep the coal away from them. Inclined planes 40 feet long with steel frames and plank floors give access to the side doors from the surface of the ground, so that coal may be transported over them by hand if necessary. There are no hopper bottoms in the coal floor, but in the center of each 12x12-foot panel between columns there is a 24-inch double revolving floor valve which can be operated by one man and will draw off all but a very small quantity of coal which can, if necessary, be easily shoveled or scraped into the valves by men on the floor when the latter is nearly empty.

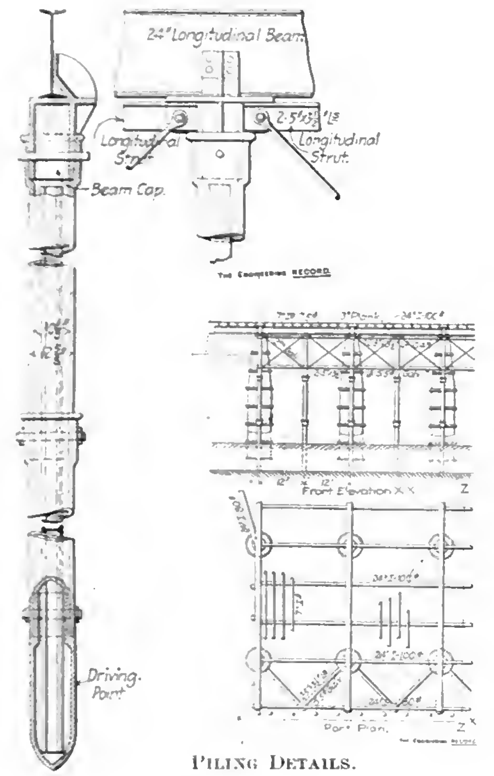
Vertical galvanized iron pipes 4 inches in diameter and 24 feet apart in both directions extend from the floor level to above the top of the maximum slope of the coal on the floor. They are pierced with ½-inch holes 6 inches apart, and both ends are capped and arranged to be accessible for testing, examination and cleaning. In each pipe is suspended a mechanical thermostat of open circuit type connected up to operate a danger signal in the custodian's house.

The coal handling plant includes two traveling steeple towers each with separate hoisting and traversing engines designed for 160 pounds steam pressure, 55-foot boom with 1-ton buckets of a loading or unloading capacity of 50 tons per hour and a 10-ton hopper with chute for loading automatic cars. All the tower machinery is housed in a shelter built of No. 20 galvanized corrugated iron. There are twelve automatic railways, four two-ton automatic dumping cars with oak bodies, lined with steel and mounted on a flexible wheel base; two automatic railway platform track scales, 7,200 feet of sectional track, 90 one, two and three-way switches and five two-ton industrial railway scales. There are also 36 one-ton coal tubs, 15 half-ton lever tubs, 6 bag trays, 36 one-ton four-wheel flat-top cars, and 36 1½-yard tip-cars.

Between the coal sheds is located a pump and power house about 22 feet wide and 50 feet long, with concrete walls and roof enclosing a steel frame supported on 32 piles driven in clusters of four and surmounted with concrete piers as for the coal sheds. Adjacent to the power house is a double steel tower with elevated fresh water storage tanks of 50,000 gallons combined capacity. In the power house are installed boilers and a 6x5¾x6-inch duplex pump with a capacity of pumping 100 gallons of fresh water per minute from boats for the boiler supply. There is also a 12x8½x12-inch duplex pump for fire pressure. It has an

8-inch suction pipe with strainer head in the bay and delivers into a 6-inch cast iron main laid around the outer walls of the coal sheds. It is connected to eight 2½-inch hydrants placed opposite doorways and fitted with couplings for standard navy hose connections. In each shed there is one 4-inch fire main along the wall of each outside monitor with valves and hose connections 75 feet apart. A similar 4-inch main is laid along the face of the wharf inside the guard timbers.

Materials are shipped from this country to Manila on the U. S. colliers and the work is erected by the Atlantic, Gulf & Pacific Company, the American Bridge Company being subcontractors for the structural steel work and the C. W. Hunt Company for the coal-handling machinery.



Piling Details.

The Dual Water Supply of Calcutta.

Calcutta has long been noted among engineers as possessing two distinct and extensive systems of water-works, made necessary by the peculiar local conditions. It is built on the right bank of the River Hugli on land so flat that it is necessary to go 100 miles from the town to reach an elevation of 100 feet. The average annual rainfall is about 61½ inches, occurring mainly in June, July, August and September. The maximum monthly temperatures in the shade are from 76 to 95 degrees and the minimum from 55 to 79 degrees; the greatest range in the year is from about 44 to about 107 degrees. The water supply was drawn originally from the river and from tanks in which the rainwater was collected. In 1820 a pumping station was built which furnished river water to open brick channels running along the streets of a small part of the city, and this plant, with some extensions, sufficed until 1862. In that year works planned by the late W. Clark were authorized. The scheme, subsequently enlarged and modified, provided at first for the distribution through a pipe system of 3,000,000 to 4,500,000 imperial gallons of filtered water at an expenditure of $550,000 to $675,000. This was the commencement of the present works, which although long known in a general way to be of much interest, were never adequately described until the Institution of Civil Engineers recently published a paper concerning them, by Mr. Arthur Peirce. From this paper the following notes have been taken.

The construction of the original works was commenced in 1866-1867. They were designed to supply 6,000,000 imperial gallons of filtered water per day, to a population estimated at 400,000, or an average of 15 gallons per head per day. The actual cost of the work appears to have been about $3,300,000.

Intake-works were constructed on the river bank at Palta, about 14 miles above Calcutta, and practically beyond the influence of the brackish water brought in by the tide. Water is pumped from the river by three 50-horse-power beam-engines, into six masonry settling-tanks having a total capacity of 24¼ million imperial gallons. From these tanks the water gravitates, after settling, onto the filter-beds, twelve in number, which have a collective area of 240,000 square feet. After filtration the water is collected in a central well, and gravitates through a 42-inch cast-iron pipe, having an average fall of about 1 foot to the mile, to a second station at Tallah, some 12½ miles distant, and near the northern boundary of Calcutta. At Tallah the water is received into a covered reservoir of 1 million imperial gallons capacity, from which it is raised by pumping machinery and distributed. The distribution is effected by pumping directly into the mains, without intervention of raised reservoirs or stand-pipes, a direct pumping station being provided in the city to furnish sufficient pressure in certain districts. Its supply is taken from a 6¼-million gallon underground reservoir.

The growth of the population, together with the extension of the boundaries in 1888, led to a largely increased demand upon the works as originally carried out, and it was accordingly decided to augment the supply considerably. A new pumping station was erected at Palta, about ½ mile distant from the old station. Three 75-horse-power pumping engines were installed, and ample provision for settling purposes was obtained by the construction of four large "kutcha" or earthen settling-tanks, two 2,060 feet in length by 230 feet in width, and two of 2,060 feet by 355 feet, the whole having a total useful capacity of 82,750,000 imperial gallons. Twenty-four additional filter-beds were also constructed, each 200x100 feet, increasing the filter area by 480,000 square feet. To convey the increased supply of water to Calcutta, a new 48-inch cast-iron pipe, 66,000 feet in length, was laid between Palta and Tallah pumping stations. The works at the receiving station at Tallah were strengthened by the addition of two new pumping engines, whilst the reservoir accommodation was increased from 1 to 3 million imperial gallons. An additional pumping engine was erected at the old city pumping station, and a new station was erected at another point, where four beam-engines were fixed and an underground reservoir was constructed of 4,000,000 gallons capacity. For the supply of the southern suburbs still another new pumping station was built and fitted with two triple-expansion Worthington engines, with an underground reservoir of nearly 3,000,000 gallons capacity. These extensions were completed in 1891, and were designed and carried out by Mr. J. Kimber. Subsequent additional engines were set up at Tallah, but the system of supply remained unchanged.

The cost of the whole of the filtered-water works, up to March, 1899, amounted to about $15,000,000.

The six original settling-tanks are each 500 feet in length, 250 feet in width, and 7 to 9 feet in depth. They are constructed entirely of masonry, four of them being provided with a series of silt-catching pits, whilst the remaining two are plain. In practice no particular advantage is found to be gained by the use of the silt pits.

The new settling-tanks present more novel features; they are merely excavated in the soil, a poor sandy clay, and the banks are formed from the soil, puddling being dispensed with except upon the side of the tank next to the filter-beds. The other banks were formed by depositing the excavated material in layers of 1 foot thickness, and consolidating them with water. In September, 1888, towards the end of the rainy season, a breach occurred in the outer bank of one tank, and with the outrush of water some 50 feet of the bank was carried away. Two days later the bank between this tank and an adjoining one gave way, making a breach about 30 feet in length. After repairing these breaches steps were taken to prevent the erosion of the repaired banks by the action of the waves; strong bamboo piles were driven at the toe of the slope, and the bank was pitched with rough-dressed stone. Other portions of the banks are pitched at the water-level with bricks set on edge. The percolation from the tanks is remarkably small considering the nature of the soil, the ascertained loss in depth being only ¾ inch in 24 hours and of this 5/16 inch is accounted for by evaporation.

The original filter-beds consist of 1 foot of pebbles, ranging in size between that of a goose egg and that of a pea, overlaid with 4 inches of coarse sand, and topped with 2 feet 6 inches of fine river sand. On passing through the filtering media the water is collected in small cross-drains 4 inches square in cross-section, covered with tiles spaced to permit the water to enter the drain. The cross-drains in each filter deliver the water into a collecting-drain laid along the middle of the filter, and these drains in turn deliver into a collecting-well from which the water flows directly into the conduit-pipes. The new filter-beds consist of two courses of dry bricks properly spaced to permit the passage of the water, overlaid with 4 inches of coarse sand, and topped with 2 feet 6 inches of fine river-sand. The two systems of filters appear to work equally well so far as the filtration is concerned, but the new filters are to be preferred as being more simple and more cheaply constructed, and are more easily cleaned than the original filters. The minimum thickness of sand permitted, before replenishing, is 1 foot. The average rate of filtration which has been found to yield the most satisfactory results is 40 imperial gallons per square foot per day of 24 hours, the head of water varying between 3 and 20 inches. The filtrate is clear and bright excepting at the commencement of the rains, when an opalescent tinge is noticeable, which is probably due to iron and other compounds washed from the upper watershed by the first heavy rains. The number of bacteria in the filtered water now seldom exceeds 50 per cubic centimeter. The only suspicious feature in the bacteriological test is the continued presence of the bacillus *coli communis*, but the bacillus is common to most Indian surface-waters. In washing the dirty sand no mechanical washers are employed. The dirty sand is placed in masonry tanks measuring about 12x12x3 feet, and having false bottoms, under which water from the settling-tanks is introduced. An objectionable feature of this method of washing is that it necessitates men standing in the tanks to agitate the sand.

The two conduits between Palta and Tallah are 4 feet and 3 feet 6 inches in diamater and 66,000 feet in length, and work under heads of 12.2 feet and 9.5 feet respectively. They consist of cast-iron pipes with turned and bored joints. The calculated discharge in 24 hours of these pipes running full (by the Kutter formula, taking the value of n as 0.011), is:

3-ft. 6-in. pipe..........	7,640,000 imperial gallons
4-ft. pipe	12,616,000 " "
Total	20,256,000 " "

which approximates closely to the actual discharge.

The underground reservoirs at the distributing stations are filled during the night from Tallah pumping station, the water being pumped through what is known as the independent pumping-main, a pipe 2 feet 6 inches in diameter reserved for this purpose only. The engines at the distributing stations complete the distribution in the service mains. The distributing mains vary between 2 feet 6 inches and 9 inches in diameter, and parallel services between 6 inches and 3 inches diameter are provided for mains exceeding 1 foot in diameter. The total length of mains and services now in use in connection with the filtered supply is 315 miles.

Ferrule connections with the main are allowed to all pucca or masonry houses, the size of the ferrule varying according to the assessed annual valuation of the premises, or the gross annual rent less 10 per cent. in the case of rented premises. In the case of "bustees," or groups of native huts under one ownership, one or more connections were formerly allowed, according to the ratable value of the property, the taps being fixed in an open space accessible to all, but under the new Municipal Act of 1899 connections are only allowed with pucca or masonry houses. In other cases water is drawn from standposts fixed at frequent intervals in the public streets.

The present practice in Calcutta is to maintain a pressure equal to a head of about 60 feet at the distributing stations between 6 A. M. and 10 A. M. and between 3 P. M. and 6 P. M. In addition a low pressure, sufficient to serve the standposts, is maintained during the remaining day hours in the more thickly-populated portions of the town.

The average daily consumption of filtered water in the town and suburbs now amounts to 20,356,873 imperial gallons, which for a population estimated at 843,487 (including floating population in port and canals) gives an average of 24.1 gallons per head of population per day. Filtered water is not used for road-watering or sewer-flushing.

In addition to the supply to the town and suburbs, water is also supplied to the cantonment at Barrackpur and to the municipalities of Dum Dum, Cossipur, Chitpur and Manicktolla. The quantity of water so supplied is on an average about 300,000 gallons per day. Connections are not generally permitted, and the supply is drawn principally from standposts.

The nature and habits of the population, and the tropical climate, in Calcutta, together with the dense population in portions of the town, render an ample supply of pure water a necessity, if the ravages of disease common under such conditions are to be successfully combated. A supply of 24.1 imperial gallons of filtered water per head per day must, however, be considered an ample allowance for domestic purposes, as in addition to the filtered supply there is a copious supply of unfiltered water for use in road-watering and sewer and privy-flushing. The existing intermittent supply of filtered water is unsatisfactory and its distribution is defective. The lavish use of the water and the careless habits of the population, taps being constantly left open in all parts of the town, lead to considerable waste. Much of this waste is doubtless due to the fact that the supply is an intermittent one; the pressure being maintained for a few hours only during the day, the consumers leave the taps open to fill various receptacles. Another cause of waste is the state of some of the older mains and services laid in the town, which are believed to be unsound, but as an easy escape is provided by old sewers and drains, it is difficult to localize the leaks.

The average cost of the filtered water, including all charges, repayment of loans and interest, amounts to about 5 cents per 1,000 imperial gallons. The charges are met by levying a rate of 6 per cent. upon the assessed annual ratable values of properties assessed.

In addition to the filtered water supply, the town proper is in possession of a practically complete system for the supply of unfiltered water, which is used for road-watering, sewer and privy-flushing, watering gardens and fire-extinguishing. This supply, as in similar instances elsewhere of dual supplies, had a comparatively small beginning. It was proposed by the late Mr. W. Clark, M. Inst. C. E., in 1871, when the filtered water supply was fast becoming insufficient for the needs of the population. The scheme was eventually carried out, the old machinery and buildings used for the supply of the town prior to the introduction of the filtered supply being utilized for the purpose. Although the filtered supply was subsequently greatly increased, the idea of abandoning the unfiltered supply does not appear to have been considered; on the contrary, the old pumping machinery was replaced by two horizontal compound condensing engines, each capable of raising 211,000 gallons per hour. These engines have, in their turn, been replaced by four three-stage expansion Worthington engines, each capable of raising 380,000 gallons per hour against a head of 140 feet. The system of pipes in connection with this supply is being extended into every sewered street, and already there are 116 miles of pipes laid, varying in diameter between 4 feet and 3 inches. The water is pumped direct from the river and is delivered without any attempt at settlement or filtration. The average daily supply now amounts to 12,000,000 imperial gallons, and is ample and practically constant, extending to 20 hours per day.

Steam is supplied from four Babcock & Wilcox boilers fitted with mechanical stokers, and superheaters of the Babcock type. The amount of superheat obtained in ordinary working amounts to 137 degrees. Some difficulty was experienced in making the joint tight against the superheated steam, and cylinder-joints are now made with thin asbestos with brass wire-gauze insertion, steam-pipe flange-joints being made with corrugated brass rings. In the smaller steam-pipes flange-joints appear to be a necessity. The difficulty of lubrication was easily overcome by the use of a high-grade cylinder-oil. The water is pumped directly into the mains, without the intervention of stand-pipes or raised reservoirs. There are 3,898 hydrants fixed in the town, for purposes of road-watering, etc. The watering of roads is effected by means of a hose, the hydrants being spaced about 100 feet apart. Sewer-flushing is effected partly by automatic flushing-cisterns and partly by hose. Privies are flushed by means of waste-preventing cisterns.

The unfiltered water-supply has lately been extended to the added area, old machinery from the town station being utilized for the purpose. A new pumping station has been erected on the river bank and about 30 miles of pipe, varying between 2 feet 6 inches and 3 inches in diameter, have been laid in the streets which have been, or are to be, sewered. Two thousand hydrants are to be fixed upon these pipes for use in road-watering, sewer-flushing, fire extinguishing, etc. The supply at present amounts, on an average, to about 350,000 imperial gallons per day, which will be greatly increased when the drainage-works now in hand are completed. These works were carried out under the chief engineership of Mr. A. J. Hughes.

The capital sunk in the unfiltered water system amounted at the end of March, 1899, to $810,000. The cost of pumping the water for the year amounted to half a cent per 1,000 gallons.

In an inland town where ample water is available for filtering the adoption of a dual supply must always be open to question, but once it is adopted, even upon small scale, it is difficult to dispense with it. In Calcutta, owing to the exceedingly level nature of the land, the levels of the streets vary only to the extent of 3 or 4 feet, the sewers have but little fall, and a large quantity of water is required to flush them efficiently. The filtered water has to be brought from a distance, filtered and pumped several times before use, and were it used for flushing purposes the supply would, for economic reasons, have to be curtailed. A large quantity of water is also required for road-watering, as little or no rain falls between the months of October and June. River water is easily obtained all the year round, is drawn from a central point, and costs 1.68 cents per 1,000 imperial gallons, as compared with 5 cents for filtered water. The principal objections to the system lie in the cost of providing and maintaining separate systems of mains and pumping stations, and the distribution, in a tropical climate, of water that is unfit for drinking purposes and is at times charged with cholera and other dangerous water-borne bacilli. The latter objection is a most serious one when it is considered that the bulk of the native population are too simple and uneducated to realize the danger likely to arise from the use of such water.

The Adjustment of Water Rates.

The San Antonio, Tex., Water-Works Company is operating under a State charter expiring in 1933, a municipal franchise for the use of streets which run ten years longer, and a municipal contract for public and private water supplies which will terminate on August 1, 1903. The proximity of the last date, the need of extensive additions to the company's plant, and the desire of the city authorities to establish a new schedule of rates led to a correspondence lasting some months between the parties to the contract. While both sides were conducting the negotiations in a friendly spirit it seemed impossible for them to reach a mutually satisfactory agreement unaided, and the city and company accordingly united in requesting Mr. Chester B. Davis, M. Am. Soc. C. E., of New York to assist them in establishing a just schedule of rates and form a contract for a period of ten years. He accordingly made an examination of the plant, the requirements of the community as to water, the methods of managing the company and the improvements and extensions of the plant which the conditions demanded. On the basis of this information he estimated the value of the plant and its legitimate expenses of operation, and prepared a form of contract which was immediately signed by the city and company, thus bringing to a sudden conclusion a controversy which had lasted eighteen months and was still as far as ever from settlement when he was retained. This unusual and highly desirable result makes a study of some features of the report a matter of much interest.

The company was found to be conservatively and economically managed, and the plant well built and capable of performing satisfactorily the service for which it was intended except in a few particulars. One of these defects is a lack of sufficient storage in the distributing reservoir, which does not hold more than a third of the present daily supply. The most serious defect is in the fire hydrants, which are not only altogether too few in number but also of the single-nozzle type which is inadequate to the service of such a city. The scarcity of such hydrants is shown to be a poor business policy, for they cost but $45 or thereabout in place and last indefinitely, while good hose costs about 95 cents per foot and lasts only five years or so. If the hydrants are spaced far apart, long lines of expensive hose are required and the available pressures at the play pipes are much lower than with shorter hose lines. Accordingly the new contract provides on new mains for double-nozzle hydrants at least every 250 feet within the fire limits and at least every 500 feet outside this boundary, and the hydrants in the high districts are to have steamer nozzles as well. On the old mains similar hydrants are to be placed whenever ordered by the city between the old hydrants, although not closer than 125 and 250 feet inside and outside the fire limits respectively, and the old hydrants are to be replaced by better types when ordered by the city, the cost of the work in all such cases to be borne by the city and the cost of materials by the company. The latter also agrees to put in mains of suitable size for fire protection as well as domestic supply and to have them well cross-connected.

While in these and other respects the company is to improve its plant, the city agrees to much better measures for preventing waste, which is excessive. A supply of 80 gallons per capita or about 5,000,000 gallons daily is ample, Mr. Davis reports, while the works are now called upon to supply 8,000,000 to 12,000,000 gallons. This excessive supply is the subject of one of the most interesting portions of the report. It is first shown that its effect is practically to exhaust the present sources of supply and, if unchecked, render it necessary to build very costly new works. As all the water must be pumped the waste is also causing a constant large addition to the operating expenses. Still another effect is felt in the distributing pipes, which are ample, when a reasonable draft for domestic supply is satisfied, to furnish plenty of water for fire protection. If the normal draft is twice as great as necessary, the fire streams are reduced in volume unless very costly new mains are laid. "About one-half of the fuel burned under the boilers and in effect fully one-third of the capacity of the entire plant," Mr. Davis says, "is absolutely wasted and thrown away, it serving no useful purpose; this third has involved the investment of a large sum of money, requires the collection each year from the consumers of water of a large and entirely unnecessary amount of money to pay the interest, the cost of maintenance, administration, operation, etc., besides paying a reasonable profit on all of this to the company as required by law."

The rather unusual position is taken in the report that it is the city's duty to check waste by exercising its police powers. It is stated thus in one place: "The municipality is bound from every fair consideration to take the initiative because it represents the consumers who do not waste and represents all who must pay for it, and more especially because it is the one way above all others which puts it in the position where it can most justly demand a revision of rates and bring about the very minimum cost of water for public and individual use." The report advises the use of meters on large services and also on small services where much waste occurs, but it also advocates inspection, as another quotation will show. "The city's sanitary inspectors and its police can maintain the constant inspection needed at little or no added expense, and since the consumer or the city or both must pay every legitimate item of operating expense, they must really pay for this waste-detection inspector, even if they compel the company to employ and direct the inspectors. It is the city's duty to maintain this inspection and to stop the unnecessary waste, which it can do at a less annual cost to the consumer." It is not apparent that this idea has been embodied in the contract, however, unless the following clause is held to cover it: "That the party of the first part agrees to protect by ordinance the works, fixtures and other property belonging to or controlled by the party of the second part, from interference, wrongful use, injury, carelessness or waste on the part of third persons." The contract gives the company the right to maintain a system of house-to-house inspection and to install meters where water is wasted or used for more fixtures than were stated by the consumer in applying for a supply.

In preparing an estimate of just rates the following items were considered by Mr. Davis to embrace everything to be considered.

1. Administration expenses, including the bookkeeping and collection of accounts.
2. Operating expenses connected with the plant.
3. Maintenance expenses to keep the plant in condition to perform the service required of it.
4. Taxes, because if they are paid they must be earned.
5. Interest, the rate to be conservative and consistent with the locality and the influencing conditions, or it may be considered a part of the gross percentage of profit to be allowed on the plant and its operation in excess of the annual allowances.

Under this plan no allowance is made for improvement and extension expenditures or for depreciation, thus following the railway accounting systems. The expenses for services, mains, machinery and other improvements and extensions become a part of the construction account, which is a part of the total investment. The depreciation is included almost wholly under maintenance, a plan recommended in a recent paper by Mr. Price-Williams published by the Institution of Civil Engineers. Mr. Davis explains his reasons for employing it as follows: "The meaning of the word depreciation in this use is the decrease in value due to a deterioration, and as a rule those who use it in connection with work of construction misunderstand entirely its meaning, and they assume, what is almost always a mere guess, that it is a certain percentage of the value of a new plant, generally varying between 2 per cent. for the more enduring structures and an increasing percentage as the plant or structure is less enduring. Five per cent. annually is usually assumed as the extent of the depreciation of machinery. In truth, nothing of the sort happens with well cared for machinery, for it is properly repaired and maintained, and the maintenance expenditures keep it in proper and running order, long after the percentage depreciation theory would have it useless. It is true that there is a real depreciation in excess of the maintenance expenditures, but what it is in a composite plant like the one under consideration no one knows or can ever determine. A sum equaling a small fraction of one per cent. of the present value of the present plant, contributed annually to a fund which is compounded at 4 per cent. annually, will more than compensate for the actual depreciation in such a plant as the one under consideration, if it is maintained in a reasonable condition."

In estimating the value of the company's property all of the plant and its appurtenances in actual use and actually needed were included at what Mr. Davis considered a fair and reasonable price. Worn out, disused or unnecessary portions and land and rights acquired because of prospective value or need were not included. The actual physical condition of the parts of the plant as compared with new material and machinery, so long as they were reasonably performing their intended service, was not considered, but betterments and extensions imperatively needed to perform any services specified in contracts made before the new rates went into effect ought to be considered, Mr. Davis states. If the valuation were made for the purpose of purchasing the property, he states that it would be proper to make a deduction to represent the actual decreased value of the plant as compared with a new one. "In the one case it is the value, or the cost, of the plant to the owner, in serving his purposes, while on the other, it is the value to the purchaser as compared with the cost of duplicating it new."

As for the reasonable percentage of clear profit which the company should expect, the report is as follows: "I believe it would be outside the spirit of the law and unfair as well to reduce the rate of profit until it equalled the lowest rate of interest, say five or six per cent., on the best loans in the vicinity, because the money invested is not devoted to so conservative a use. Nor do I believe it just to ask the consumers to pay rates sufficient to provide dividends to the stockholders equalling those coming from well-managed successful manufacturing and ordinary commercial occupations, which may easily reach twelve or a greater percentage, because the business of a water company does not involve equal risks. It is my opinion that if the rate is fixed between seven per cent. as the very minimum and ten per cent. maximum, on a reasonable value of the plant above all of the administration, operation and maintenance expenses and also taxes, it will be a fair and reasonable return to the company." The contract which was signed gives a profit of about eight per cent. on the basis of Mr. Davis' figures.

The Action of Bacteria Beds at Newbury, England, in reducing the sludge problem to a minimum, is described in a recent issue of "The Surveyor," substantially as follows: Up to December, 1899, the whole of the sewage was treated chemically. At that time one of the old precipitation tanks, 60x24x4 feet in size, was converted into an experimental bacteria bed by filling it up with furnace clinkers. The results were so satisfactory that two other tanks were converted in the following March, clean sifted shingle dug from a portion of the land at the works being used for filling. These two beds proved even more satisfactory than the clinker bed, so that after six months' working, the Main Drainage Committee was induced to construct a sufficient area of bacteria beds to treat the whole of the sewage. Accordingly five concrete tanks, each 60x24x5 feet, were constructed and filled with gravel. They were first charged on June 24, 1901, and have worked continuously ever since. They are worked on a six-hour cycle (*i. e.*, filled four times in twenty-four hours). The use of chemicals and the work of sludge-pressing ceased on the same day, the saving in these two items being over $1.460 per annum. The capacity of these gravel beds when first charged was about one-half the total cubical contents of the empty tanks; after a few days this shrunk to one-third, and at the end of three months to one-fifth, at which figure it has remained since. The effluent is passed over the land, and has proved satisfactory to the Thames Conservancy analyst. The beds receive only 264,000 gallons out of a total of 408,000 gallons per 24 hours.

Suspension Foot Bridge, Easton, Pa.

By John McNeal, Jr., Civil Engineer, Easton, Pa.

The numerous industries established near the western limits of the city of Easton, Pa., during the past few years, employing about two thousand men, opened the way, in the opinion of the Lehigh Bridge Company of that place, for a small investment in the form of a toll bridge across the Lehigh River, in the immediate vicinity of these works. The location decided upon for this bridge, made the design much out of the ordinary, consequently competitive designs were requested from several bridge companies and that presented in this article, submitted by the Boston Bridge Works of Boston, Mass., was accepted. Specifications and plans for the masonry substructure were prepared by the writer and the bridge erected under his supervision.

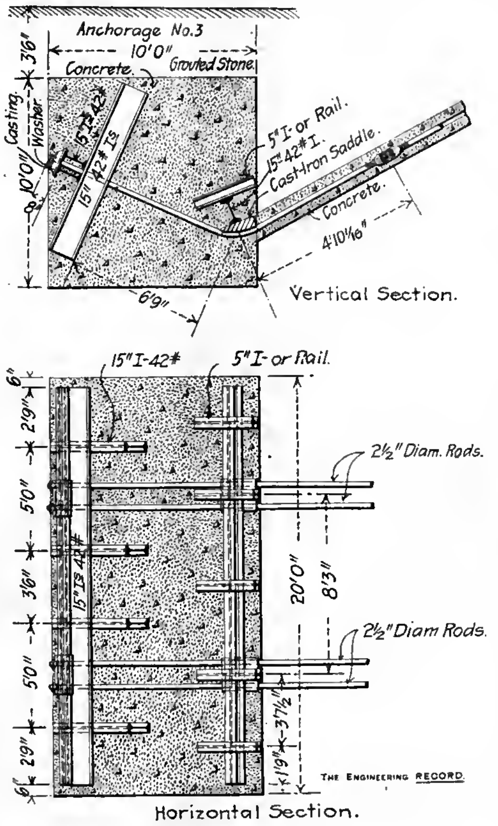
The bridge shown in the accompanying plans, connecting Easton proper with South Easton or the South Side, crosses the Lehigh River, the canal of the Lehigh Coal & Navigation Company and the Lehigh Valley Railroad, making the total length of the structure 668 feet. In order to avoid crossing Dock Street at the north end of the bridge, it was necessary to have four runs of steps to reach the grade of the street. The anchors for this end of the bridge were placed under the bed of Dock Street and the rods to which the cables were attached allowed to project just beyond the street line.

During the excavation for the anchor at the Dock Street end of the bridge, it was found necessary to change the original plan for this anchor, owing to the excessive amount of water encountered, which the gravelly soil allowed to seep through from the river. This change was made possible by making a bend in the anchor rods near the base and adding additional weight in the form of castings and I-beams to overcome the decrease in depth.

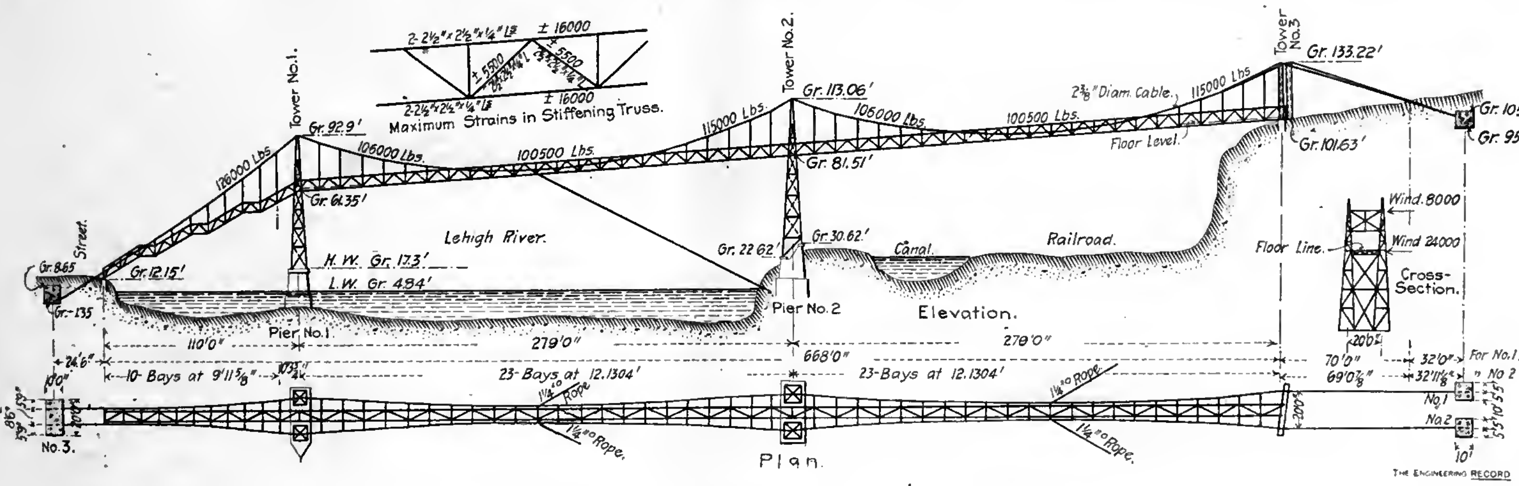
The anchors at the south end of the bridge were placed in a lot purchased by the company, just south of Glendon Avenue, and the cables

The main cables are composed of seven strands of galvanized steel wire, 19 wires to each strand, making a total diameter of 2⅜ inches. One and one-quarter-inch guys were also run from the middle points of the two long spans to anchors placed on the berm bank of the canal and on the sides of Glendon Avenue, at an angle of 45 degrees with the center line of the bridge. The main anchors, as well as the anchors for the guy lines, were imbedded in concrete, at a safe distance under the surface of the ground.

The stiffening truss is attached to the cables by means of hangers composed of ¾ inch round iron. The stiffening truss is composed of two



The Dock Street Anchorage.



The Suspension Foot Bridge at Easton, Pa.

carried above the street by means of a tower placed on the north side of the avenue, leaving a clear headway of 20 feet.

The bridge has three spans, one of 110 feet and two of 279 feet each, necessitating three towers; one in the Lehigh River, one on the berm bank of the canal and the one already mentioned on the north side of Glendon Avenue. The difference in elevation between the ends of the bridge is 89.48 feet. As already stated four runs of stairs are placed at the north end of the bridge leading to a point over the center of the river pier, and from this point to Glendon Avenue the grade of the bridge is about 7.2 per cent.

trusses of 2½x2½x¼-inch angles of the same section throughout, properly braced, in order to give the greatest possible stiffness. The stiffening truss is proportioned for a live load of 20 pounds per square foot, the cables and floor for a live load of 50 pounds per square foot and the floor itself for a live load of 80 pounds per square foot. The width of the footway from center to center of trusses is 6 feet.

On the two long spans, the low point of the cable is 24 feet 3 inches to the north of the center point, the reversed side of the cable being 1/10.

The following Eastonians are the directors of the Lehigh Bridge Company: Wm. Coyle, John McNeal, Jr., Harry H. Haines, Augustus Sausser and George F. Coffin.

The Chemical Analysis of Portland Cement; Its Possibilities and Its Limitations.

A paper read before the American Section of the International Association for Testing Materials by Richard K. Meads.

The value of chemical analysis of Portland cement is becoming more and more appreciated each year. This is due to the fact that the chemical nature of cement is being better understood. Certain compounds are recognized as possessed of certain good or bad influences. In the days when cement mixture was made upon the result of the trial kiln it was natural that little faith should be put in chemical analysis, while now that well equipped chemical laboratories are as much a part of the Portland cement plant as the kilns or the grinding machinery, more importance is being awarded to chemical analysis. It is still a very common error to suppose that because chemical analysis is not an absolute guide to the fitness of cement that it is no guide at all. It is true that the results are in themselves no certain indication of the quality of cement, yet coupled with the usual physical tests they are invaluable, not only as a check upon the physical report, but also as a line on how we may expect the cement to behave on use.

Indeed, certain engineers are now giving great prominence in their specifications to the results of chemical analysis. When important engineering work is to be done, no method should be scorned which will give us any data upon which to base our opinion on the fitness of the cement to be used. No expert upon water supply would recommend or condemn any save a decidedly good or bad water upon the result of a sanitary analysis only, yet no such expert would pass an opinion without having one made. Just as the sanitary expert compares his analysis with the topography of the land and studies the sources of contamination and the causes which tend to make each item high or low, so must the cement expert balance one item against another, and form his estimate on the whole, not from a single point. Of course, this does not apply to cements in which magnesia or sulphur trioxide exceeds the limits or in which the lime is markedly too high or too low. These can in most cases be condemned on this one count.

Cements are usually analyzed for the following constituents: Silica, iron, alumina, lime, magnesia, carbon dioxide, sulphur trioxide and water. The last two are ordinarily determined together and called loss on ignition. The variation in the percentage of any one of these elements is confined between narrow limits. In a table of over 100 analyses compiled by the writer, comprising some 30 or more brands of American, English and German Portland cements known to be of high quality, the limits of variation were as follows: Silica, 20.95 to 23.48; alumina, 5.51 to 9.74; ferric oxide, 2.28 to 4.95; lime, 58.93 to 65.59; magnesia, 0.90 to 3.18. To find that the composition of a cement lies within these limits does not assure us that the cement is all right, because the hydraulic properties depend also upon the thoroughness and the way in which these elements are combined. If, however, a cement mixture is incorrectly proportioned no amount of burning can make of it a first-class cement.

The silica, alumina, lime, magnesia, etc., are combined to form three classes of compounds: 1, Compounds having hydraulic properties, such as the trisilicate and di-aluminate of lime; 2, compounds modifying the setting and hardening of cement, either for good or bad, such as free lime, magnesia and calcium sulphate; 3, inert compounds, such as uncombined clay, sand, calcium carbonate, etc. Since we know of no compounds which absolutely modify the properties of cement for the good, the ideal cement would consist only of compounds in class 1, viz., it would be all tri-silicate, and di-aluminate of lime. The compounds in classes 2 and 3 should not aggregate more than 10 per cent. in good cement.

Chemical analysis will show us per se if such deleterious compounds as magnesia, calcium sulphate or sulphide are present in sufficient quantities to injure the cement. The analysis will also show if the cement is of normal composition. Even if the magnesia, etc., are under the limits, cements with abnormal proportions of the chief constituents, unless wanted for some special purposes, are to be looked upon with disfavor. Chemical analysis will also let us calculate by the use of the "hydraulic index" if the lime limit has been exceeded or if the percentage of lime is far under this. The analysis can be made to show the percentage of uncombined clay, sand, and calcium carbonate and can be made to serve as a check upon the burning, and also upon the care with which the mixing and grinding were done.

The experiments of Le Chatelier, Dr. Newberry and others have established the hydraulic properties of Portland cement to be dependent upon the presence of certain silicates, aluminates, and ferrites of lime. Newberry and Le Chatelier both give the formula $3CaO.SiO_2$ to the most important of these compounds, the tricalcium silicate. Assuming that this formula is correct it will be seen that the silica and lime in the compound are in the ratio of 1 to 2.8. The aluminate of lime has the formula $2CaO.Al_2O_3$ according to Newberry and $3CaO.Al_2O_3$ according to Le Chatelier. The first of these formulas is more probably correct, as it agrees closely with the best practice. Taking this as the formula for the aluminate of lime it will be seen that the alumina and lime bear the ratio of 1 to 1.1. From this Newberry deduced the following "hydraulic index" or ratio between the lime, the basic element and the silica and alumina, the acid ones:

Percentage Lime = Percentage Silica $\times$ 2.8 + Percentage Alumina $\times$ 1.1.

Most well-known Portland cements are made from a mixture of cement rock and limestone, or of clay and marl, the composition of which is practically that shown by Newberry's formula. That they do not agree exactly is due to the fact that the formula represents the maximum of lime which will combine with the silica and alumina.

This maximum is seldom attempted by any cement maker because of the danger of an excess of free lime in the cement. In order to get the silica, alumina and lime to combine, it is necessary to grind and mix the raw materials very thoroughly and burn until the lime is all combined. If the grinding is not fine enough, the mixing not intimate enough and the burning insufficient, some of the lime will remain free or uncombined and cause the cement to crack and expand in hardening.

If cement were simply the cement mixture with the carbon dioxide and water driven off, and the lime, silica and alumina properly combined, the analysis of many samples would show 90 to 95 per cent. of the lime called for by Newberry's formula. Unfortunately cement as it comes on the market is unavoidably adulterated by the ash of the fuel used in burning and by the 1 or 2 per cent. of calcium sulphate generally added to slow its setting. The ash, as it is almost entirely silica and alumina, tends to make the lime appear too low and the cement over-clayed. The addition of the gypsum if reported as lime and sulphur trioxide tends to make the lime too high. These two causes act against each other, but still leave a balance in favor of the acid elements, silica and alumina. Unfortunately for chemical analysis there is no good method for differentiating between the free lime and that combined to form hydraulic compounds. The pat test only fixes a limit. This limit is probably as high as 2.5 per cent. and in certain cements even higher than this. In some work done by the writer consisting in adding small increasing quantities of lime to cement, the free lime in which had been saturated by carbon dioxides, the checking began at about 2.0 per cent. and became marked at 2.5 per cent. With the introduction of a method for accurately quantitatively determining free lime chemical analysis will take first place as a method of ascertaining the value of cement.

The nearer the cement comes to having the maximum percentage of lime allowed by Newberry's formula, without showing free lime or under burning by the pat and needle tests, the stronger the cement will be. If, on the other hand, the percentage of lime is considerably below the limit, the cement contains a large percentage of inert material, i. e., uncombined clay, sand, etc., because the lime was insufficient to convert all the clay to silicate and aluminate of lime. For safety's sake cement always contains a small excess of uncombined clay or sand. This is shown by the percentage of silica found by fusion with sodium carbonate (or evaporation of the residue insoluble in hydrochloric acid with hydrofluoric acid) differing from that found by simple solution in dilute hydrochloric acid.

By a little modification we can easily make Newberry's formula show the minimum of lime which should be present in a good cement. Using approximate, conservative figures, it takes about 40 per cent. of the weight of the clinker of fuel to burn the former. About 10 per cent. of this coal is ash, 75 per cent. of the ash is silica and 25 per cent. in Al_2O_3. This would make the fuel ash add 3 per cent. silica and 1 per cent. alumina to that already in the clinker. The percentage of sulphur tri-oxide multiplied by 1.7 will give the lime added by the gypsum. Making these corrections and assuming that the maker should be able to carry in his mixture 95 per cent. of the lime called for by Newberry's formula, we have

Per Cent. Lime $>$ [(Per Cent. Silica — 3) $\times$ 2.8 + (Per Cent. Alumina — 1) $\times$ 1.1] $\times$ 0.95 + Per Cent. Sulphur trioxide $\times$ 1.7

Or Per cent. Lime $>$ (Per Cent. Silica —3) 2.7 + (Per Cent. Alumina — 1) $\times$ 1.0 + Per Cent. Sulphur tri-oxide $\times$ 1.7

No really first-class cement will fall below this minimum limit.

It will be seen that while Newberry's formula fixes the limits of the percentage of lime for a cement, the percentages of silica and alumina may vary. The properties of the compounds themselves, however, regulate the proportions of each, for the tri-silicate of lime gives the hardening powers to cement while the rate of setting is supposed to be controlled by the di-aluminate of lime. Portland cement usually contains from 7 to 10 per cent. iron oxide and alumina together. As the percentage of alumina increases in a cement other things being equal, it becomes more and more quick-setting, and, on the other hand, as the silica increases under similar conditions, its set becomes slower but it will ultimately develop greater hardness.

Iron oxide is supposed to have similar hydraulic properties to alumina. Aside from this it has a decided effect upon the color of the cement. Probably if present in the ferrous state, its action is deleterious and it also points to adulteration of the cement with blast furnace slag, or to cement burned with a strongly reducing flame, either of which show poor cement. In cements examined by the writer made by the rotary process the ferrous iron present was under 0.2 per cent.

The chemical analysis gives us a splendid insight into the care and skill with which the cement has been manufactured. For example, suppose that a cement contains a normal percentage of alumina and yet sets very rapidly. Then the cement is under-burned or the raw materials were poorly mixed. These latter causes tend to make cement quick setting. On the other hand, if the cement sets very slowly and does not contain an excess of calcium sulphate, then it may be diagnosed as over-burned. Again, if the cement is proportioned correctly, according to the formula given, and yet shows free lime when tested by the pat test, the raw materials were probably poorly mixed, not ground fine enough, or the burning was insufficient.

Manufacturers are more prone to sin on the side of under-burning than of over-burning, since over-burned clinker is a very hard substance to grind while under-burned clinker is much easier. Probably the separate determination of carbon dioxide and of water in cement would also aid very materially in getting a line on the burning, as well as explaining many of the freaks of setting so often met. Fresh under-burned cement will show high loss on ignition. This loss is entirely carbon dioxide; on the other hand, cement which has stood some time and has a high loss on ignition due to saturated free lime usually shows as much water as carbon dioxide.

Another test which gives us a good indication of the burning is the difference between the silica by solution in hydrochloric acid and that by fusion with sodium carbonate, since the tri-silicate and di-aluminate of lime are entirely soluble in hydrochloric acid. A simpler way of applying the test is merely to note the residue left on evaporation of the insoluble matter with hydrochloric acid. This residue in a well-made cement should not exceed 0.3 per cent.

In valuing cement the writer suggests that the chemical analysis conform to the following limits: Percentage of silica, 20 to 23; Alumina, 6 to 11. Percentage of lime less than 2.8 times the percentage of silica plus 1.1 times the percentage of alumina. Percentage of lime greater than 2.7 times (the percentage of silica — 3) plus (the percentage of alumina — 1) minus 1.7 times the percentage of sulphur tri-oxide. Percentage of magnesia less than 3½ or even 3. Percentage of sulphur tri-oxide less than 2 or even 1½.

It should be borne in mind, however, that a change in our knowledge of how to make cement may narrow at any time these limits, more especially with regard to the minimum of lime and also of the silica, which is made unnecessarily high by contamination with the fuel ash.

The Power Equipment of a Buffalo Grain Elevator.

A remarkable grain elevator was recently put into service by the Iron Elevator & Transfer Company, of Buffalo, N. Y. It is built entirely of concrete and steel, and is situated on the Lake Shore & Michigan Southern Railroad. All grain passing East over this road is weighed and transferred from Western into Eastern cars at this elevator, which has an actual working capacity of 60 carloads in and out in a 10-hour day. In addition to the regular work of transferring grain in transit, the elevator is equipped for cleaning and separating the mixed grains and, for this purpose, has a storage capacity of 650,000 bushels, divided into 90 steel bins, with a capacity of from 1,000 to 12,000 bushels each. The bins are of rolled steel plates, cylindrical in shape; they are 65 feet deep, and the largest ones are 15 feet in diameter. The foundation is of concrete and is built at a sufficient altitude above the ground to form a working story or basement 10 feet high under the bins.

The grain is handled throughout the building by means of endless rubber belt conveyors and elevating legs which are driven entirely by induction motors located at various points in the structure. The aggregate power provided amounts to 280 horse-power, which is divided among five Westinghouse induction motors, varying in size from 30 to 75 horse-power each. The power is transmitted from the motors to the machinery by rope drives in every case. The cleaning and clipping machinery, located in the second story of the track shed, is all driven by motors; one 50 horse-power motor is connected by a rope drive direct to a large clipper. A 30 horse-power motor is also used to drive a powerful car-pulling machine in the basement.

Electric power is received from the Niagara Falls power circuits in the form of three-phase, alternating current at 2,200 volts. This voltage is transformed to 400 volts for distribution in the elevator. All motors are controlled from a fire-proof electrical room in the basement of the elevator by means of a switchboard from which the wires pass through iron conduits to the motors. In this manner all sparks attendant upon the starting and stopping of the motors are confined to this room and the danger of dust explosions and fires originating from the electrical apparatus is reduced to a minimum.

Compressed air is distributed to all points of the elevator. This air, at a pressure of 100 pounds per square inch, is available throughout the building, and is used for blowing dust out of the motors, for sweeping floors and beams and for syphoning any water that may collect in the drain pits under the elevator. A blacksmith's forge is also supplied with air from this system.

In addition to the iron elevator just described this company owns an older wooden transfer elevator and a very large feed grinding establishment, known as the Diamond Mills, situated near the wooden elevator. The former is a railroad grain elevator of the old fashioned wooden crib type, which has been operated heretofore by steam with great economy, owing to the fact that dust and clippings from the grain were burned as fuel. The Diamond Mills, also, received power for their operation from the plant of the wooden elevator. In spite of this economy, however, both establishments will hereafter be operated by Westinghouse induction motors, receiving current from Niagara Falls, the change being made as a result of the marked saving in cost of operation of the new iron elevator, as compared with that of the old wooden house. The power equipment for these two plants is now being installed and will aggregate about 500 horse-power, comprising the following apparatus: three 75-kilowatt oil-insulated transformers, provided with special tap from which a suitable starting voltage for the motors can be obtained; a 100-horse-power three-phase induction motor and three 75-horse-power motors, three of 50 horse-power and one of 30 horse-power.

Grain Spouts and Motor-Driven Conveyor Belt in Basement.

All the electrical apparatus above mentioned has been furnished by the Westinghouse Electric & Manufacturing Co. Credit for the engineering and construction work is due to the Macdonald Engineering Company, of Chicago.

Tar Macadam.

Extracts from a paper presented to the Midland Municipal Officers' Association by Mr. George H. Owen, Road Surveyor of Nottingham.

Tar macadam is composed of stones cemented together with a mixture of tar and pitch, or tar, pitch and creosote oil. The stone must be perfectly dry, and if at all possible mixed when it is warm, as less tar will be required and it will be more easy to manipulate. The drying process differs in the various towns, but, in my opinion, the kiln or drying floor as used in Nottingham is by far the best. It is composed of iron plates built upon brickwork about 2 feet above ground level, with two fires at each end and the chimney in the middle. The cast-iron plates, about 4 feet by 3 feet and 1 inch thick, are supported upon 4½-inch intermediate walls, which are pigeon-holed to allow the heat from the fires to circulate freely under the floor in its passage to the chimney. The fireplaces, which are carried under about 3 feet, must have a fire-brick roof between them and the drying floor, to prevent the iron from getting red hot and warping. This roof also distributes the heat more evenly. Two large coppers for boiling the tar are placed at one end, capable of holding about 80 gallons, the fire flues of which also pass under the iron floor. The stone is laid on the kiln from 6 inches to 1 foot thick, according to the amount of drying required, and if it is very wet it will be found necessary to turn it over once or twice. While it is necessary to have the stone dry and warm, care should be taken that it is not too hot or it will burn all the nature out of the tar. As regards the stone to be used, it will be found that the tar will adhere better to a porous stone, such as limestone or slag, than it will to granite or whinstone. At Nottingham slag is the chief, and I may say the only, material used, and the sizes are 2¼ inches for the bottom and ¾ inch for the top layer.

The tar mixture to be applied varies considerably, as the quality of the tar differs so much. Thin tar either requires more boiling than thick tar, or it should be stiffened by the addition of some pitch. Tar that has been distilled must not come to a boil, or it will become unworkable and will not incorporate freely with the stone. I do not recommend the use of pitch unless the macadam is to be used at once, for if the tar is boiled sufficiently it will be found to equal the tar and pitch mixture in cementing properties and be far superior in elasticity and covering power. From observations I have found that tar boiled properly has much more life in it and will not perish nearly so quickly as when pitch and creosote oil are added to it. An average time for boiling will be one and a half to two hours, and it should be stirred frequently to prevent it from boiling over or burning. To test the quality of the tar it is a good plan to have a small tin of it boiled over a Bunsen burner and mix some at intervals with some chippings. From these samples one can then determine what time will be required for boiling to bring it to its right consistency. When a workman has had a little experience he can generally tell when the tar is ready by getting a little between his forefinger and thumb. If it rubs off the finger easily it has not been boiled long enough.

The best method of mixing is to have a large bucket, say to hold 10 or 12 gallons of tar. Place two barrows of stone, about 6 inches thick, as a "bottom," on the top of which two men shovel the stone off the kiln while another keeps pouring the tar over it by means of a ladle until the bucket is empty. Then, if the turning be commenced and continued from the bottom of the heap, the stone itself in falling and working will be found to assist greatly in the mixing. It will facilitate in the work to a great extent if a good smooth floor is provided for mixing on, and the workmen should have instructions to keep this floor clean. Two men can mix 10 tons per day of 10 hours. From 8 to 9 gallons of tar (if pitch is added reckon about 10 pounds to a gallon) will be required to coat 1 ton of stone when it is warm, but this amount will vary according to the quality of the tar and the nature of the stone. Granite does not require as much tar as slag, and either of these materials with a quantity of chippings and dust will take more than the clean stone. The treated stone should then lie in the heap about three weeks or a month, but if it is required for immediate use a little pitch, say 2 to 4 pounds per gallon of tar, should be added. While it is necessary to have the stone free from dirt, a quantity of dust and chippings, sufficient to fill the interstices, will augment the binding and ensure a compact mass.

The material when ready for use is laid upon a good, hard, dry rubble foundation. First a layer of 2¼-inch material which, when rolled, is about 4 inches deep, and then a layer of ¾-inch to a thickness of 1 inch. When this has been rolled for some time slag dust or fine gravel is scattered over it and the rolling continued until the whole is consolidated. All wet and moisture should as far as is practicable be kept away from the foundation and the tarred stone, and the work should therefore be carried out in dry weather. A very bad practice is to water the stone before the roller passes over it, to stop the tar from adhering to the wheels. This undoubtedly reduces the life and elasticity and also the affinity of the material. If the roller is kept going over the raw tarmacadam during the coolest hours of the day, say until 10.30 a. m. and from 3 p. m., it will be found that very little will adhere to the wheels, and in the meantime rolling the parts which have already been dusted will be found both practicable and beneficial.

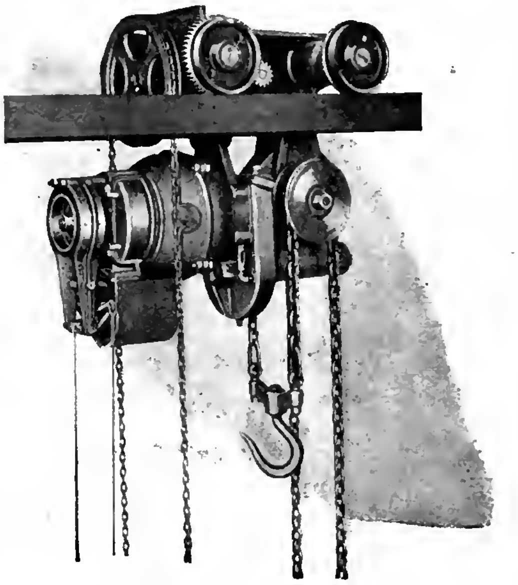
It will be found that tar macadam, if properly mixed and laid, does not begin to wear as soon as the traffic commences to pass over it. Owing to its elastic nature some time elapses before it is completely consolidated and it acts like a cushion to the foundation for a couple of years. When it does begin to wear, and little ruts and hollows make their appearance, they should be "picked out," swept clean, painted with a little hot tar, and a layer of tarred chippings put in and rolled. When a road is very much worn it is best to thoroughly pick the surface to a depth of 3 inches, clean all dirt and all material away, paint or sprinkle lightly with hot tar and resurface in the same manner as for new work. The old material if screened free from dirt can be treated with a little hot tar without the addition of pitch and used again. A very good way of preserving tar macadam is to thoroughly clean the surface, paint with hot tar and sprinkle with slag dust on fine gravel. This is called "floating," and is chiefly adopted in streets where there is very little traffic.

The cost of tar macadam in Nottingham is, roughly, about 40 cents per square yard for materials and labor only. Judging from experience, from 50 to 75 per cent. less labor is required in cleaning it than in cleaning ordinary macadam. Its greater first cost in comparison with ordinary macadam is more than offset by its greater durability.

A New Electric Hoist.

Various attempts have been made to design an electric hoist capable of handling heavier loads than come within the range of hand hoists, and not requiring the heavy and expensive supporting structures necessary to carry the large amount of dead weight of ordinary traveling cranes. The hoist, shown in the accompanying illustration, designed specially to fulfill these requirements, is protected by patents owned by the Sprague Electric Company. It is intended to transfer light work rapidly around shipyards, factories, etc., and, when supplied with trolley carriage, geared hand cross travel and a bridge travel motor, to take the place of small traveling cranes. It consists of few parts, all of which are interchangeable. It is easily adaptable to all types of runways and bridges, and the sizes range in maximum capacities from 1,500 to 10,000 pounds. The smaller sizes can be equipped with a trolley arranged to run on a single rail, or I-beam, and, if so arranged, will take curves of a reasonably small radius.

All the different movements necessary for a traveling crane, hoisting, lowering, cross-travel and bridge-travel, are controlled by simply pulling the chains and cords connected to the mechanism, which can be done by the ordinary workman to be found in the place where the



The Sprague Hoist.

hoist may be used. No special crane operator or cage is necessary. The motor and hoisting mechanism can be hung from a strap if only a hoist and lowering motion is desired, or they can be attached to a trolley carriage arranged for cross-travel, either by pushing the load or by a geared hand traverse motion. A bridge-travel is also provided, the controller for which is mounted on the end of the trolley carriage as shown in cut. This controller is operated by cords, the handles of which are located near the work. The bridge-travel motor itself is mounted in some convenient position on the crane; the bridge-travel motion is reversible, and in practice it is possible to obtain a very short movement in either direction.

The motors furnished with this equipment are Lundell round type motors entirely enclosed and the hoist can be operated out of doors without being affected by the weather. The resistance plates for the bridge-travel controller are of the enclosed type, and have a very large overload capacity. The company manufactures the complete hoist as shown, consisting of hoist wheels and chain, worm and spur gear, gear cases, hoisting motor and attached cylindrical switch, trolley carriage, geared hand operated cross-travel of trolley carriage, and motor and controller for bridge-travel of crane. The hoist and motor can also be furnished complete without trolley carriage or with trolley carriage and geared hand cross-travel, but without bridge-travel motor and controller. The company does not manufacture cranes, but will equip them with this apparatus including wiring. A complete description of the hoist will be given in Bulletin No. 2,098 to be issued from the New York office of the company.

The Relative Rights of Power Plant Owners and Cities to River Water.

An opinion by the Ohio Supreme Court in City of Canton v. Shock et al., 63 N. E. Rep. 600.

The city of Canton is a municipal corporation, and is situated between the east and west forks of Nimishiller Creek; the forks meeting at or near the south line of the city, and thus forming that creek. The entire natural drainage of the city is toward and into these two forks of the creek, which is a natural water course. The city has established its system of water-works on the west branch of the creek, on a lot of land adjoining said branch; and it takes its water supply from said creek, and from certain wells near the same, and from Myers' Lake, near by. The city uses so much of the water supply thus passing through its water-works as it needs for its use as a city, and supplies its inhabitants with water for domestic, commercial, and manufacturing purposes, at a price fixed by the city, so as to produce an income about sufficient to pay the expenses of said water-works.

The defendants in error own a water-power grist mill, located on the creek, a short distance downstream, south of the city, and have used the water of the creek for many years—over 50—as power to run their mill, and until about the year 1887 there was sufficient water to supply both the city and the mill; but as the city grew, and extended its water-works, it used larger quantities of water, and thereby the supply to the mill became reduced to such an extent that in dry seasons of the year there was not sufficient water to run the mill all the time, and it became necessary to shut down at nights. Thereupon, in the year 1898, the defendants in error (plaintiffs below) commenced an action against the city in the court of common pleas, seeking to recover damages from the city for thus using the water, and thereby diminishing the supply to the mill. The city claimed to be a riparian owner, and entitled to make such use of the water of the stream as it had made, and that the plaintiffs below had no greater right to the use of the water to run their mill than the city and its inhabitants had to use the waters of the creek above the mill for domestic, commercial and manufacturing purposes.

Upon the trial of the case these questions were put in issue by the pleadings and evidence. Thereupon the court charged the jury as follows: "On the question of the right of the city to take this water for the purposes named, the defendant claims that substantially all the water diverted by it from the creek in question, and which was not returned to said creek, was used for the purpose of supplying the inhabitants of the city, and a small portion of territory adjoining thereto, with water for domestic, sanitary, agricultural and manufacturing purposes; that said stream does now and for many years has passed in and through the corporate limits of said city; that it owns the premises upon which its pumping station is situated, and has lines of pipe proceeding from said creek and pumping station, and passing through the city, to supply said persons; and that it is, in a sense, a riparian owner located on said stream, and it claims that the inhabitants of said city so supplied by it have the rights of riparian owners in said stream—that is to say, the right to use the same for domestic, agricultural, sanitary, and manufacturing purposes; and I am requested by the defendant's counsel to say to you, as matter of law, that if these facts are true, and if the water so drawn from said stream, and not returned to it so as to be effective for plaintiffs' water power, was substantially all consumed by the citizens of said city, and territory adjoining thereto, for the purposes and uses aforesaid, and if their uses were reasonable in manner and extent, then the city would not be liable to the plaintiffs, although such use might so diminish the volume of said stream that at certain times of the year it would cause a substantial diminution of plaintiffs' water power. I say I am asked by defendant's counsel to so instruct you, but I cannot so instruct you, as matter of law. On the contrary, I say to you, as a matter of law, that the undiminished flow of a natural private stream, such as the one in question is conceded to be, is the right of every riparian owner, yet this right is limited to this extent: that each riparian owner may, without subjecting himself to liability to another lower riparian owner, use of the stream whatever is needed for his own domestic purposes and the watering of stock. The defendant, the city, cannot be considered a riparian owner, within the scope of this exception."

The city saved exception to this part of the charge, and to the charge as a whole. A verdict was returned in favor of plaintiffs below, motion for new trial overruled, judgment entered on the verdict against the city, and a bill of exception allowed, signed, and made part of the record. The circuit court affirmed the judgment, and thereupon the city filed its petition in error here, seeking to reverse the judgments below.

As this is an action against the city for damages, no question as to eminent domain, or appropriation of private property for public uses, is involved in the issue; the controlling issue being as to whether the city, as a municipal corporation, is a riparian proprietor having the right to use the waters of the creek for its own purposes, and to supply them to its inhabitants for the ordinary purposes of life, and as to whether the right to use water from a stream by one riparian proprietor for manufacturing purposes, such as running a gristmill, is inferior or equal to the right to use the water from the same stream by an upper proprietor for domestic purposes.

It is urged by counsel for defendant in error that a municipality situated on a natural water course is not, in its corporate capacity, a riparian proprietor, and that only those inhabitants whose lots or lands border on the stream are such proprietors; and some cases are cited which seem to take that view of the law. Other cases are decided upon the theory that such municipality is itself, in its corporate capacity, a riparian proprietor, and entitled as such, to riparian rights in the stream upon which it is situated. Water Co. v. Carnes, 27 Atl. 609; Mayor, etc., of City of Philadelphia v. Spring Garden Com'rs, 7 Pa. 348; City of Philadelphia v. Collins, 68 Pa. 106; Jones, Easem. Sec. 747, and cases cited in a note to the section. In this State the question remains undecided by this court, and therefore is an open one, and we are at liberty to follow such rule of decision as is supported by sound reason and the weight of authority.

It was held by this court at this term in City of Mansfield v. Balliett, 63 N. E. 86, that a city situate on a stream is liable in its corporate capacity to a lower proprietor for polluting the water of such stream by running the sewage of such city and its inhabitants into such stream. This case holds the city, in its corporate capacity, and as an upper proprietor, liable to a lower proprietor for polluting the water of the stream; and if the city is liable not only for its own acts, but also for the acts of its inhabitants, in flowing sewage into the stream, it must be upon the principle that, as upper riparian proprietor, it has violated its duty toward a lower riparian proprietor on the same stream, and that therefore the city, in its corporate capacity, is a riparian proprietor on the stream, and must bear the burdens of such position. While the inhabitants own their lots individually, the city owns the streets, the fire department, and all other public property and public works, and, in its corporate capacity, provides for the convenience and welfare of its inhabitants as to streets, fire protection, lighting and supplying water; and in such and other like matters the city overshadows the individuals, and stands in its corporate capacity as a single proprietor extending throughout its entire limits, and entitled, as such, to all the rights, and subject to all the liabilities, of a riparian proprietor on the stream upon which it is situated. Sound reason, the weight of authority, and the present advanced state of municipal government, rights, and liabilities, require that a municipality should be held and regarded, in its entirety, as an individual entity, having in its corporate capacity the rights, and subject to the liabilities, of a riparian proprietor; and we so hold in this case.

The bringing of the action against the city for damages is of itself an implied admission that the city, in its corporate capacity, is an upper proprietor, liable for the wrongful diversion or use of the water of the stream upon which it is situated. Being charged with the liability of such upper proprietor, as conceded by bringing the action, and as was rightly held in the City of Mansfield Case, it must also be accorded the rights and benefits of such proprietor. As such proprietor, the city uses the water of the stream, through its water-works, in extinguishing fires, sprinkling streets, and other public purposes, and supplies water to its inhabitants for domestic use and manufacturing purposes. Being an upper riparian proprietor, it follows, as a matter of law, that it has the right to use out of the stream all the water it needs for its own purposes, returning to the stream all that is not consumed in such use; not, however, transporting the water, as was done in Railroad Co. v. Miller, 3 Atl. 780, nor diverting the water, as was done in Wheatley v. Chrisman, 24 Pa. 298. The right of an upper proprietor to use the water of a stream for manufacturing purposes is at least equal to the right of a lower proprietor on the same stream to use the water for a like purpose; and so long as the upper proprietor uses the water reasonably, and returns all the water not consumed in the use back into the stream, the legal rights of the lower proprietor are not invaded. There being no right of property in the water of a natural flowing stream—the only right being to the use of the water as it flows by the lands adjoining the stream—it follows that, as the water comes first to the upper proprietor, he may use it reasonably for power purposes, returning to the stream all that is not consumed in the use, and that the right of the lower proprietor attaches only to the use of the water that comes to his premises after passing, and so serving the purposes of the upper proprietor.

As the right of the city to supply water to manufactories within its bounds for power purposes is only equal to the right of a lower proprietor to use water for the same purpose, the question arises in this case as to the rights of the parties to use the water of the stream for such purposes. The question is a difficult one, both in theory and application, as the different sizes of streams and different circumstances have caused courts to make different holdings, but the combined result of the cases seems to be: That where there is not sufficient water in a stream to supply fully the needs of all the proprietors on the stream for power purposes, no one has the right to use all the water, and thereby deprive those below him from the use of any; nor can those below rightly insist that those above shall use no water for power, and thereby save it all for those below. Each should use the water reasonably, and so as to do as little injury to the others as circumstances will permit. As a loss must fall upon one or the other of such proprietors, neither should be compelled to bear the whole loss, but the water should be so divided and used that each one may bear his reasonable proportion of the loss. And that, in case of difference between upper and lower proprietors, in such cases the question should be left to the sound judgment of a jury, under proper instructions, to say whether the party complained against has used for power purposes, under all the circumstances, more than his just proportion of the water of the stream. Evans v. Merriweather, 3 Scam. 492. This being so, the city of Canton, in supplying water to its inhabitants for power purposes, had the right to use the water of the stream to a reasonable extent only, and so as to do as little injury as might be, under all the circumstances, to the lower proprietor; each party bearing an equitable share of the loss caused by the shortage of water. Dry seasons are not caused by either party, but are the act of God, and each party must bear the losses resulting to him therefrom.

From the earliest dawn of history to the present time, the primary use of water has been for domestic purposes, and its secondary use for the purposes of power. People on the upper stream have the right to quench their thirst, and the thirst of their flocks and herds, even though by so doing the wheels of every mill on the lower stream should stand still. Railroad Co. v. Miller, 3 Atl. 780. And the same right in the use of water as to quenching thirst extends to all uses for domestic purposes, and the right of a lower proprietor to the use of the waters of a stream for power purposes is subject to the superior right of all upper proprietors for domestic purposes, and must yield thereto. All water powers on a stream are established subject to the superior right of all upper proprietors to use water out of the stream for domestic purposes, and if the upper proprietors have grown so large or become so numerous as to consume most or all of the water, the lower proprietors have no cause of complaint, because it is only what they should have reasonably expected in the growth and development of the country, and subject to which contingency they established their water powers.

In addition to taking water from the stream for its own use, and supplying the same to its inhabitants for domestic and manufacturing purposes, the amended petition avers that the city supplied water to its inhabitants for commercial purposes. If this means only that the city received pay for the water so supplied, and thereby made the water an article of commerce, the averment is of no force. The city having the right to supply water to its inhabitants for domestic and manufacturing purposes, it can make no difference in that right that the supply is for pay, rather than for nothing. The injury, if any, to the lower proprietor, arises from the taking of the water, and not from the pay received therefor.

It is also averred in the amended petition that the city supplies water to people outside of the city for domestic, commercial, and manufacturing purposes. If such supply to outsiders, or to be transported away from the city for commercial purposes, is sufficient in quantity to materially injure defendants in error, taking into consideration the size of the stream and water supply, the city, to that extent, is exceeding its right as a riparian proprietor. The general rule is well stated by Paxson, J., in Railroad Co. v. Miller, 3 Atl. 780, 781, as follows: "The principle established by a long line of decisions is that the upper riparian owner has the right to the use of the stream on his land for any legal purpose, provided he returns it to its channel uncorrupted and without any essential diminution; that in all such cases the size and capacity of the stream is to be considered, and that any interruption of or interference with the rights of the lower riparian owner is an injury for which an action will lie, unless too trifling for the law to notice." The obligation to return the water to the stream without "any essential diminution" means that the water not consumed in the use or "legal purpose" must be returned to the stream, or an opportunity given for it to flow back into the stream by the ordinary channels. It cannot be lawfully diverted or transported, so as to prevent it from flowing back into the stream.

The city having no right to materially diminish the flow of the water in the stream to the injury of defendants in error by supplying water to outsiders, or for commercial purposes to be transported to other parts, or to supply to its inhabitants for power purposes an unreasonable quantity, as above pointed out, it follows that if the city has materially diminished the flow of the water in the stream by so supplying water to outsiders or for transportation, or unreasonably for purposes of power, it is liable to respond in damages to the party injured thereby; but for the water consumed by the city for its own purposes, or so supplied to its inhabitants for domestic use, even though it received pay therefor, it is not liable. The water taken by the city from the stream for its own use, and so supplied to its inhabitants, is taken by virtue of its rights as a riparian proprietor, and not by virtue of the right of eminent domain, and therefore no compensation need be made therefor.

The general rule that a lower proprietor is entitled to the natural flow of a stream undiminished in quantity, subject to the lawful use of the water by upper proprietors, has been referred to with approval by this court in several cases. Iron Co. v. Tucker, 26 N. E. 630; City of Mansfield v. Balliett, 63 N. E. 86. In the City of Mansfield case there was no question involved as to the volume or quantity of water; the only question being as to the liability of the city for polluting the waters of the stream, and the right of the lower proprietor to recover damages for such pollution. The case of Iron Co. v. Tucker, supra, was also by a lower proprietor against an upper one for damages for polluting the waters of a stream. The question as to the pollution of the waters of a stream in this State seems to be fairly well settled by these two Ohio cases, but they do not determine the relative rights of upper and lower riparian proprietors as to the use of the waters of a stream, as was so strongly urged by counsel for defendants in error.

The court of common pleas erred in its charge to the jury as to the city being an upper riparian proprietor, and as to its right to use water out of the stream for its own purposes, and as to its right to supply water from the stream to its inhabitants for domestic and manufacturing purposes. The real and only question upon which a liability could be founded, viz., whether the flow of the water in the stream was materially diminished, to the injury of the lower proprietors, by the supplying of water by the city to people outside of its limits, or to be transported away from the city for commercial purposes, or by an unreasonable supply of water for power purposes, seems to have been overlooked, and no charge requested or given on that subject.

The circuit court erred in affirming the judgment of the common pleas. Both judgments will be reversed, and the cause remanded for further proceedings. Judgments reversed.

The Reconstruction of the Redheugh Bridge, England.

The recent reconstruction of the Redheugh highway bridge at Newcastle-on-Tyne, England, was an undertaking of considerable difficulty owing to the necessity of interfering as little as possible with the heavy traffic while removing and erecting spans of a character that made rapid work impracticable. The old highway bridge, completed in 1871, had two river spans of about 252 feet each, two side spans of 167 and 168 feet, and short-span masonry arch approaches making a total length of 1,187 feet. The width over all was 41 feet, including a 20-foot roadway and two 7-foot sidewalks. It had a clearance of 86½ feet above high water and the river spans were supported on three iron towers each with four vertical columns on separate masonry piers. The towers were extended about 40 feet above the top chords of the main spans and carried diagonal longitudinal tension members attached to the bottom chords at points one-third of the way between the piers so as to form auxiliary back stays of suspension guys. The old trusses were riveted lattice girders with cast iron gas mains for inclined top chords and had water mains laid inside the trough-shaped bottom chords.

The piers of the approach arches were used for the new plate girder approach spans and all the rest of the old structure was entirely removed and replaced by the new one, which had spans of the same length and greater width on the same center line and at the same grade. The new piers each consisted of four 8-foot steel cylinders filled with concrete and sunk 50 feet or more below the river bed by the pneumatic caisson process. The cylinders in each pier were 12 feet apart longitudinally and 55 feet apart transversely, on centers. They were built in 4½-foot courses with 6-inch inside circular cover splices and contain permanent 3-foot air shafts between which and the outer shell concrete filling was placed as the pier sunk. After sinking the shafts were also filled with concrete. The contractors were not allowed to reduce the pressure in the working chamber to sink the cylinders, or to move the air lock but once, and a timber grillage was kept inside the working chamber to prevent any inflow of mud. The concrete was not dumped in the cylinders from a height of more than 8 feet and after being placed it was shovelled and trodden by men with rubber boots.

The tops of the cylinders are 6 feet above high water level and are connected by single longitudinal plate girders 3 feet deep and 4 feet long with their center points about at the high-water level and riveted through vertical and horizontal flange angles to the opposite faces of the pairs of cylinders. Each transverse pair of cylinders is well braced.

Each pair of cylinders supports one bent of the tower which is made with a pair of 60-foot columns battered about 1:7 in a vertical transverse plane. Each column is made in three sections and has a cruciform cross-section made with a 36-inch and a 39-inch web connected at their intersection with four 3x3½-inch angles and having two 6x4-inch angles in each flange. The columns are spliced with planed butt ends and flange and web cover plates and their flanges are tied every 6 feet by 3x2½-inch bent angles riveted around the column like a ring. Each bent is divided into three vertical panels by the transverse girders at the top and by a bottom and two intermediate horizontal transverse struts. The width of the strut equals that of the column and its ends form jaws which engage and are riveted to the column flanges. Each panel is X-braced by two pairs of 9-inch plate diagonals, spliced at both ends with double cover plates to the main connection plates. At one end these plates are riveted to the column flanges and at the other end, where the diagonals intersect, they are riveted to a vertical compression member which connects the center points of the transverse horizontal struts.

The tops of the two bents in each tower are connected by four horizontal longitudinal plate girders 12 feet long and 6 feet 9½ inches deep, one girder being riveted across the flanges of each side of each column. Each pair of girders is connected by transverse diaphragms and top flange cover plates. Below the longitudinal girders the bents are connected by 3x3½-inch angle lattice bars, riveted in place as the columns were erected, section by section. Across the top flanges of the longitudinal girders in each tower are seated four transverse plate girders, 6 feet 9½ inches deep and 48 feet long, which overhang 8 feet at each end and have their top flanges flush with the tops of the columns. Bearing plates ½ inch thick are riveted across the tops of the columns and transverse girders to make a solid platform for the pedestals for the trusses of the main spans.

The pedestals are of cast iron, made in two pieces with half holes to fit a 12-inch pin with collars engaging the sides of the pedestals and long ends projecting beyond them on both sides, for use in erection. Each part of the pedestal has one vertical web parallel to the pin and five at right angles to it, the latter staggered in the upper and lower pieces, and the former in the plane through the axis of the pin. The fixed end pedestal is seated directly on a solid forged steel bed plate 42 inches square and 6 inches thick. A nest of segmental 10-inch rollers 5¾ inches wide is interposed between the shorter pedestal and the bed plate at the expansion end of the span.

The main span trusses are of the Pratt type with riveted connections and main panels 16 feet long with horizontal and vertical struts intersecting at the center and a sub-diagonal strut from the center to the bottom chord panel point. The top chords have a trough-shaped cross-section made up of 4x4-inch flange angles, 20x20x$^{12}/_{20}$-inch web plates and 34x1-inch top cover plates. The bottom chords have similar cross-sections with additional inside flange angles, inside cover plates and transverse vertical diaphragm plates. The compression web members are built up of angles and plates latticed, and the main tension diagonals are plates, stiffened at the lower ends with T-bars. The counters have forged steel couplings with screw adjustments through which holes were drilled and pins driven and riveted to lock them after erection.

Plate girder floorbeams 4 feet apart are suspended by vertical angle irons riveted to both webs of the lower chords and carry shallow I-beam stringers 4 feet apart which are supported on shelf angles and are covered with a buckle plate solid floor, paved. The floorbeams are 53 feet long and have tapered cantilever ends extending about 13 feet beyond the trusses and 6½ feet beyond the sidewalk hand rails to carry the gas and water mains. There is one panel of sway bracing between the tops of each transverse pair of vertical posts, and there are light lateral diagonals in the plane of the top chords between the top struts of the sway frames.

Erection was commenced with the reconstruction of the approaches which were built in successive longitudinal halves. Centering was placed under all the masonry arches and the western half of each was taken down simultaneously so as not to impose any unequal thrusts on the piers. The piers were then built up to the required height on the west side of the axis of the bridge and the plate girder viaduct built over them and the roadway constructed. The traffic which had previously been maintained over the old arches in the eastern side of the bridge was then diverted to the new roadway and the eastern half of the approaches built in the same manner. While the approaches were being reconstructed the new piers were built, their cylinders and towers clearing the old ones and allowing most of the tower bracing to be connected up outside the old towers.

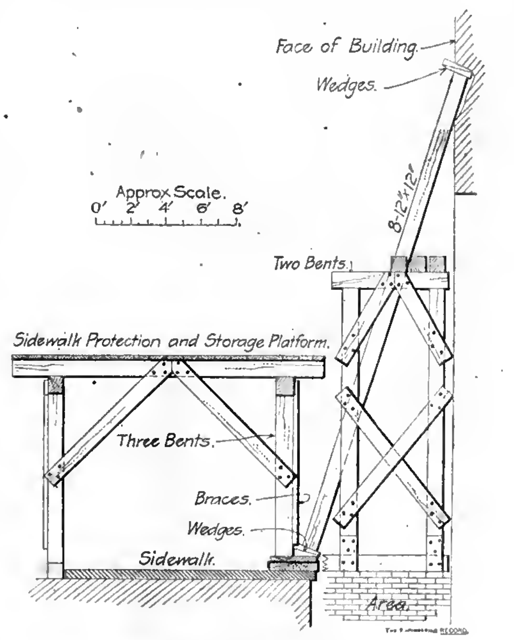
The new main spans were erected with their center lines parallel to the axis of the bridge and 4½ feet away from it so that the new trusses cleared the old ones and could be assembled without interrupting the traffic which was maintained on the old roadway. The adjacent ends of the trusses in the four main spans were built out from the three river piers as connected double balanced cantilevers without any support from the old structure. In erection the ends of the trusses were pivoted on their pedestal pins and the pedestals were blocked up above the required heights.

The gusset plates at the hip joints were extended beyond the inclined end posts and were pin-connected to horizontal tension bars which at the opposite ends were pin-connected to short links over the center of the pier and thus formed ties between the adjacent ends of the trusses in the same plane. The ends of the center link were connected by two pairs of vertical bars with the projecting ends of the pedestal pins of both spans. The vertical bars were made in three sections each, the middle section having 2¾-inch screw ends with nuts bearing on a horizontal yoke, permitted an adjustment of nearly 3 feet. By means of this toggle the ends of the semi-spans were elevated or depressed to meet at the center panel for final connection. During erection the short spans were counterweighted to make their moments around the pier centers equal those of the long spans. After the trusses were erected and the toggles were removed the ends of the spans were lifted by hydraulic jacks placed under the projecting end pins, the packing was removed and they were lowered to their final level and the four spans, weighing complete about 1,600 tons, were moved 4½ feet transversely to final position.

The reconstruction of the bridge occupied four years and was executed by Sir William Arrol & Company, Glasgow, contractors, Mr. George Huntley resident engineer. Messrs. Sandeman & Moncrieff, Newcastle, were the designing engineers. The bridge has been illustrated in "The Engineer," "Engineering" and other English technical journals from which the foregoing description has been condensed.

Replacing a Stone Front.

The six-story and high-basement building at No. 38 Wall Street, New York, has brick walls with carved stone lintels extending across the 21½-foot front between the lower stories. The entrance was originally at one side but the building is being remodeled and the entrance changed to the center, the brick and stone front replaced up to the third story, and two new cast-iron columns inserted on the sides of the new entrance. This involves temporarily supporting the front above the second story while the old facing and lintels are removed and the new are put in place. The upper part of the wall and the floor loads which it carries are supported by a fourth-story stone arch having a span of the full width of the building, and the upper part of the brickwork below the arch is carried by a plate girder of the full length of the wall and supported like the arch on the piers at the corners of the building. These members leave only a comparatively small weight to be provided for during repairs, and it was at first intended to carry it by horizontal needles put through the wall under the third floor. The tenant would not consent to this and the wall had to be supported entirely from the outside, which was done by a system of inclined shores arranged as shown in the sketch.



SHORES AND PLATFORMS.

A row of eight 12x12-inch timbers about 30 feet long are arranged in pairs, one on each side of each window, and seated on a double tier of distributing planks on top of the thick sidewalk flagstones close to the area wall. The first tier of planks are parallel to the face of the building and are anchored by three transverse flat steel straps with their ends bent down at right angles and engaging the edge of the coping of the area wall. The shores have both ends cut off square and take bearing on pairs of wooden wedges driven against the sill pieces and against the brickwork at the third floor level at the top of the shores, where cloth or some other soft packing is interposed between them and the brickwork to prevent cracking the latter. The shores are set so close together that they cover over one-third of the wall area.

At each end of the row is a two-post transverse bent, having vertical posts scabbed to horizontal sills and caps. The former rest on the sidewalk beyond the ends of the area and the latter support three long horizontal timbers between the wall and the shores. These timbers form a platform to receive the new 21½-foot by 2-foot 10-inch by 1-foot 2-inch stone lintel, which is estimated to weigh about four tons and will be run in under the shores close to the building at street level and then hoisted horizontally by tackles suspended from breast derricks set on an outside scaffold. This is the ordinary sidewalk protecting platform and has a solid deck of longitudinal planks supported about 12 feet above the curb on three transverse bents with transverse and longitudinal kneebraces at their tops. All the timber except diagonal braces is 12 x 12-inch and the structure is much heavier than is considered necessary to carry the load. No jack screws are used and great care is taken with the arrangement and driving of the wedges, the latter are arranged with their upper surface horizontal at the tops of the shores and their lower surfaces horizontal at the bottoms of the shores, and have so small an angle that there is no danger of their slipping or allowing the shores to kick out.

Mr. Ernest Flagg is the architect of the building and Mr. Edmund D. Broderick is the contractor.

The Fall of the Campanile at Venice.

No mention has been made up to the present time in these columns of the fall on July 14 of the famous Campanile at Venice. The reason for this silence has been the absolute lack of any definite information concerning the cause of the accident. The information received up to the present time which is most interesting is summarized below. The structure itself is too well known to need detailed description at this time. Its foundations date back nearly to 900. After 250 years it was probably nothing but a plain stalk surmounted by an arcaded belfry and a small spire. It is commonly considered only as the belfry of St. Mark's, but when its inferior style is contrasted with the architectural splendor of that famous church, it hardly seems as though it was much more than a monument of Venetian civic pride. Early in the sixteenth century its height was increased by a masonry box of large dimensions on top of the balcony, surmounted by a square spire and the whole topped with a 16-foot angel. It was about 320 feet high and always open, although no single visitor was allowed to ascend the inclined plane to the top. If a lone traveler wished to make the ascent, he was obliged to hire some one to accompany him. At the base of the shaft was a loggia or vestibule, a small structure built in 1540 by Sansavino, and a much more satisfactory work architecturally than the tower.

According to a paper in the library of the Institution of British Architects, the foundation of the tower was a carefully prepared base of stone blocks resting on the inevitable piling which carries all Venetian buildings. According to "The Builder," this foundation was ample to carry the weight of the structure. Nevertheless, for a number of years the city authorities have been warned from time to time that the structure showed signs of failing. As to the immediate cause of that failure, the reports received to date substantially agree with a statement by Mr. A. Robertson sent to "The Scotsman," on July 15, from which the following extract is taken:

Though the walls were thick, for they were only a few inches under 6 feet, they were really not solid. They consisted of two parallel walls of brick, the space (3 feet wide) between them being filled up with broken bricks, rubble, cement, stones, etc. Therefore the walls were not so strong as they looked.

The cement used was Istrian lime mixed with sea sand. This lime does not become hard, nor does it adhere well to the bricks. Indeed, in the course of the past centuries it became dry powder. It is all over Venice to-day. It formed the cloud that hid the falling Campanile.

It had been damaged by lightning, by fire and earthquake several times. On June 7, 1398, it was struck by lightning. In 1401, on the occasion of festivities for the Doge Michael Steno, fires were lighted on the platform, and the top was burned. On October 24, 1403, the same thing happened. In 1405 the same thing happened. In 1417 it was struck by lightning, and the new top of wood again burned. On June 21, 1436, all the shops round the Campanile built against it were burned. On March 26, 1511, an earthquake split its four corners. In June, 1548, it was struck by lightning. In 1565 it was struck by lightning. On July 10, 1591, an earthquake caused it to shake from top to bottom. In 1653 again struck by lightning. On August 23, 1657, again struck by lightning. On April 23, 1745, again struck by lightning, which damaged its east side severely, killing many people in the Campanile and near it. This was its last and most serious damage, although it was not till June 18, 1776, that the Republic employed the scientist, Guiseppe Toaldo, to put up a lightning conductor.

The Republic, seeing its east side to be severely damaged, consulted two engineers of fame and ability, Signor Zandrini, of Venice, and Signor Polene, of Padua, to examine and repair it. These engineers said the whole wall wanted support, and they proposed building a new wall against the old one. This was done. But the new wall was never properly tied to the old one. The two were practically separate, and so the weight of the Campanile was borne unequally and its equilibrium disturbed.

The ringing of the bells, the firing of artillery, and only three weeks ago the simultaneous firing in the Piazza of hundreds of muskets had a tendency to disturb it. Also the more or less frequent earthquakes that visit Venice.

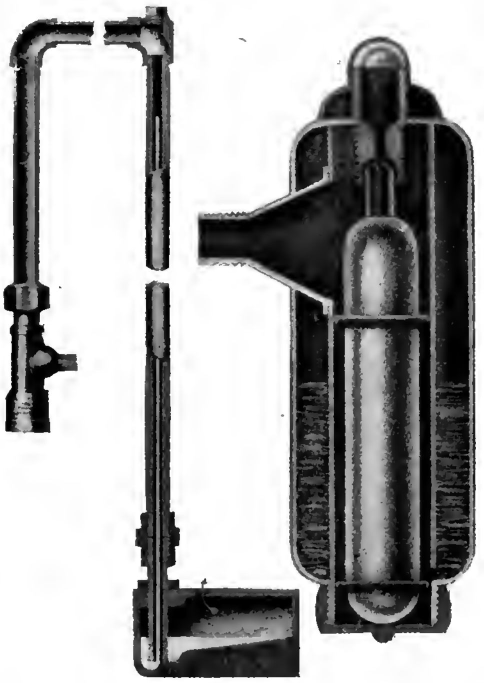
Twenty years ago one of the corner pilasters of the inner wall, and precisely that at the northeast corner, was seen to be cracked in many places. The authorities of St. Mark's Church, who have charge of the Campanile, as it is the bell-tower, had this pilaster tied up. No more cracks appearing anywhere, the Campanile was thought perfectly safe and was let alone.

And now comes the critical point. The Loggietta, little marble hall built by Sansovino, rests against the eastern wall of the Campanile. It had almost a flat roof. To prevent the rain beating against the Campanile and running down its side from entering this marble hall, a row of slabs of stone sloping downwards was inserted in the Campanile where the roof met it.

Only last week, that is, but ten days ago, these stones were begun to be removed, as the rain was somehow getting into the Loggietta, and a lead sheeting was to have been substituted. Instead of carefully removing one stone at a time, they removed half of them, that is 25 feet of them. Not only so, but they dug through the new wall of the Campanile, that of 1745, and struck the old original wall, which they found separate from the new, and full of holes and cracks. Whilst working, the old wall slipped down an inch or two. Instantly the cut made was built up, but it was too late. On Wednesday it was observed that the new wall was cracked at the northeast corner, above the Loggietta, where the work was begun. On Thursday it enlarged. On Friday it struck across the north side of the Campanile, sloping upward to the second window from the ground, then up to the third. On Saturday it passed behind the fourth and through the fifth. On Sunday the situation was, to use the word of an engineer, "desperate," and the Campanile was doomed. On Monday the crack visibly opened whilst we watched it, and the end came in a moment, when the whole structure sank into itself.

The Trane Vacuum Heating System.

A system of steam heating designed to operate with steam at a pressure below that of the atmosphere, without the use of any machinery or steam-actuated devices for the maintenance of a vacuum, was put on the market a short time ago by the James A. Trane Vacuum Heating Company, 40 Dearborn Street, Chicago. An essential feature of the system is the use of a mercury seal fixed to the outlet of the radiator air valve to prevent a return of air by that passage after it has once been expelled. Assured of the absence of air, the heating apparatus is depended on to produce such a vacuum as will be formed by the condensation of steam within the radiators, the non-existence of air within the radiators allowing for a circulation of steam throughout the plant at low pressures and consequently low temperatures. As the boiling temperature of water is less the greater the vacuum, the greater the condensation in this system the more rapid the generation of steam, since by the condensation the system is relieved of pressure; and on this account, it is considered that the fire in the boiler needs replenishing much less frequently, is accompanied with less waste heat, than with a low-pressure steam apparatus requiring higher temperatures.



An accompanying drawing shows the proportions of the mercury seal and the method of connecting to the radiator air valve. The pipe enclosing the mercury column is arranged ordinarily between the first and second columns of the radiator, so that the piping and seal are both hidden from view. One seal may be provided for each radiator or a system of air pipes can be carried to a convenient point, as in the cellar or basement, and a single seal connected to the air main. Assuming the radiator full of air on starting, the air has, of course, to be expelled as in any system, and passes through the mercury.

In connection with the seal, an ingenious air valve designed by Mr. E. P. Allen has been adopted by the Trane Company, as meeting the essential requirement of a tight valve. This is shown in an accompanying cross-sectional view. It consists of a shell connected to the radiator to form a well in the lower half of the valve, a sealed metal float placed in the well and a sealed outer chamber which is connected with the inner chamber by means of a small hole near the bottom of the inner shell. During the first operation of the valve the air in the radiator passes through the valve. When steam enters, the steam condenses, gradually filling the inner well with water, floating the sealed metal float to its seat, thus closing the valve. Five to ten minutes are allowed after steam enters in the first operation to condense sufficient water to carry the float. During this first operation the air in the outer chamber is expanded and more or less expelled through the small hole into the inner chamber and thence out of the valve through the regular outlet. As the inner chamber fills, the outer chamber becomes sealed by the water in the inner chamber. Since the air valve cools when steam is turned off, a vacuum is created in the outer chamber and the water in the inner shell is drawn into the outer chamber, allowing the float to drop, thus opening the valve. When steam again enters the valve, the heat expands the remaining air in the outer chamber and forces the water into the inner chamber, carrying the float to its seat.

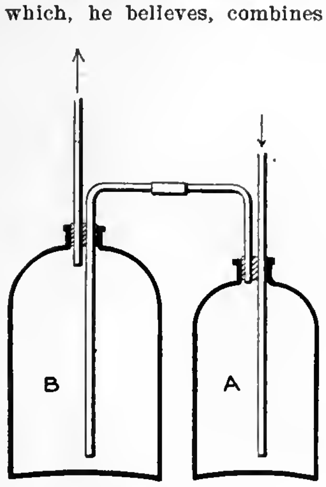
The various appliances manufactured by the company for the system are intended to be applied also to any low-pressure steam plant already constructed. Poorly constructed apparatus, it is asserted, will retain a vacuum of 10 to 20 inches for at least five to ten hours, and that the majority of steam plants of to-day, if supplied with the mercury seal, will be capable of maintaining a vacuum of 15 to 28 inches for 10 to 40 hours. A saving of 25 per cent. in fuel is claimed over the ordinary hot-water apparatus, with temperatures of radiators as mild as in the latter system of warming, and a still greater saving over low-pressure steam plants.

A New Engine is apparently languishing for lack of financial support; at least the following appeal in the columns of a New York daily would so indicate: "Wanted—Large capital to invest in an invention; a new motor (steam engine), no steam ejection, no condensator, directly rotative, complete utilization of latent heat, boiler stone and explosion absolutely impossible, permanent equal height of water in boiler, used steam returns to boiler, greatest reduction of fuel."

A Wheelbarrow is not generally considered a very difficult appliance to design properly, yet the average barrow certainly has features which can be improved. For example, a little while ago a gang of men was dumping earth from the end of a trestle. One of them tipped his barrow sidewise on the wheel guard, which slipped on the timber, and thus caused the fall of both man and barrow. It was some time before they could be brought up again and meanwhile six men were idle. This was a comparatively small matter, of course, yet it is the avoidance of these little things that spell success. In this particular case, the old barrows have been replaced by the type made by the Ellington Manufacturing Company, Quincy, Ill., which have the wheel guard so formed that it is possible to dump at either side or straight ahead.

An Apparatus for Collecting Samples of Water at Various Depths.

For many years chemists engaged in the sanitary analysis of water have recognized the value of the oxygen-dissolved determination as a rough indication of the condition of a ground water. The methods employed for securing samples for the usual analysis cannot be used for an oxygen-dissolved sample owing to the rapid absorption of the atmospheric oxygen by the water. The method generally employed for taking a sample for oxygen-dissolved consists in dropping a rubber hose into the water and, by means of a suction pump, forcing a stream of water into the bottom of the sample bottle. This process is continued until water amounting in volume to several times the capacity of the bottle has passed through it, thus washing out all water which has come into contact with the air. A second method, often used, consists in fitting a sampling bottle with two tubes. One, the inlet tube, extends to the bottom of the bottle and is carried through the stopper and about an inch above it. The other tube has its lower end just within the stopper and is connected with the open air by a rubber tube. Since there is no overflow possible, the sample has been in contact with the air in the bottle for a short time. Being under the necessity of taking a large number of samples for the determination of dissolved oxygen, Mr. Earle B. Phelps devised an apparatus for this purpose which, he believes, combines the advantages of the two methods without having their defects. He has described it substantially as follows in "The Technology Quarterly":



WATER SAMPLING BOTTLES.

The arrangement of the sampling bottle is shown in the accompanying diagram. A and B are two bottles of about 250 and 500 cubic centimeters capacity respectively, and are fitted with glass and rubber connections, as indicated. They are enclosed in a suitable weighted wire cage to which is attached a suspending cord with graduations indicating the depth. The method of operating is as follows: The cage containing the bottles is dropped quickly to the desired depth. The tube of the bottle B being higher than that of the bottle A, water will flow in through A and air pass out through B. A will be filled with water which will then overflow into B. When B is also full, which condition is shown by the cessation of air bubbles rising to the surface, A has been filled three times. The water which entered during the descent has all been washed over into B, and the water which A now contains has not been in contact with the air. Thus one obtains a fair sample of the water at the particular depth at which the determination is to be made. The cage is hauled to the surface, the rubber stopper removed, and a glass stopper quickly inserted. The reagents are then added as usual.

The temperature may be determined with sufficient accuracy in the bottle B after bringing it to the surface. A very convenient method for a more careful study of the temperature is to use in connection with this apparatus a Whipple thermaphone.

Although devised primarily for the collection of samples for the oxygen dissolved determination, this apparatus may be used for a variety of purposes. The writer has frequently used the water in the bottle B for the determinations of the micro-organisms.

It may appear that the bottle B is larger than an accurate determination requires. An experiment to determine this point was made as follows: A few drops of a strong solution of Fuchsine were added to the bottle A and a stream of water allowed to flow through the apparatus. By this means the actual course of the water through the apparatus could be easily followed. It was found that many eddy currents were formed and that A had to be filled at least three times before the dye was completely expelled.

Personal Notes.

Mr. George Hanson has resigned his duties as superintendent of the Texas & Pacific road to carry out some large contracts for the Missouri, Kansas & Texas R. R.

Mr. J. Z. George has resigned the duties of manager of the Vicksburg Electric Light & Railway Co., to become a partner of A. M. Lockett, New Orleans, in engineering and contracting work.

The following members of the Corps of Engineers, U. S. A., have been detailed to the General Service and Staff College at Fort Leavenworth: Capt. T. H. Rees, First Lieutenants George M. Hoffman and Gilbert A. Youngberg, Second Lieutenant W. Willing.

Mr. S. M. Swaab, Assoc. M. Am. Soc. C. E., has resigned his position as first assistant engineer on the work for the improvement, extension and filtration of the Philadelphia water supply to become assistant engineer on the staff of the Philadelphia Rapid Transit Co.

Messrs. Julian Kennedy of Pittsburg and Axel Sahlin of Cumberland, England, have formed a partnership for consulting practice in iron and steel production, under the name of Julian Kennedy, Sahlin & Co. Offices have been taken at 2 Norfolk St., Strand, London, and the reconstruction of several British iron works has already been entrusted to the firm.

Mr. W. B. Throop, recently appointed superintendent of the Aurora division of the Burlington system, was graduated from Cornell in 1877, and has been connected with the Burlington road since 1878. For about twelve years he was in the engineering and maintenance of way departments, and was then transferred to the operating branch of the service.

In order to celebrate properly the eightieth birthday of Mr. John Fritz, which will occur in a few months, it is proposed to raise by subscriptions of $10 each a fund to establish a medal to be awarded annually "to the originators of the most useful scientific or industrial achievements, in perpetual honor of John Fritz and to the glory of engineering." The committee of award is to consist of four members from each of the American national societies of civil, mechanical, mining and electrical engineers, but the recipients of the medal may be of any nationality. Many subscriptions have already been received, and it is confidently believed that the medal will be a distinction equal to the Bessemer gold medal of the Iron & Steel Institute. Subscriptions should be sent to the treasurer of the fund, Mr. John Thomson, 253 Broadway, New York.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvi, xvii, xviii and xxvii.

WATER.

Meridian, Miss.—Kirkpatrick & Johnson, of Jackson, Miss., have prepared plans for water works, and bonds to the amount of $150,000 for construction are reported to have been voted at the election held Aug. 2 and 4.

Hawkesburg, Ont.—The citizens have voted to raise $100,000 to install a modern system of municipal water works.

Oaxaca, Mex.—According to press reports, the Governor of the State of Oaxaca has offered a prize of $5,000 to any individual or company who will sink an artesian well. Andrew D. Barlow, Amer. Consul, Mexico City, Mex., may give further particulars.

Mamaroneck, N. Y.—Press reports state that the interurban Water Co. intends to construct a reservoir at Mamaroneck for the purpose of supplying Pelham and Mt. Vernon with an additional supply of drinking water.

Inglewood, Cal.—The Inglewood Water Co. has been incorporated; capital stock, $250,000. Directors: A. C. Freeman, P. A. Stanton, G. W. Van Alstyne, and others.

Morris, Ill.—It is stated that bids are wanted Aug. 12 for extending the water works. F. W. Ridgeway, City Clk.

Elgin, Tex.—Propositions for a system of water works and an electric light plant will be received by Chas. Gillespie, Mayor.

Mannington, W. Va.—B. E. Mitchell, Chmn. Water Com., writes that the contract for furnishing a quantity of cast iron pipe and specials, bids opened July 23, has been awarded to the U. S. C. I. Pipe & Fdy. Co., Cincinnati, for $4,000. Contract for labor, to G. R. Miner Const. Co., Salem, Wis., for $2,000.

Restraver Township, Pa.—The Restraver Water Co., Restraver Township, Westmoreland County, has been incorporated. Capital, $10,000. Directors: G. H. Craig, Allegheny; J. I. Martin, Beaver; M. R. Haymaker, Edgewood, and others.

Martinsburg, W. Va.—N. Wilson Davis is said to be preparing a report for the Water Bd. on proposed improvements.

Pittsburg, Pa.—The Common Council has passed a resolution providing for the appointment of a committee to secure an option on the plant of the Monongahela Water Co.

Pueblo, Colo.—The Trustees of the Pueblo water works have passed a resolution accepting the contract with the N. Y. Continental Jewel Filtration Co., of New York, when the price (which is said to be $114,000) is agreed upon, for a filtration plant having a capacity of 8,000,000 gal. per day.

Yonkers, N. Y.—The Bd. of Water Comrs. has received reports from 3 engineers in relation to increasing the city's supply of water. Wm. H. Baldwin, in his report, places the total cost of a system of natural sand bed filtration at $41,000; John A. Byrne in his report places the total estimated cost of natural filtration plant, capacity 3,600,000 gal. daily, at $35,633; and W. DeH. Washington in his report places the estimated cost of a sand filtration plant having a capacity of 4,000,000 gal. daily at $88,000.

Georgetown, S. C.—City Treas. J. Jenkins Hucks writes that on July 29 it was voted by a large majority to issue $75,000 bonds for the construction of water works and a sewerage system. J. L. Ludlow, of Winston, N. C., is reported to have prepared plans, etc.

Kenmore, N. Y.—Bids are wanted Aug. 15 for furnishing and laying cast-iron water pipe, as advertised in The Engineering Record.

Covington, Tenn.—Local press reports state that negotiations for the purchase of the water plant through arbitration having failed, the municipal authorities have formally notified the water company of their purpose to build a plant.

Sacramento, Cal.—The proposition to issue $150,000 bonds for the construction of new water mains in this city carried by a large majority at the election held July 24.

R. G. Hanford has submitted to the City Trustees a proposition from the North Fork Ditch Co. to supply the city with clear mountain water.

Upland, Ind.—The Town Bd. of Trus. has appointed a committee to investigate the advisability of putting in municipal water works.

Weatherford, Tex.—Consulting Engr. J. S. Thatcher, Dallas, writes in regard to bids opened July 28 by the City Council for furnishing material and labor necessary for the construction of a system of water works, that no bids were received on the entire work, so the Council concluded to withhold what bids were received, and will now receive propositions from manufacturers of pumps, boilers, hydrants and valves; the system to consist of a standpipe 14 ft. x 115 ft., a 70-H.-P. boiler, one 750,000-gal. duplex steam pump, one air compressor of 250 ft. per minute capacity, 50 double nozzle hydrants, 8-in. and 6-in. valves and boxes, about 6 miles of 6 and 8 in. pipe, power house and suction reservoir and 3 deep wells. Henry Miller, Mayor.

Mesa, Ariz.—City Clk. J. H. Pomeroy writes that this city proposes to construct water works, but plans and specifications have not yet been completed.

Redfield, S. D.—Bids are wanted Aug. 29 for extending the water mains. J. S. Huston, City Aud.

Ballard, Wash.—City Clk. J. Murdock writes that it is proposed to expend $10,000 in water main extensions. O. M. Rankin, Engr. in Charge.

Monticello, Minn.—Village Recorder W. J. Thompson writes that bonds to the amount of $10,000 were voted July 29 for water works and $4,000 for a gas plant.

Philadelphia, Pa.—Bids are wanted Aug. 12 for building Lardner's Point pumping station at the Torresdale filtration plant. Wm. C. Haddock, Dir. Dept. of Pub. Wks.

Washington, D. C.—Bids are wanted Sept. 6 for furnishing 30-in., 36-in. and 48-in. cast-iron water pipe and specials, as advertised in The Engineering Record.

Westerville, O.—Bids are wanted Aug. 19 for constructing water works, as advertised in The Engineering Record.

Charleston, S. C.—Bids are wanted by the American Pipe Mfg. Co., Philadelphia, Pa., until Aug. 15 for the construction of a combined earth and timber crib dam, timber lock, 2,000,000-gal. clear water basin and a 10,000,000-gal. settling basin, to be located about 11 miles from Charleston, as advertised in The Engineering Record.

Ellendale, Minn.—Village Recorder E. M. Thompson writes that on July 22 it was voted to construct water works.

Meadville, Pa.—The Council is considering the question of a pure water supply, but definite action has not yet been taken. A. C. Pardee, City Clk. W. A. Doane, City Engr.

Milton, Mass.—Bids are wanted Aug. 12 for the purchase of $315,000 bonds issued for the purchase of the property and rights of the Milton Water Co. J. Porter Holmes, Town Treas.

North Hempstead, N. Y.—Bids are wanted by the Town Bd., until Aug. 18 for furnishing a water supply for fire purposes to the Great Neck Water Dist., as advertised in The Engineering Record.

New Paltz, N. Y.—The New Paltz Water Works Co. proposes to build a reservoir. H. L. Griffis, Engr. in Charge.

Asheville, N. C.—City Clk. M. W. Robertson writes that it is proposed to install water meters. Bids will not be asked, but meters will be purchased direct from manufacturers as required. Wm. Francis, Supt.

East Rutherford, N. J.—Boro. Clk. Geo. A. Duncan writes that the question of constructing a municipal water and light plant is under consideration. W. W. Binning, Councilman.

Bloomington, Wis.—Press reports state that a water works and electric light plant is to be installed at once, at a cost of $16,000.

Elma, Wash.—The City Council has decided to build a reservoir and secure a new water supply.

Fonda, N. Y.—This village has voted to purchase the system of the Fonda Water Works Co. at a cost of $32,000.

Sulphur Springs, Tex.—Water works bonds to the amount of $20,000 were voted at the recent election.

Pennsgrove, N. J.—At the election held Aug. 5 a vote was taken in favor of the issue of $35,000 bonds for Boro. water works and electric light plants.

Muskogee, Ind. Ter.—Press reports state that the contract for a complete water works plant and sewer system has been let by this city to Allan Block & Co., of St. Paul, for $171,924. The work is to be completed June 15, 1903.

Colby, Wis.—The construction of water works and an electric light plant is said to be under consideration.

Cadiz, Ky.—The matter of establishing a water system is said to be under consideration.

Wonewoc, Wis.—Henry G. Strong is reported to have completed estimates for the $10,000 water system, for which bonds have been voted.

Houston, Tex.—The Texas Rice Development Co., of Houston, has been incorporated, to irrigate lands in Wharton and Brazoria counties; capital stock, $250,000. Incorporators: S. J. Johnson, D. C. Ritchie, A. C. Wilkinson and G. W. Huber.

Brookville, O.—The Council has passed an ordinance providing for the issue of $24,000 bonds for the construction of water works.

Springfield, O.—The City Council has concurred in the recommendation of Mayor Phillips for the construction of a dam at the water works pumping station on the river, and has directed the City Engr. to prepare plans and specifications and an estimate of the cost of said improvement. The Mayor has been authorized to communicate with various water meter manufacturers to secure prices, with a view to adopting a uniform meter system throughout the city.

Narberth, Pa.—The Town Council has decided to investigate the cost of establishing municipal water and electric light plants.

Great Falls, Mont.—This city has sold $45,000 water bonds, the money to be used in extending the water system and installing a subsidiary pumping plant.

New London, Wis.—At the election held July 29 it was voted to issue $35,000 bonds for water works and a power house.

Baraboo, Wis.—The Baraboo Water Works Co. having refused the city's offer of $85,000 for its plant, it is stated that the city will probably take steps at once for the construction of a municipal plant, $60,000 having been voted for same some time ago.

Stockton, Cal.—The stockholders of the Stockton & Mokelumne Canal Co. are reported to have voted $110,000 to enlarge and improve the Woodbridge irrigation system.

Ithaca, N. Y.—Plans for the dam to be erected in Six Mile Creek by the Ithaca Water Works Co. are said to have been completed and submitted to Consulting Engr. Geo. Y. Wisner, of Detroit, Mich., and Frank C. Osborn, of Cleveland, O., for approval.

Weiser, Idaho.—Bonds to the amount of $40,000 are reported to have been voted for water works and an electric light plant.

Manchester, O.—A committee of which S. S. Alexander is chairman, is making investigations with a view to installing water works and an electric light plant in this town.

Tucumcari, New Mex.—The Tucumcari Electric Light & Water Co. has been incorporated by Alexander D. Goldenberg, J. A. Street, C. H. Rankin and others. The capital is $10,000. The headquarters are at Tucumcari, Guadalupe County.

Farmington, Mo.—Bids will be received at the office of the Mayor until Sept. 4 for a brick pumping station; 2-H.-P. boilers and tank; a 50-H.-P. steam engine; 275,000-gal. pumping engine; 210 tons of pipe and specials, etc., as advertised in The Engineering Record.

Pittsburg, Pa.—Pres. J. F. Grimes, of the Chartiers Valley Water Co. is quoted as having stated that plans have been completed for a new pumping station, which the company proposes to build on the Monongahela River. It is stated that contemplated improvements will cost about $5,000,000.

East Liverpool, O.—The Bd. of Water Works Trus. is considering the installation of a filteration plant estimated to cost $50,000.

Greeley, Colo.—Ray Walters is said to be making a preliminary survey for a new source of water supply for this city.

Houma, La.—D. Angers, Town Clk., writes that bids will be received until Sept. 9 for constructing water works. Cost not to exceed $27,000. Geo. C. Morgan, Engr., Chicago, Ill.

Moline, Ill.—The Council has voted to adopt plans and specifications of D. W. Mead, of Chicago, for water works improvements, which provide for the installation of a 6,000,000 gal. pump, a mechanical filtering plant, settling basin and clear water basin of 5,000,000-gal. capacity. Estimated cost, $70,000.

Toledo, O.—Local press reports state that the Water Works Bd. is receiving bids for 300 tons of pipe.

Avon, N. J.—A certificate of merger and consolidation has been filed by the Avon Water Co. and the Wall Water Co., which were reincorporated as the Monmouth Water Co. The capital stock of the new corporation is $1,000,0000. The officers and directors chosen for the first year are: Pres., Oliver H. Brown, of Spring Lake; Vice-Pres., Cecil Campbell Higgins, of Bedford, N. Y.; Secy., James Steen, of Eatontown; Treas., Henry Campbell, of Eatontown, and Jasper Bray, of Point Pleasant.

SEWERAGE AND SEWAGE DISPOSAL.

Burlington, Ia.—City Engr. Emmet Steece writes that ¾ of a mile of 8 to 4-in. pipe sewer and about 2 miles of tile sewers will soon be ordered.

Dunkirk, N. Y.—Asst. City Engr. H. A. Holstein writes that bids for the Roberts Road sewer will not be opened before Aug. 16. The sewer is to be about 1 mile in length of tile, 20-in.

Evanston, Ill.—Comr. of Pub. Wks. J. H. Moore is preparing plans for drainage and sewerage of entire city. Larger portion of city is now sewered, but plan looks to future growth, also to relief of certain trunk sewers now overtaxed.

Defiance, O.—Bids are wanted Aug. 13 for constructing sewers in several streets. W. H. McClintock, City Clk.

New York, N. Y.—The Mayor has approved the resolution authorizing the issue of $100,000 bonds for the repair and reconstruction of sewers in the Boro. of Manhattan.

Washington, D. C.—Bids are wanted Aug. 30 for constructing sewers in the Dist. of Columbia, as advertised in The Engineering Record.

Rensselaer, N. Y.—The City Engr. has been directed to prepare plans and specifications for sewers to be constructed through Nelson and Riverside Aves. and Belmore Pl.

Ludwick, Pa.—Bids will be received by the Boro. Council until Aug. 18 for constructing a system of sewers in this borough. Specifications may be obtained at the office of the Greensburg Storage & Transfer Co.; R. J. Feightner, Boro. Secy.; J. J. Neel, Boro. Engr.

Havre, Mont.—Town Clk. S. T. Sanderson writes that on July 21 it was voted to issue $10,000 bonds for the construction of a sewerage system.

West Hartford, Conn.—Town Clk. Henry C. Whitman writes that A. B. Alderson, West Hartford, is the Engr. in Charge of proposed construction of sewerage system for the eastern part of town. Contracts for this work will probably be let this season. E. T. Stanley, Chmn. Bd. of Comrs.

Canton, O.—City Engr. Philip H. Weber writes that the following bids were opened Aug. 4 for the construction of sanitary sewers in Dist. No. 1: *a*, Section 1, including 4,430 ft. 18-in. pipe, 18 manholes, etc.; *b*, Section 2, including 750 ft. 15-in. and 3,220 ft. 18-in. pipe, 15 manholes, etc.; *c*, Section 3, including 1,520 ft. 10-in., 750 ft. 12-in. and 1,500 ft. 15-in. pipe, 14 manholes, etc.; M. A. Talbott & Co., Logansport, Ind., *a* $7,931, *b* $6,442, *c* $6,446; Geo. B. Herring & Son, Mansfield, O., *a* $7,815, *b* $6,732, *c* $6,306; McKinney & Son, Toledo, O., *a* $8,442, *b* $6,989, *c* $6,657; F. A. Piero, Canton, O., *b* $5,623, *c* $5,918.

Sanford, Me.—Town Clk. W. H. Wood writes that a survey has been made for a sewerage system, but it will not be built at present.

Mt. Clemens, Mich.—City Clk. Henry C. Benton writes that a brick sewer is to be built in Church St.; probable cost, $2,000.

Lockhart, Tex.—Mayor E. M. Storey writes that the contract for constructing a sewerage system (bids opened July 23) has been awarded to T. S. Hodges, of Gonzales, Tex., for $3,150. The contract calls for 3,450 ft. of 10 to 8-in. pipe sewers, 10 manholes, 4 catch basins and 1 flush tank; cut to average 6 ft. in depth and be excavated in black earth and gravel.

Atchison, Kan.—City Engr. Fred Giddings writes that the following bids were opened July 7 for the construction of sewers in Dist. C, South Atchison: Bidders—A, Hanley, McGuire & Wise, Leavenworth, Kan.; B, Rackliffe & Gibson, St. Joseph, Mo. (contract awarded); C, Chas. Crawford, Atchison; D, W. W. Cook & Son, Junction City, Kan.:

Items and Quantities.	A	B	C	D
Pipe sewers:				
6-in., 9 ft. depth, 60 ft.	$.25	$.31	$.31½	$.32
8-in., 5 ft. or less, 210 ft.	.28	.26	.26½	.27
8-in., 5 to 7 ft., 2,549 ft.	.30	.30	.32½	.31
8-in., 7 to 9 ft., 7,664 ft.	.40	.35	.35½	.33
8-in., 9 to 11 ft., 6,828 ft.	.43	.40	.44	.37
8-in., 11 to 13 ft., 3,062 ft.	.49	.43	.44½	.46
8-in., 13 to 15 ft., 1,773 ft.	.53½	.53	.55	.53
8-in., 15 to 17 ft., 610 ft.	.63	.60	.65	.54
8 in., 17 to 19 ft., 120 ft.	.75	.70	.75	.63
8-in. curves, extra, 2	.50	.50	.50	.54
8-in. Y's, extra, 607	.75	.35	.35	.42½
Pipe sewers:				
10-in., 5 ft. or less depth, 100 ft.	.36	.33	.35	.30
10-in., 5 to 7 ft., 100 ft.	.38	.36	.38	.34
10-in., 7 to 9 ft., 364 ft.	.40	.41	.42	.42
10-in., 9 to 11 ft., 200 ft.	.43½	.44	.45	.44
10-in., 11 to 13 ft., 100 ft.	.50½	50	.50	.52
10-in., 13 to 15 ft., 82 ft.	.63	.60	.60	.63
10-in. Y junctions, extra, 13	.85	.45	.46	.43
12-in. pipe sewer, 8¼ ft. depth, 105 ft.	.60	.51	.73	.54
12-in. Y's, extra, 11	.95	.60	.60	.58
12-in. curves, extra, 2	1.40	1.00	.55	.96
15-in. pipe sewer, 11.75 ft. depth, 40 ft.	.95	.80	.84	.81
18-in. pipe sewer, 9.50 ft. depth, 1,849 ft.	1.20	1.00	1.00	1.03
18-in. Ys, extra, 34	2.00	1.25	1.20	1.33
18-in. curves, extra, 12	2.00	2.00	1.45	2.08
24-in. pipe sewer, 12.4 ft. depth, 560 ft.	2.80	2.00	2.10	2.13
24-in. Ys, extra, 5	4.00	2.80	2.00	2.80
24-in. curves, extra, 10	4.50	4.30	.4.30	4.36
6-in. slants, 73	.30	.35	.35	.35
Pipe sewer manholes, 10.1 ft. deep, 55	45.00	40.00	40.00	42.00
Brick sewer manholes, 13.3 ft. deep, 9	40.00	30.00	30.00	33.00
Lamp holes, 9.8 ft. deep, 14	7.50	8.00	7.50	8.50
Flush pipes, 9.6 ft. deep, 49	7.50	7.30	7.50	7.50
Catch basins:				
No. 1, 4 ft. deep, 24	19.50	18.00	18.00	20.00
No. 2, 4 ft. deep, 3	19.50	20.00	20.00	24.00
No. 3, 4 ft. deep, 2	26.00	24.00	24.00	26.00
No. 4, 4 ft. deep, 2	27.00	28.00	28.00	29.50
No. 5, 4 ft. deep, 1	31.75	30.00	31.00	31.10
Brick sewers:				
32-in., 1½ rings, 9.7 ft. depth, 354 ft.	3.38	3.20	3.35	3.49
33-in., 1½ rings, 10.5 ft. depth, 353 ft.	3.48	3.50	3.60	3.64
36-in., 1½ rings, 9.9 ft. depth, 349 ft.	3.66	3.60	3.65	3.67
42-in., 2 rings, 13.4 ft. depth, 401 ft.	4.39	4.44	4.45	4.67
44-in., 2 rings, 6.5 ft. depth, 386 ft.	4.87	4.80	4.65	4.90
46-in., 2 rings, 4.4 ft. depth, 715 ft.	5.43	4.40	4.85	4.50
72-in., 2 rings, 2 ft. depth, 356 ft.	6.43	6.60	6.80	6.66
Relay brick pave. on sand, 1 course, 741 lin. ft.	.10	.20	.18	.23
Relay brick pave. on sand, 2 course, 487 lin. ft.	.25	.25	.23	.29
Relay brick pave. on concrete, 1 course, 445 lin. ft.	.26	.60	.60	.52½
Relay sidewalks, brick, 3,253 lin. ft.	.25	.20	.10	.25½
Relay sidewalks, stone or cement, 360 lin. ft.	.49	.33	.34	.37
Concrete paving old culvert, 331 sq. yds.	.37½	.40	.60	.67½
Embankment, 2,679 cu. yds.	2.90	2.40	2.25	2.75
Rock excav., extra, 1,963 cu. yds.	6.18	5.75	6.00	7.50
Cement concrete, 186 cu. yds.	4.85	5.00	5.00	5.50
Rubble masonry, 33 cu. yds.	35.00	25.00	22.00	20.00
Lumber, 5 M. ft. B. M.	2.15	2.00	2.50	3.25
Totals	$42,966	$38,707	$40,028	$41,325

Note.—The price for curves and junctions each is in addition to the price per lin. ft. for sewer. Embankment is for filling over shallow sewers. The price per cu. yd. for rock excavation is in addition to the price per ft. for sewers in earth. Excavation is generally in clay, excepting for brick sewers 44 in. in diameter and over, which are laid in rock bed.

Lansing, Mich.—City Engr. H. A. Collar writes that plans for sewers in the 1st and 5th Wards call for most of the work in brick from 28x42 in. to 48x72 in., egg shaped, with some 8 and 10-in. pipe, in all 7,600 ft. Estimated cost, $23,000.

Boston, Mass.—Supt. of Streets Jas. Donovan will receive bids until Aug. 20 for furnishing and installing 6 boilers of 185 lbs. working pressure, at the sewer-division pumping station, Calf pasture, for the new 72,000,000 gal. pump. A bond of $10,000 is required and a certified check of $1,000 must accompany each bid. The boilers are to be of the horizontal, underfired return tubular type, having a length of about 18 ft. 5¼ ins. over all, and a least internal diameter of shell of 78 ins. Everything for building and installing the boilers is to be furnished by the contractor, excepting the steel plates for the boiler proper, which will be supplied by the city of Boston. The boiler must be tested before painting by water pressure to 300 lbs. per sq. in. E. D. Leavitt, of Cambridge, Mass., is Consulting Engr.; work must be completed by Jan. 25, 1903.

Sterling, Ill.—Press reports state that steps are being taken to establish a sewer system at a cost of $20,000.

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until Aug. 15 for constructing a joint district sewer in Tower Grove Joint Sewer Dist., embracing 2,260 ft. of 12.5x15 ft. brick and concrete sewer, with all necessary appurtenances, and for constructing joint district sewers, in Rock Spring Joint Sewer Dist., embracing 570 ft. of 10x12 ft. brick and concrete sewer, and 1,020 ft. of 10.5 ft., 310 ft. of 10 ft., 1,540 ft. of 8 ft. and 1,630 ft. of 7.5 ft. brick sewer, with all necessary appurtenances. Hiram Phillips, Pres.

Washington, D. C.—The Dist. Comrs. have ordered a trunk sewer laid in 13th St. S. W. at an estimated cost of $7,960.

Jersey City, N. J.—The Finance Com. has granted the request of the Street and Water Bd. for the following appropriations: $15,118 for sewer system in Belmont, Gardner, Monticello and Jewett Aves.; $20,000 for relief sewer in Division St.; $4,950 for relief sewer in Ocean Ave.; $5,635 for relief sewer in Harrison Ave., and $1,660 for relief sewer in Henderson St.

York, Pa.—Local press reports state that an ordinance providing for the establishing of a complete sanitary sewer system is about to be introduced in the Councils.

Georgetown, S. C.—See "Water."

Hartford, Conn.—Bids are wanted Aug. 13 for constructing Albany Ave. and Blue Hills sewer system, estimated to cost $33,000; also branch of intercepting sewer and New Park Ave. sewer system, estimated to cost $6,400; also a sewer in Tremont St. and across private lands to Smith St., estimated to cost $2,700. Joseph Buths, Pres. Bd. St. Comrs.

Brooklyn, N. Y.—Bids are wanted by J. Edw. Swanstrom, Boro. Pres., until Aug. 20 for furnishing material and constructing a sewer in Bedford Ave. Engr.'s estimate of the work is as follows: 9,795 lin. ft. of 36 to 96-in. brick sewer; 510 lin. ft. of 12, 15 and 18-in. stoneware pipe sewer, 69 manholes, etc.

Ft. Snelling, Minn.—See "Government Work."

Monticello, Ind.—It is stated that bids are wanted Aug. 19 for extending the Washington St. sewer. Webb P. Bushnell, City Engr.

Hawkesbury, Ont.—The citizens have voted in favor of the expenditure of $53,000 for a sewerage system.

Winnebago City, Minn.—Loweth & Wolff, of St. Paul, have been engaged to make a survey and prepare plans for a system of sanitary sewerage. J. Adams Armstrong, Village Recorder.

Perry, Ia.—Business men of this place are stated to have pledged $7,000 toward the construction of a sewerage system.

Loudonville, O.—The City Council has been petitioned by property owners to construct a sewer system.

Muskogee, Ind. Ter.—See "Water."

Paris, Ill.—Bids will be received by Z. T. Baum, Pres. of the Bd. of Local Improv. until Aug. 14 for constructing 5,000 ft. of 8 and 10-in. sanitary sewers, as advertised in The Engineering Record.

Peoria, Ill.—Bids are wanted by the Bd. of Local Improv. until Aug. 21 for furnishing material and constructing the Persimmon St. sewer system. Approximate estimates of the work are as follows: 420 lin. ft. of 2 ft. 2 in.x3 ft. 3 in., 430 ft. of 2 ft. 6 in.x 3 ft. 9-in., 425 ft. of 2 ft. 10 in.x4 ft. 3 in. and 440 ft. of 3 ft.x4 ft. 6 in. brick sewer; 6,610 ft. of 8 to 20 in. pipe sewer, 38 storm water inlet and 26 manholes. E. A. Furry, Chmn.; M. E. Beasley, City Engr.

Plainfield, N. J.—Local press reports state that bids will be received by the Common Council until Sept. 2 for constructing a system of sewers in the West End of the city.

Omaha, Neb.—City Engr. Rosewater has plans for a new roadway and sewerage system to be established in the northwestern part of the city.

Dunmore, Pa.—Sewer bonds to the amount of $35,000 have been sold by this Boro.

Girard, O.—The Mayor has been authorized by the Village Council to secure the services of an engineer to plan for the proposed sewerage system.

Eaton, Colo.—The Special Sewer Com. has reported to the Town Bd. that the estimated cost of a sewer system is $9,600.

Cincinnati, O.—City Engr. Stanley reported to the Bd. of Pub. Service that the proposed sewer in 8th, Wells and McPherson Sts. on Price Hill will cost $18,976.

Providence, R. I.—The Special Com. of the City Council is said to have completed arrangements for the construction of a 48-in. brick sewer from Blackstone Boulevard to Seekonk River.

West Seneca, N. Y.—It is proposed to construct a sewer estimated to cost $30,000 to drain the land east of the steel plant.

Lower Merion, Pa.—The following bids are stated to have been received for sewering Lower Merion Township: From Bryn Mawr to Ardmore—David Peoples, Philadelphia, $69,870; Jos. McGlathery, Philadelphia, $75,952; Acuff & Morehead, $76,858. Bala $60,328. Ardmore—Gill & Co., Philadelphia, $18,732; R. H. Johnson, Wayne, $23,179; Acuff & Morehead, $21,006. Ardmore to Rosemont—Land & Co., Philadelphia, $74,952; Acuff & Morehead, $76,838. Bala to Overbrook—David Peoples, $83,906; T. F. Reilley, Philadelphia, $88,153; Acuff & Morehead, $71,016.

Delray, Mich.—Sewer bonds to the amount of $65,000 have been sold by the Village Council.

New York, N. Y.—Bids will be received until Aug. 18 by Louis F. Haffen, Pres. of Bronx Boro., for constructing sewers in numerous streets. Engr.'s estimate of the work is as follows: 14,255 lin. ft. of 12 to 18-in. pipe sewers; 40 ft. of 3-ft. 6-in.; 225 ft. of 38x50-in., 225 ft. of 34x46-in. and 1,125 ft. of 26x36-in. brick sewers.

Clinton, Ia.—Local press reports state that the contract is about to be let for the construction of a combined storm and sanitary sewer on Margaret St.

BRIDGES.

Washington, D. C.—The War Dept. has approved plans submitted by the Bd. of Engr. Officers, for a bridge to be built across Potomac River, which will take the place of Old Long Bridge. Appropriation, $996,000. The structure is to consist of 11 spans, each 216 ft. long, and 1 revolving draw span, 290 ft. long. It is to have a double track for electric cars, granolithic sidewalks and an asphalt driveway.

Hillsboro, Tex.—Three steel bridges are reported to have been washed away by the freshets.

McKeesport, Pa.—The Common Council has approved the ordinance appropriating $7,440 toward the construction of a viaduct at Versailles Ave.

Zanesville, O.—F. M. Townsend is stated to have secured the contract to repair 3d St. bridge, for $5,950.

White House, Ky.—F. I. Cabell, Engr. of Construction of the Chesapeake & Ohio Ry. Co., has applied to the War Dept. for permission to construct a bridge across the Levisa Fork of Big Sandy River, about 6¼ miles above White House.

Barberton, O.—Wm. A. Johnston is said to be interested in the building of a viaduct across the canal at Tuscarawas St.

Lorain, O.—Press reports state that the Erie R. R. Co. will build a bridge in this city, to be 120 ft. long, and cost about $100,000.

Mifflinville, Pa.—C. H. Reimard, of Bloomsburg, is stated to have secured the contract to construct a bridge across Susquehanna River, at Mifflinville, for $93,985.

Columbus, O.—Local press reports state that the Pennsylvania R. R. Co. has filed plans and specifications for a steel bridge, which will replace the present bridge across Scioto River. Estimated cost $125,000. H. R. Leonard, Engr. of Bridges, Philadelphia, Pa.

Dyersville, Ia.—The Bd. of Superv. has voted to expend $5,000 for the construction of a bridge across Maquoketa River, in this city.

Brattleboro, Vt.—The Comrs. appointed by the towns of Brattleboro and Hinsdale (N. H.) have, according to reports, awarded the contract to construct a steel bridge connecting the 2 towns, to the United Construction Co., of Albany, N. Y., for $35,000.

Hornellsville, N. Y.—Damage amounting to $50,000 is reported to have been done by the recent freshets to bridges and highways in Canisteo township.

Springfield, Ill.—Plans and specifications are reported to have been received for the proposed viaduct to be constructed by the Chicago & Alton R. R. at Eastman Ave.

New Florence, Pa.—The citizens are considering the question of accepting the offer of the Pennsylvania R. R. Co. to construct either a tunnel or bridge at Ligonier St. Probable cost of work $20,000.

Perryville, Ark.—It is stated that bids will be received Aug. 20 for building a steel bridge, 280 feet long, over Fourche River. A. F. Leeghn, Co. Judge.

Houston, Tex.—Local press reports state that bids will be received by the Co. Judge until Aug. 14 for constructing a steel bridge, with wooden flooring, across Harris Bayou, at Main St.

Westchester, Pa.—It is proposed to build a stone arch bridge over Pigeon Creek in East Coventry Township, Chester Co., and specifications for same are being prepared by the Co. Comrs.

San Jose, Cal.—Bids are wanted by the Santa Clara Co. Bd. of Superv., Henry A. Pfister, Clk., until Aug. 18 for constructing a steel bridge or a concrete bridge over Carnendero Creek on the Monterey Road.

Brooklyn, N. Y.—Boro. Pres. Swanstrom has reported to the Bd. of Estimate & Apportionment in favor of building a $160,000 bridge across Gowanus Canal at Hamilton Ave.

Morgan, Tex.—Press reports state that 2 iron bridges on the Texas Central R. R., between this city and Fowler, have been washed away by freshets.

Binghamton, N. Y.—Bids are wanted Aug. 19 for a bridge to cross Park Creek at Cross St. I. C. Hull, City Clk.

Appleton, Wis.—City Engr. Chas. Vinal is reported to be preparing plans for a stone bridge, which it is proposed to build in place of the John St. structure.

Utica, N. Y.—The Owego Bridge Co., Owego, is stated to have received the contract to construct a bridge at Hancock St. for $6,822.

Indianapolis, Ind.—It is stated that the Lake Erie & Western R. R. will construct an iron bridge across White River, in this city. G. C. Cleveland, Asst. to Ch. Engr., Indianapolis.

Souris, Man.—The by-law to raise $8,000 for the building of a bridge in this city is reported to have carried.

Parkersburg, W. Va.—See "Electric Railways."

Santa Rosa, Cal.—The San Francisco Bridge Co. is stated to have submitted the lowest bid for building a bridge across Russian River, at Markham's, at $28,350.

Tarentum, Pa.—The Tarentum St. Ry. Co. has applied to the Council for permission to construct a bridge at Ross St.

Youngstown, O.—Co. Engr. Geo. Montgomery is preparing plans for a bridge to be built at Mahoning Ave. Probable cost $130,000.

Reports state that the Pittsburg & Lake Erie R. R. Co. has completed plans for a steel bridge, to be built in East Youngstown; estimated to cost $100,000. J. A. Atwood, Ch. Engr., Pittsburg, Pa.

Indianapolis, Ind.—Bids will be received by the Bd. of Co. Comrs. until Aug. 15 for constructing arch culverts on Kissell road, in Pike Township; for constructing roadway approaches to bridge over Swamp Branch, on Seerley road; for constructing an arch culvert on Seerley road, in Decatur Township; for constructing an arch culvert at intersection of Shelbyville and Bunker Hill roads, in Franklin Township. Bids will also be received until Aug. 29 for constructing a bridge across Pleasant Run, on East New York St. Harry B. Smith, Co. Aud.

Chicago, Ill.—See "Government Work."

Three Rivers, Mich.—The proposition to raise $15,000 to build a bridge across St. Joseph River is reported to have carried at the recent election.

Boston, Mass.—City Engr. Jackson will soon let the contract for the construction of the 3 remaining masonry piers for Broadway bridge over Fort Point Channel, two of the piers being at the channel and one at the S. Boston shore end of the bridge. About 40 of the 50 plans of the steel work for the superstructure are finished. These are exclusive of the draw. The appropriation for the bridge is $375,000.

The Metropolitan Water & Sewerage Board is stated to have awarded the contract for building steel bridges on the line of the central Mass. system of the Boston & Me. R. R., which is being relocated in Berlin and Clinton, to the American Bridge Co., of New York, for $91,450.

Akron, O.—The construction of a bridge at Cuyahoga St. is contemplated.

St. Charles, Ill.—An agreement has been reached between the city and the Elgin, Aurora & Southern Traction Co., whereby the Traction Co. is to construct a $26,000 concrete bridge, and the city is to pay $12,000 toward the cost.

Armour, S. D.—Bids will be received by John W. McKee, Co. Aud., until Sept. 1 for furnishing material and constructing 3 steel wagon bridges.

Parker, S. D.—Local press reports state that bids will be received by the Co. Comrs. until Sept. 3 for constructing a 70-ft. steel bridge. Jos. J. Waltner, Jr., Co. Aud.

PAVING AND ROADMAKING.

Muskegon, Mich.—Final estimates place the total cost of paving Lake St. at $35,193.

St. Joseph, Mo.—The House of Delegates has passed ordinance providing for the macadamizing of Dewey Ave. and the repaving with brick of a portion of 9th St. A resolution has also been adopted by the House of Delegates directing the City Engr. to test the relative merits of brick and asphalt as paving material.

South Bristol, N. Y.—This town is to be bonded to the amount of $12,000 for the repair of roads and bridges damaged by recent storm.

Oneida, N. Y.—City Engr. Wellington R. Vedder writes that bids will be received by this city until Aug. 21 for 39,000 sq. yds. of vitrified brick pavement.

Leavenworth, Kan.—About 22 blocks on Broadway will soon be paved with asphalt.

Marshall, Mich.—The proposition to issue $25,000 bonds for brick paving is reported to have carried.

Cincinnati, O.—The Bd. of Pub. Service has approved specifications for the improvement of Oregon St., partly with brick and partly with boulders. Estimated cost, $14,020.

Charleston, W. Va.—The City Council is reported to have awarded contracts for about 60,000 yds. of paving to Pfaff, Ringwald & Smith, of Chillicothe, O., their bids ranging from $1.46 to $1.66 for Requital block and $1.45 to $1.70 for Kanawha block; curbing at 55 cts. for Kentucky blue stone or 57 cts. for Berea stone. The total contract is said to amount to over $100,000.

Auburn, N. Y.—The contract for paving South St. with asphalt has been awarded by the Common Council to Warner-Quinlan Asphalt Paving Co., of Syracuse, at $1.84½ per sq. yd. Total, $31,365.

Ashland, Wis.—Press reports state that Second St. is to be paved with asphalt at once.

Three Rivers, Mich.—The proposition to issue $24,000 bonds for paving Flint Ave. and St. Joseph St. is reported to have carried by a large majority.

Cincinnati, O.—Bids are wanted Aug. 29 for the improvement of Taylor Ave. by grading, curbing and paving with brick. Robt Allison, Pres. Bd. of Pub. Service.

Williamsport, Pa.—Brandon Park Commission will receive bids until Aug. 20 for about 2,600 sq. yds. of macadam pavement. Plans, etc., can be seen at the office of Frederic A. Snyder, City Engr., Williamsport.

Washington, D. C.—The contract for paving with sheet asphalt (bids opened July 26), has been awarded to the Barber Asphalt Paving Co., at $1.56 per sq. yd., and the contract for asphalt block paving, bids opened at the same time, has been awarded to the Washington Asphalt Block & Tile Co. For bids received see The Engineering Record of Aug. 2.

Worcester, Mass.—The contract for furnishing 550,000 granite paving blocks has been awarded to Morse & Eagan, of Montpelier, Vt., at $1.45 per yd.

Crookston, Minn.—A resolution before the Council provides for the paving of about 33 blocks of residence streets with granite macadam.

College Point, L. I., N. Y.—President Cassidy, of Queens Boro., is said to be in favor of asphalting 13th St., the main thoroughfare of College Point. Estimated cost, $22,000.

Des Moines, Ia.—The City Council has passed over the Mayor's veto a resolution to pave East Walnut St. with asphalt, about 20,000 yds.

Lincoln, Neb.—City Engr. Campen's plans and specifications for repaving 2 districts have been approved by the City Council. Dist. No. 14, which is East O St., calls for 11,800 sq. yds. of brick work at $1.25 per yd., with 1 year guarantee, and 16,722 sq. yds. of asphalt at $1.60 per sq. yd., with 5-year guarantee, or $1.85 per sq. yd., with 10-year guarantee. Dist. No. 18, which is 7th St., calls for 5,500 sq. yds. of brick work at $1.20 per yd., with 1 year guarantee.

Niagara Falls, N. Y.—City Engr. Walter McCulloh has submitted his third set of estimates of the cost of paving Niagara Ave. The maximum cost of asphalt is given as $81,658, brick, $74,097, and macadam, $37,100.

Leavenworth, Ind.—Bids are wanted Aug. 16 for building a free turnpike on the Leavenworth and Marengo road, 6¾ miles in length. D. E. Wright, Comr. o fCrawford Co., English, Ind.

Washington, Pa.—The proposition to issue $30,000 paving bonds in East Washington Boro. is stated to have carried.

Waukesha, Wis.—Bids are wanted Aug. 29 for macadamizing McCall and Williams Sts. John P. Dey, Chmn. Bd. of Pub. Wks.

Hamilton, O.—An ordinance is reported to have been passed for the issue of $30,000 bonds for paving High St.

Jeffersonville, Ind.—Bids are wanted until Aug. 29 for the improvement of portions of several streets, with granitoid walks, vit. gutter, stone curb and macadam roadway. Victor W. Lyon, City Engr.

Council Bluffs, Ia.—City Engr. S. L. Etmyre writes that Pierce St. is soon to be improved by 3,000 ft. of artificial stone curbing and 5,500 sq. yds. of brick paving on a concrete base.

Ft. Worth, Tex.—Property owners on Houston St. are urging the City Council to have the street paved with asphalt.

Lowell, Mass.—City Engr. Geo. Bowers writes that the City Council has passed an order to pave with asphalt portions of 4 streets, in all 12,800 sq. yds.

East Windsor, Conn.—Bids will be received by the Bd. of Selectmen until Aug. 13 for constructing a macadam and telford road in the town. H. W. Talcott, 1st Selectman.

Muscatine, Ia.—Bids will be received by the City Recorder until Aug. 14 for grading, paving and curbing the streets and alleys in a part of improvement Dist. No. 20. Estimated quantities: Excavation, 7,000 cu. yds.; Ohio sandstone curbing, 5x20-in., 3,668 lin. ft., and 5x16-in., 2,400 lin. ft.; brick pavement on a 6-in. rock foundation, with 2½-in. top filler of sand, 11,196 sq. yds. Jas. J. Ryan, City Engr.

Dayton, O.—Bids will be received by the Bd. of City Affairs until Aug. 29 (readvertisement) for paving the roadway of Central Ave. with bituminous macadam or macadam, and for paving with bituminous macadam, brick or sheet asphalt, on Maple St., and for furnishing and setting the curbs. Estimated quantities: 12,970 sq. yds. of paving; 8,075 lin. ft. of straight curb, and 140 lin. ft. of circular curb. Robt. H. Ferguson, City Compt.

Glastonbury, Conn.—Bids will be received by the Bd. of Selectmen until Aug. 14 for constructing a macadam and telford road in this town. C. S. Loveland, 1st Selectman.

Cedar Falls, Ia.—The City Council on July 21 let the contract for paving and curbing certain streets, in all 17,454 sq. yds. paving, 4,200 lin. ft. of cement curb and 5,800 cu. yds. excavation to the Likes Improvement Co., of Des Moines, Ia., as follows: Paving with non-repressed brick on crushed rock foundations, $1.21 per sq. yd.; curbing, at 16 cts. per lin. ft.; excavation, at 16 cts. per cu. yd. An injunction was served on the Mayor and Councilmen on July 23 restraining them from entering into a contract with above company.

Washington, D. C.—The District Comrs. have ordered the roadway of I St. n. e. macadamized at an estimated cost of $6,800, and the roadway of B St. and Virginia Ave. n. w. macadamized at an estimated cost of $8,900.

York City, Pa.—The City Council has sold highway improvement bonds to the amount of $65,000.

Flint, Mich.—City Engr. A. W. Hall writes that the pavement of 3d St. East is being agitated.

Des Moines, Ia.—Bids are wanted Aug. 28 for paving with brick on Lyon St., in all about 11,097 sq. yds. John W. Budd, City Engr.

Camden, N. J.—The Co. Bd. of Freeholders has voted to construct a public road across the Meadows from Pleasantville to Camden. The estimated cost of the highway over 5 miles of marshland is $80,000, of which the State will probably pay $30,000.

Hawkesbury, Ont.—A vote was taken Aug. 4 in favor of expending $20,000 for street improvements.

New York, N. Y.—Louis F. Haffen, Pres. Boro. of Bronx, has awarded contracts for street improvements in the Bronx to the Barber Asphalt Paving Co. as follows: Forest Ave., at $1.02 a yd., $21,066; Park Ave., E. 165th St. to Tremont Ave., $1.02 a yd., $53,207; Washington Ave., 3d Ave. and 159th St. to Pelham Ave., $1.28 a yd., $135,739; Washington Ave. intersections, $1.28 a yd., $7,558.

Milwaukee, Wis.—Bids are wanted Aug. 12 (readvertisement) for furnishing material and repaving the roadway of 16th St. viaduct with creosoted pine blocks. Chas. J. Poetsch, City Engr.

Memphis, Tenn.—Bids will be received by the Bd. of Fire & Police Comrs. until Aug. 29 for paving portions of numerous streets with asphalt. Local press reports state that there will be in all about 151,000 sq. yds., and that the probable cost will be about $225,000. W. B. Armour, City Secy.

New York, N. Y.—Bids will be received until Aug. 18 by Louis F. Haffen, Pres. Bronx Boro., for grading Grant Boulevard and Concourse, from E. 181st St. to Mosholu Parkway, and constructing temporary roadways, sidewalks and paths. Engr.'s estimate of the work is as follows: 298,000 cu. yds. of earth excavation, 402,000 cu. yds. of rock excavation, 603,000 cu. yds. of filling, 14,100 cu. yds. of random range ashlar faced masonry in retaining walls, 170,000 sq. yds. of macadam pavement, 33,300 sq. yds. of paved gutters, etc. Bids will also be received at the same time for regulating and grading, setting curbstone, flagging sidewalks, etc., on portions of numerous streets. Engr.'s estimate of the work is as follows: 21,720 cu. yds. of earth excavation, 29,350 cu. yds. of rock excavation, 82,315 cu. yds. of filling, etc. Bids will also be received until Aug. 18 for paving and repaving with asphalt on portions of several streets, in all about 39,890 sq. yds. of new pavement and 32,610 sq. yds. of stone pavement to be relaid as foundation, or in approaches, etc.

Medford, Wis.—Bids will be received by J. H. Wheelock, City Clk., until Aug. 16 for constructing 3,117 ft. of cement curb and gutter, 9,400 sq. yds. of macadam, 3,063 ft. of 6, 8 and 10-in. water mains, etc. W. G. Kirschoffer, Engr., Baraboo, Wis.

Paris, Ill.—Bids will be received by Z. T. Baum, Pres. Bd. of Local Improv., until Aug. 14 for 15,200 sq. yds. of brick paving on a concrete foundation, 2,000 lin. ft. of stone curbing and 6,100 lin. ft. of combined curb and gutter, as advertised in The Engineering Record.

Wapakoneta, O.—The City Council has decided to sell $30,000 bonds for street and highway improvements.

Toledo, O.—Bids will be received by the Bd. of Co. Comrs. until Sept. 3 for constructing stone roads Nos. 36 and 37 by grading, draining, bridging and macadamizing the same. Wm. M. Godfrey, Co. Aud

Duluth, Minn.—City Engr. W. B. Patton writes that the following bids for paving East Superior St. were opened July 25: Western Construction Co., Lafayette, Ind., Trinidad Lake asphalt, $65,000; Western Paving & Supply Co., Indianapolis, Ind., Trinidad Lake asphalt, $55,446; Barber Asphalt Paving Co., New York, Trinidad Lake asphalt, $54,760; Warren Bros. Co., Boston, Mass., Warren's bituminous macadam, $50,280.

New York, N. Y.—The Sicilian Asph. Pavg. Co. has been awarded 19 contracts for an aggregate of 45,570 sq. yds. of asphalt paving on present pavement relaid as foundation, the tendered price for asphalt being $1.05 per sq. yd. and the price for relaying, 25 cts. per sq. yd.; total amount, $83,253. Contracts were also awarded to the Barber Asph. Pavg. Co. on bids received at the same time, July 29, for 12,420 sq. yds., total $25,176, and to the Asphalt Const. Co., for 4,920 sq. yds., total, $9,771.

Bids were also received for granite paving on concrete foundation, the N. Y. Sand & Gravel Co. being awarded a contract for $5,424, involving 1,470 sq. yds. of granite block, and Cunningham & Kearns, a contract for $7,450, involving 2,100 sq. yds.

Detroit, Mich.—The contract for furnishing asphalt block for the resurfacing of John R. St. has been awarded to the Lake Erie Asphalt Block Co. at $1.90 per sq. yd It is estimated that 5,080 sq. yds. of asphalt blocks will be required.

City Engr. Ferguson writes that the lowest bid received July 24 for paving a portion of Wabash Ave. with cedar block on a 6-in. concrete foundation was from H. Merdian, Detroit, as follows: 6,796 cu. yds. excavation at 30 cts.; 8,210 lin. ft. Berea straight curb at 48 cts.; 172 lin. ft. Medina circles, 95 cts.; 12,817 sq. yds. paving, $1.22 per sq. yd.; 224 cu. yds. curb concrete, at $2.50. Total, $22,393.

POWER PLANTS, GAS AND ELECTRICITY.

Washington, Ia.—Bids are wanted Aug. 26 for constructing a municipal electric lighting plant. Hugh H. McCleery, City Clk.

Atlanta, Ga.—A. H. Cox, Attorney, representing the Atlanta Electric Co., has petitioned the City Council for a franchise. This company proposes constructing a dam on the Chattahoochee River and generating the power for electrical purposes.

Jordan, Minn.—Bids are wanted Aug. 23 for $6,000 electric light bonds. C. Roderig, City Clk.

Indianapolis, Ind.—Bids are wanted Aug. 19 by the Bd. of Trus. for the installation of 2 500-H.-P. water tube boilers for the Central Indiana Hospital for Insane. Archt., Adolf Scherrer, Indiana Trust Co. Bldg.

Beatrice, Neb.—Bids are wanted Aug. 16 for the construction of an electric light and power house. Address Geo. A. Berlingh, Beatrice.

Globe, Ariz.—C. M. Clark is reported interested in the construction of a power plant on Salt River, directly north of Globe. It is estimated that it will furnish 6,000 H. P., enough to supply the town of Globe and the surrounding mining camps.

St. Louis, Mo.—Bids for the annual contract for lighting municipal buildings will be received by the Bd. of Pub. Improv. until Aug. 15.

National Military Home, Kan.—Bids are wanted Aug. 25 for the extension of the electric light plant at Western Branch, N. H. D. V. S. Maj. W. W. Martin, Treas.

Monticello, Minn.—See "Water."

Los Angeles, Cal.—H. H. Sinclair, Gen. Mgr. Power Development Dept., Edison Electric Co., writes that a power plant is to be constructed on Kern River. Estimated cost—hydraulic installation, $860,000; electrical installation, $800,000. Partial contracts will be made from time to time. F. C. Finkle, Engr. in Charge.

Manchester, Mass.—There is talk of constructing an electric light plant. The committee which has investigated the matter has recommended the establishing of a plant to cost about $150,000.

Evanston, Wyo.—The Edison Electric Co. has been incorporated, with a capital of $10,000,000. The company proposes to establish a power and light plant in the vicinity of Evanston and in the Uinta oil fields. It will also build and operate electric railways, furnish power to run drills and pumps in the oil fields, and also transmit power to distant mining camps. Andrew Cooke and Peter A. Fagg are among the incorporators.

Pueblo, Colo.—The Pueblo Gas & Fuel Co., of Pueblo, has been incorporated to construct, acquire, purchase and lease gas works, manufacture and lay pipes for the purpose of supplying the city and county of Pueblo, with gas for illuminating and other purposes; capital, $300,000. Directors: T. E. Eyman, J. D. Taylor and C. H. Prall, of Pueblo.

Farson, Leach & Co. and Devitt, Tremble & Co., Bankers, of Chicago, Ill., are reported to have purchased the plant of the Pueblo Gas Light Co. for $500,000. It is the intention of the new owners to expend several hundred thousand dollars in enlarging and extending the plant, and to reorganize the finances of the company.

Findlay, O.—The Kerr Mfg. Co., of Ft. Wayne, Ind., is stated to have secured the contract for an artificial gas plant for the Citizens Gaslight & Htg. Co., for about $60,000.

Buffalo, N. Y.—The Twentieth Century Acetylene Gas Co. is reported incorporated, with a capital of $100,000, to construct an acetylene gas plant. Jas. A. Roberts, Pres.; Jos. B. Roberts, Secy.

Plainview, Minn.—T. G. Bolton, Arthur Koenig and F. J. Cornwell are stated to have secured a franchise for an electric light plant. They have purchased a plant located at Durand, Wis., and will remove it to this place.

Ephrata, Pa.—Thos. A. Wilson is stated to have purchased the old grist mill on the Cloister premises and will establish there an electric light plant, to supply Ephrata and the surrounding county with light.

Monroe, Wis.—The City Council is stated to have granted the Chicago Bldg. & Mfg. Co., of Chicago, Ill., a franchise for a gas plant.

Great Falls, Va.—The Water Motor & Power Co. is reported to be planning to erect a large power house at Great Falls. The Co. has been organized to supply power to manufacturing plants. It was recently incorporated in Del., with a capital of $1,000,000. The incorporators include several prominent men of Washington, D. C.

Nashville, Tenn.—Duncan & Waddey, Real Estate Agents, are stated to have sold a tract of land in the 19th Dist. to the Cumberland Mfg. Co. The company proposes constructing an electric plant there when the lock is completed by the Government. The plant will furnish electrical power to the city.

Lampasas, Tex.—The Lampasas Light & Power Co. has been incorporated; capital $15,000. Incorporators: B. F. Barnes, F. J. Harris and others.

Ord, Neb.—The Council is stated to have passed an ordinance granting the Ord Light & Fuel Co. a franchise to construct and operate gas and electrical works.

Richmond, S. I., N. Y.—Arthur Corliss, of Brooklyn, Benj. R. Seaman, of Elizabeth, N. J., and Robt. P. Barry, Jr., of N. Y. City, are directors of the Richmond Light Co., just incorporated, with a capital of $3,000,000, to carry on operations in the Boro. of Richmond.

Talladega, Ala.—The Talladega Co. is stated to have purchased the city gas plant. The company proposes to generate 5,000 H. P. at Jackson's Shoals, 8 miles from the city, and operate an electric power, light and traction plant. It is proposed to run a car line from Lincoln to Ironaton, passing through and encircling the city of Talladega.

Kankakee, Ill.—The Council has granted franchises to the Citizens Gas Co. and to the Kankakee Electric Co.

Denton, Md.—L. B. Towers is reported interested in the construction of an electric light plant.

Navarre, O.—Geo. A. Myers, of Massillon, is stated to have secured a franchise for an electric light plant in Navarre.

Narberth, Pa.—See "Water."

Rhinelander, Wis.—Thos. A. Taylor and associates are stated to have secured a franchise to construct and operate an electric light plant.

Weiser, Idaho.—See "Water."

Dell Rapids, S. D.—The business men and citizens are reported to be discussing the matter of providing a local electric light plant. Whether it shall be established by the city or by a company has not yet been determined.

Manchester, O.—See "Water."

Pittsburg, Pa.—The Shadyside Electric Co. is stated to have applied for a charter to organize a company to furnish light, heat and power to the residents of the East End district. Wallace H. Rowe, W. L. Abbott and Alan W. Wood are said to be interested.

Columbus, O.—Bids are wanted Aug. 18 for furnishing labor and material for constructing an electric light plant for the city. Perry Okey, Supt. of Lights, has on file plans and specifications, which provide for 3 cross compound condensing engines of 500 H.-P. each, at 150 revolutions; 2 condensers, 3 400-Kw. steam turbines and generators; 4 horizontal water tube boilers, 300 H.-P. each; 1 176x9 ft. steel chimney; fuel economizers; 3 500-Kw., 2 phase, 60 cycle alternating current generators; and 1,500 7.5 ampere series alternating enclosed arc lamps. Clarence M. Addison, Clk. Bd. Pub. Wks.

New London, Wis.—See "Water."

Knoxville, Tenn.—The Knoxville Gaslight Co. will extend its mains to Oakwood addition; about 1 mile of 6-in. mains and 3 or 4 miles of laterals.

Elgin, Tex.—See "Water."

Susquehanna, Pa.—The Susquehanna County Electric Co. is reported incorporated, with a capital of $30,000.

Colby, Wis.—See "Water."

Albuquerque, N. M.—J. J. Henry and T. B. Whitted, of Denver, Colo., are stated to have purchased a controlling interest in the Albuquerque electric light plant and the city gas works. It is reported that a large sum will at once be expended in improvements. It is also reported that they may decide to build an electric railway in Albuquerque.

Penngrove, N. J.—See "Water."

Indianapolis, Ind.—The City Council has passed an ordinance ratifying the franchise recently granted the Citizens' Heat & Light Co.

Bloomington, Wis.—See "Water."

Kenmore, N. Y.—The citizens are stated to have voted Aug. 5 to install pipes, lamp posts and burners required for a complete gas lighting system, at a cost not to exceed $5,000.

East Rutherford, N. J.—See "Water."

Dexter, Mich.—Bids will be received by A. Davis & Co. until Aug. 20 for constructing an electric light and power plant for furnishing street and commercial lighting in this city.

Columbus, Ga.—Stone & Webster, 93 Federal St., Boston, Mass., write that they have decided to build a dam across Chattahoochee River at Columbus. It is not intended to construct a new power station.

ELECTRIC RAILWAYS.

Prospect, O.—The Columbus, Delaware & Marion Electric R. R. Co. will construct a branch line from Prospect to Richwood, a distance of about 6 miles. H. A. Fisher, Gen. Mgr., Columbus.

Covington, Ky.—A charter has been granted to the Sandy Valley & Elkhorn Ry. Co., of Kenton County; capital, $50,000. The road will start from a point opposite Ironton, O., and run through Greenup, Boyd, Lawrence, Johnson, Floyd, Pike and Letcher Counties in Ky. Incorporators: L. C. Goodale and F. L. Hoffman, of Cincinnati, O., and Frank Sullivan, of Covington.

Indianapolis, Ind.—Local press reports state that the Indianapolis Traction & Terminal Co. has secured a franchise for the erection of passenger and freight terminal stations and the construction of downtown loops. The following 8 companies are also reported to have secured franchises: The Union Traction, the Indianapolis Northern, the Greenfield, the Greenwood, the Shelbyville, the Martinsville, the Plainfield and the Lebanon Traction.

New Philadelphia, O.—The Massillon & New Philadelphia Electric Ry. Co. has been incorporated, with a capital of $600,000, to construct a line from Navarre to New Philadelphia. Incorporators: Dr. E. C. Lewis, of Canal Dover; Jno. C. Welty, of Canton, and others.

Winona, Minn.—A survey is being made by Geo. P. Brandis for an electric line from Winona to Rushford, a distance of about 28 miles. The Winona Ry. & Light Co. is supposed to be the promoter of this scheme.

Ridgway, Pa.—A charter has been granted to the Elk County St. Ry. Co., with a capital of $126,000, to construct a line 21 miles long from Ridgway to Johnsonburg, Rolf St. Marys and other places. Incorporators: Walter S. Ravenscroft, Ridgway; Edw. H. Yaeger, Pittsburg, and others.

Atlantic City, N. J.—The Camden, Atlantic City & Chelsea Passenger Ry. Co. has been incorporated with a capital of $250,000, to construct an electric railway in and about Atlantic City. Kane S. Green, Rosemont, Pa.; Wm. B. Schofield, Camden, and Louis Knehnle, Atlantic City, are among the incorporators.

Anderson, Ind.—Gus M. Hodges, of Dayton, O., is negotiating for a right of way for an electric railway between Anderson, Ind., and Newcastle.

Toledo, O.—It is stated that the Toledo Ry. & Light Co. will expend about $75,000 in improving the facilities of the company in this city. The first step will be the construction of car shops and storage sheds on Central Ave. A. E. Lang, Pres.

Cleveland, O.—Bids are wanted Aug. 25 for the construction and operation of street railways in numerous streets, separate bids having been asked for routes Nos. 1, 2, 3, 5, 6, 7, 8, 9 and 10. Bids are also wanted Aug. 28 for constructing and operating street railway route No. 4. Chas. W. Toland, City Clk.

Riverside, Cal.—Local press reports state that the City Trus. have made certain amendments to the proposed franchise for an electric road asked for by the San Bernardino Valley Traction Co., and that the time for receiving bids for same has been extended to Sept. 2.

Bolivar, N. Y.—The Town Trus. are stated to have granted a franchise to the Olean Electric Ry. Co.

Whitehall, N. Y.—The Vermont & Whitehall Ry. Co. has been incorporated, with a capital of $500,000, to operate an electric railway 9 miles long from Whitehall to the Vermont State line, to intersect the proposed route of the Rutland St. Ry. Directors: David A. Slattery and Ronald K. Brown, of N. Y. City; Ezra A. Tuttle, of Brooklyn, and others.

Tipton, Ind.—The Union Traction Co. is reported to have secured a site for the erection of a power plant at Tipton. G. F. McCulloch, Gen. Mgr., Anderson.

Batavia, N. Y.—The Buffalo & Depew Electric Ry. Co. is about to petition the Council for a right of way through Batavia. John T. Mooney, Supt., Depew.

Pueblo, Colo.—The Rapid Transit Co. has been incorporated to construct an electric line to Beulah, about 28 miles west of the city. Chas. Henkel, Pres.; J. J. Burns, Secy.

Evanston, Wyo.—See "Power Plants, Gas and Electricity."

New Albany, Ind.—The New Albany St. Ry. is reported to have passed to the control of the syndicate which now owns all the lighting, heating, traction and water properties of New Albany and Jeffersonville. It is stated that about $75,000 will be expended for improving the street railway.

Chestertown, Md.—The Baltimore & Chestertown R. R. Co. has been incorporated, with a capital of $75,000, to construct an electric railway from Chestertown to Rock Hall and Tolchester Beach. Incorporators: Henry R. Fothergill, Wilmington, Del.; Harcourt N. Trimble, Philadelphia, Pa., and others.

Clarkston, Mich.—The Council is stated to have granted J. A. Randall, of Detroit, a franchise for an electric railway to be constructed from Pontiac to Clarkston.

Canastota, N. Y.—The Canastota & Morrisville Ry. Co. is stated to have secured franchises in Canastota and Sylvan Beach. Wm. H. Patten, Pres.

Urbana, Ill.—The Danville, Urbana & Champaign R. R. Co. is reported incorporated, with a capital of $250,000, to construct an electric railway from Danville through the counties of Vermillion, Champaign, Platt, Macon and Sangamon, to Springfield. Principal office to be at Urbana.

Ossining, N. Y.—The Highway Comrs. are stated to have granted a franchise to the Westchester Traction Co. to construct its road to the town line of Ossining.

Fowler, Colo.—The Otero Interurban Light, Power & Traction Co. is reported to be circulating petitions among property owners preparatory to asking the Town Council for a franchise to operate a railway over the streets of Fowler. The company proposes to build an electric line across Otero County from west to east.

Warsaw, Ind.—The City Council is stated to have granted a franchise to the Winona, Warsaw, Elkhart & South Bend Traction Co.

Ft. Smith, Ark.—The Ft. Smith Suburban Ry. Co. has been incorporated, with a capital of $100,000, to construct a belt line 6 miles in length. Geo. Sengel, Pres. S. A. Williams, Secy.

Talladega, Ala.—See "Power Plants, Gas and Electricity."

Galesburg, Ill.—The City Council is reported to have granted a franchise to the Galesburg & Kewanee Electric St. Ry. Co.

Mayfield, Pa.—A charter is stated to have been granted to the Mayfield, Carbondale & Crystal Lake Ry. Co., to construct a line from Mayfield through Carbondale to the lake.

Salt Lake City, Utah.—The Co. Comrs. are stated to have granted a franchise to the Salt Lake & Suburban Ry. Co.

Parkersburg, W. Va.—The Parkersburg Bridge Terminal Ry. Co., of Parkersburg, W. Va., has been incorporated to build a railway in Wood County, W. Va., and in Washington County, O., and to construct bridges across the Ohio and Little Kanawha Rivers. Incorporators: J. T. Blair, Greenville, Pa., and B. S. Bacher and H. J. Cook, of Parkersburg.

Methuen, Mass.—The Selectmen are stated to have granted a franchise to the Lawrence & Methuen St. Ry. Co.

Sharon, Pa.—The Sharon & West Middlesex Electric R. R. Co. has been incorporated, with a capital of $50,000, to construct a line from Sharon to West Middlesex.

Viroqua, Wis.—The City Council is stated to have granted a franchise to the La Crosse & Eastern Ry. Co.

Paris, Ill.—The Paris & Terre Haute Traction Co. has been incorporated to construct a railway from Paris to various cities in Edgar and Champaign Counties; capital, $5,000. Incorporators: Geo. W. Hughes, Hume, Ill.; Henry H. Knipe, Marshall, Ill.; Joseph D. Hunter, Paris, and others.

Youngstown, O.—The City Council is stated to have granted a 25-year franchise to the Pennsylvania & Mahoning Valley Electric Ry., to construct a line on Mahoning Ave. to the National Steel plant. The line will connect with the system of the company throughout the city. E. M. Scofield & Co., of New York, N. Y., are stated to have secured the contract for constructing the superstructure of a power house to be erected by the Pennsylvania & Mahoning Valley El. Ry. Co. in the eastern part of the city. Contract price reported to be $40,000.

Milan, Ill.—The Western Illinois Electric Ry. Co. has been incorporated, with a capital of $15,000, to construct an electric railway connecting the lower end of Rock Island County and Aledo, in Mercer Co. Incorporators: Franklin H. Caldwell and Elmer E. Reynolds.

Souderton, Pa.—The Souderton, Skippack & Fairview Electric Ry. Co. has been incorporated, with a capital of $100,000, to construct a line through Harleyville, Skippack, Centerpoint and Fairview, a distance of about 17 miles. E. S. Moser, Pres., Collegeville; B. W. Dambly, Secy., Skippack.

Bound Brook, N. J.—Ch. Engr. H. M. Herbert, of Bound Brook, writes that a company is being organized to construct the Watchung Scenic Ry. between Plainfield and Bound Brook; length of proposed road, 10 miles. Surveys have not yet been completed, but the probable cost is placed at $200,000.

Parkesburg, Pa.—The Boro. Council is stated to have granted a franchise to the West Chester St. Ry. Co.

Cleveland, O.—The Cleveland & Sharon Traction Co. has been incorporated, with a capital of $10,000, by Thos. C. Willard, Chas. W. Dille, and others, to construct an electric railway connecting Cleveland with Sharon, Pa., and passing through Cuyahoga, Geauga and Trumbull Counties.

Albuquerque, N. M.—See "Power Plants, Gas and Electricity."

Roslyn, L. I., N. Y.—The Mineola, Roslyn & Port Washington Traction Co., of Roslyn, has been incorporated, with a capital of $150,000, to operate an electric road 10 miles in length. Directors: Isaac H. Odell, Fred. H. Parker, and others, of N. Y. City.

RAILROADS.

Huntington, Ind.—Huntington Township is stated to have voted a subsidy of $78,500 to the Dayton, Union City & Huntington R. R. Co.

Montreal, Que.—A press report states that the Canadian Pacific Ry. Co. will expend about $200,000 in reconstructing its yards at North Bay. David McNicoll, Gen. Mgr., Montreal.

Lake Charles, La.—Bids are wanted for grading 25 miles of Southern Pacific R. R. at Lake Charles. Address S. A. Robertson, Orange, Tex.

Hoxie, Ark.—The St. Louis, Memphis & Little Rock R. R. Co. has been incorporated, with a capital of $1,250,000. The road will begin at Hoxie and run a distance of 125 miles through Craighead, Jackson, Woodruff, Prairie and Lonoke Counties to Little Rock. F. E. Blomeyer and F. E. Burroughs are among the directors.

Morris, Ill.—The Chicago, Rock Island & Pacific R. R. Co. is reported to be making a survey for a new line from Morris to St. Louis, Mo., by way of Bloomington. W. E. Danchy, Ch. Engr., Chicago.

New Athens, Ill.—The Okaw Valley R. R. Co., of New Athens, has been incorporated, to build a line from Vanedy Station to New Athens: capital, $10,000. Incorporators: Chas. Stroh, New Athens; Geo. C. Probst, Nashville, Ill., and others.

Rochester, N. Y.—A press report states that W. J. Wilgus, N. Y. City, Ch. Engr. N. Y. Central & Hudson River R. R., has completed plans for the double-tracking of the Falls division, between Rochester and Niagara Falls; the improvement will cost about $200,000.

Autaugaville, Ala.—A charter has been granted to the Autauga R. R. Co. to construct a railroad from Autaugaville to Booths or Prattville; capital, $100,000. S. M. Dinkins, Pres., Montgomery. M. M. Smith, Vice-Pres., Autaugaville.

Clayton, Mo.—The St. Louis, Clayton & Olive St. R. R. Co. is stated to have petitioned the Co. Comrs. for a right of way through St. Louis County. D. C. Taylor, Pres.

Cherryvale, Kan.—A charter has been granted to the Cherryvale & Texas Ry. Co. to build 900 miles of road from Cherryvale, Kan., through Independence and Caney, Kan., and the Cherokee, Osage and Ponce Indian reservations to Perry, Okla. Ter., where one line will be constructed to El Paso and another via Pawhuske, Okla., to Paris, Tex.; capital, $18,000,000.

Nashville, Tenn.—Hunter McDonald, Ch. Engr. of the Nashville Chattanooga & St. Louis Ry., writes that preliminary surveys only have been made for proposed extensions in Wilson, Cannon and DeKalb Counties.

Superior, Wis.—The Superior Suburban R. R. Co. has been incorporated to construct and operate a railroad 100 miles long within Douglas County; capital, $25,000. Incorporators: John A. Bardon, Wm. J. Leader, and others, all of Superior.

Corbin, Ky.—Col. L. F. Hubble is reported interested in the construction of a railroad from Corbin to Celina, Tenn.

Jefferson City, Mo.—A charter has been granted to the Memphis & Chicago Ry. Co., with a capital of $200,000, to construct a railroad through Cape Girardeau and Scott Counties, Mo. R. T. Booth and W. B. Drake are among the incorporators.

San Augustine, Tex.—L. J. Smith, of Kansas City, has secured the contract for constructing 20 miles of railroad from San Augustine to Center.

Orange, N. J.—A press report states that the Lackawanna R. R. Co. has prepared plans for the elevation of its tracks through Orange and will present them to the Common Council at an early date. W. K. McFarlin, Ch. Engr., Hoboken.

Riparia, Wash.—The contract for building the line of the Oregon R. R. & Navigation Co. on the north bank of the Snake River between Riparia and Lewiston, is reported to have been awarded to Mr. Wren, of Spokane, and Mr. Greenough, of Missoula, Mont. Work to begin at once and to be completed by April 15th. There are 71 miles of road to be built, and this contract covers grading and bridging for the whole line, involving about $800,000.

PUBLIC BUILDINGS.

Portland, Me.—Frank W. Cunningham is stated to have secured the contract for erecting the city home for $112,450.

Cincinnati, O.—The Directors of the House of Refuge are about to petition for an appropriation of $50,000 for additions to the institution.

Springfield, Ill.—Bids will be received by S. A. Bullard, Archt., 208 S. 6th St., until Aug. 13 for furnishing material and erecting the Prentice M. E. Church.

Boston, Mass.—Bids will be received by the Trus. of the Boston City Hospital until Aug. 14 for installing a ventilating and heating system in Pavilion 3. A. Shuman, Pres.; Jas. Mulcahy, Archt., 66 State St.

Hennepin, Ill.—Bids are wanted Aug. 25 for erecting a brick Catholic church. Rev. F. Gahlman, Pastor.

Hartford, Conn.—The Hartford Co. Senators and Representatives are stated to have voted an appropriation of $90,000 for an addition to the court house, the installing of new boilers and for electric lighting of the buildings.

Lawton, Okla. Ter.—Bids will be received by the Bd. of Co. Comrs. until Aug. 25 for erecting a court house. Sam Frances, Chmn.

Houston, Tex.—Plans, specifications and detailed drawings will be received by D. D. Bryan, City Secy., until Oct. 6 for a combined market house and city hall. Cost not to exceed $100,000.

Ottawa, Ont.—Bids are wanted Aug. 23 for the construction of the Mint at Ottawa. Fred Gelinas, Secy. Dept. of Pub. Wks.

Buffalo, N. Y.—Bids are wanted Aug. 14 for the erection of a 1-story brick lavatory, to be located on the grounds of the Elk St. Market; also for sundry alterations in the tower of Clinton Market Bldg., to be used as a lavatory. Francis G. Ward, Comr. of Pub. Wks.

Jackson, O.—Bids are wanted Aug. 21 for an addition to and repair of the Jackson Co. Court House. C. P. Schellenger, Co. Aud.

Eureka, Cal.—Geo. A. Kellogg, Secy. Bd. of Trus., writes that the contract for constructing the Carnegie Library has been awarded to A. N. Foster, of Eureka, Cal., for $20,842.

Louisville, Ky.—J. H. Cowles, Clk. of Fiscal Court, writes that D. X. Murphy & Bro., 250 5th St., have been selected to prepare plans for the Jefferson Co. Jail, estimated to cost $196,000.

Pasadena, Cal.—The plans of C. H. Brown, of Los Angeles, are stated to have been accepted for a city hall, to cost $34,000.

Marion, O.—Richards, McCarty & Bulford, Ruggery Bldg., Columbus, are stated to be preparing plans for the Marion Co. Jail, to cost about $120,000.

Alexandria, La.—The plans of F. B. & W. S. Hull, of Jackson, Miss., are stated to have been accepted for a court house for Rapides Parish, to cost $71,000.

Camden, N. J.—Kaighn & Draper, 414 Haddon Ave., are stated to have secured the contract for erecting the Nurses' Home at Cooper Hospital, for $21,500.

Sacramento, Cal.—The plans of Willis Polk, Chicago, Ill., are stated to have been accepted for an Episcopal church, to be erected on 15th and J Sts., to cost about $45,000.

Baton Rouge, La.—The Legislature, just adjourned, appropriated $25,000 for improvements at the State House, building and grounds.

St. Paul, Minn.—Plans have been filed by the Minnesota Children's Home Society for a new Infants' home, to be located in St. Anthony Park; cost, $25,000.

Madison, Wis.—The Mueller Co., of Milwaukee, is stated to have secured the contract for ventilating, heating and lighting the capitol; contract price reported to be $60,000.

Kenton, O.—Richards, McCarty & Bulford, Ruggery Bldg., Columbus, are stated to have prepared plans for a $25,000 Carnegie Library for Kenton.

Buffalo, N. Y.—The contract for the grading, excavating and sewer work for the proposed 65th Regt. Armory is stated to have been awarded to Mosier & Summers, for $64,684.

Wichita, Kan.—It is stated that plans have been completed for a $30,000 church for the M. E. Society.

Perry, Ia.—The Council is stated to have decided to erect a $15,000 city hall.

Colorado Springs, Colo.—The contract for the ornamental iron work on the new county court house is stated to have been awarded to the Chicago Ornamental Iron Co., Chicago, Ill., for $18,445.

Dedham, Mass.—Bids received July 29 for the building to be used as a registry of deeds and probate and for the purposes of the Norfolk County Probate Court to be erected opposite the present court house on High St., Dedham, are stated to have been rejected, as all were in excess of the amount allowed by State Legislature, which is $200,000.

New York, N. Y.—The St. Aloysius R. C. Congregation is stated to have purchased a site at 132d St., west of 7th Ave., for the erection of a brick and stone church, to cost about $100,000.

Plans have been filed for a 3-story brick lodging-house, to be erected at 225 and 227 W. 35th St., by the Children's Aid Society; cost, $40,000.

Springfield, O.—Bids are wanted Aug. 23 for $60,000 bonds, to be used for the erection of a building for County Offices. J. A. Hinckle, Chmn. Bd. Co. Comrs.

Galion, O.—Bids are wanted Aug. 25 for erecting the Galion Public Library. Address, "Building Committee, Public Library."

Harrisburg, Pa.—Bids are wanted Aug. 16 for the erection of treatment and D and D buildings. Dr. H. L. Orth, Supt. Pa. State Lunatic Hospital. Addison Hutton, Stephen Girard Bldg., Philadelphia, Archt.

Marshalltown, Ia.—The State Bd. of Control has awarded the contract for erecting 7 additional buildings at the Soldiers' Home to J. F. Atkinson, of Marshalltown, for $55,974.

Springfield, Mass.—Ex-Mayor D. O. Gilmore has had plans prepared by Lord, Burnham & Co., of New York City, for an arboretum, 24x100 ft., which he is to erect at Forest Park and present to the city.

Cape May, N. J.—The congregation of St. Mary's R. C. Church is reported to have decided to erect a $35,000 edifice on Washington and Ocean Sts.

Kentland, Ind.—It is stated that bids are wanted Sept. 2 for erecting a court house, to cost about $50,000. Jas. F. Bruff, Archt., Kokomo.

Boulder, Colo.—It is stated that bids are wanted Aug. 30 for erecting a library in this city, to cost about $75,000. G. W. Roe, Archt., Pueblo, Colo.

St. Louis, Mo.—Isaac S. Taylor, Dir. of Wks. of the La. Purchase Expo., writes that Conrad Kellerman, Roe Bldg., secured the contract for erecting the Liberal Arts Bldg., for $175,000.

Boston, Mass.—Bids will be received by the Trus. of the Boston Insane Hospital, 64 Pemberton Sq., until Aug. 20 for furnishing material and erecting 4 buildings and connecting corridors at the Women's Dept., Ward 23. Wheelwright & Haven, Archts., 1001 Colonial Bldg.

Hollister, Cal.—It is stated that bids are wanted Aug. 25 for making alterations and additions to the Co. Hospital. Jas. G. Piratsky, Co. Clk.

Erie, Pa.—Bids will be received by the Bd. of Fire Comrs. until Aug. 15 for erecting an addition to Engine House No. 7. Richd. E. Ford, Secy.

Harrisburg, Pa.—Bids are wanted Sept. 6 for the construction of a Capitol building, as advertised in The Engineering Record.

Duluth, Minn.—At a meeting of the Co. Comrs., July 30, a levy of $60,000 was made for the purpose of securing a new court house for St. Louis Co. It is stated that the proposed court house will cost about $300,000.

Los Angeles, Cal.—The Pauly Jail Bldg. & Mfg. Co. of St. Louis, Mo., is stated to have secured the contract for the cell work on the Los Angeles County Jail for $69,983.

Sewickley, Pa.—It is stated that the contract will soon be let for erecting a town hall, to cost about $40,000.

Riverside, Cal.—It is stated that plans will be received by the Co. Bd. of Superv. until Aug. 13 for a court house. Probable cost, $150,000. W. W. Phelps, Co. Clk.

La Junta, Colo.—Bids are wanted Aug. 18 for erecting a city hall. G. S. Thompson, City Clk.

BUSINESS BUILDINGS.

Norristown, Pa.—It is stated that the Pennsylvania R. R. Co. will expend about $250,000 in improvements here, including the erection of passenger station on Lafayette St. W. H. Brown, Ch. Engr., Philadelphia.

Clare, Mich.—Haug & Scheurman, of Saginaw, are preparing plans for a $10,000 block for J. W. Calkins, of Clare.

Delray, Mich.—D. J. Kennedy, of Bay City, is stated to have secured the contract to construct all the buildings, foundations, docks, etc., for the Cleveland & Detroit Iron Smelting Works, to be erected at Delray; contract price reported to be about $200,000.

Toledo, O.—It is stated that plans have been completed for a passenger and freight station to be erected by the Toledo Ry. & Terminal Co. on Cherry and Seneca Sts., to cost about $200,000.

Jersey City, N. J.—The Prentiss Tool & Supply Co., 203 1st St., is stated to have decided to erect a brick storehouse on Communipaw Ave. and Woodward St., to cost about $25,000.

East Liverpool, O.—Frank H. Covalt, of Newport, Ky., is reported interested in the erection of a 5-story hotel and opera house building.

New York, N. Y.—Plans have been filed for a 5-story clubhouse to be built at 353 and 355 W. 17th St. Architect, J. H. Duncan, 21 W. 24th St. Theo. B. Starr is the owner; estimated cost, $50,000.

The Geo. A. Fuller Co., 137 Bway., is stated to have secured the contract for erecting an office building on 42d St., Bway. and 7th Ave. for the New York Times. Architect, Cyrus L. W. Erdlitz, 1123 Bway.

Steubenville, O.—It is stated that the Pennsylvania Co. will erect a depot here, to cost about $50,000. Thos. Rodd, Ch. Engr., Pittsburg, Pa.

Edw. L. Moore is reported interested in the erection of a $50,000 theater.

Columbia, Tenn.—A. E. Hawthorne & Co., of Nashville, are stated to have secured the contract for erecting the Louisville & Nashville R. R. depot at Columbia for $45,000.

Rochester, N. Y.—It is stated that the N. Y. Central & Hudson River R. R. Co. will erect a depot here, to cost about $230,000. The train shed will also be enlarged. W. J. Wilgus, Ch. Engr., N. Y. City.

Kankakee, Ill.—Local press reports state that the C., C., C. & St. L. Ry. will build a $30,000 depot at this place. G. W. Kittredge, Ch. Engr., Cincinnati, O.

Sioux City, Ia.—Geo. W. Burkhead, Ia. Savings Bank Bldg., is preparing plans for a 3-story modern brick building to be erected on 4th St. by Alex. Elliot. Cost, $12,000.

Mankato, Minn.—A correspondent writes that the Chicago Great Western R. R. (Saml. C. Stickney, Mgr., St. Paul), and the Chicago, Milwaukee & St. P. Ry. (R. H. Williams, Gen. Mgr., Chicago, Ill.), will erect a union depot at Mankato. Cost, $60,000.

Homestead, Pa.—The Elks of this place have decided to build for themselves a home which will probably be located on 7th Ave. and Amity St. There is $12,000 in the building fund, and as much more has been pledged.

Duluth, Minn.—The Metropolitan Bldg. Co. is reported incorporated, to erect an opera house to cost about $50,000. Plans are being prepared by Architect Wangenstein, Providence Bldg. Lane McGregor and Frank W. Densmore are among the directors.

Boston, Mass.—Plans have been filed for a granite and brick office building to be erected on State St., Merchants' Row and Corn Court, for the State St. Assoc., of which Richards M. Bradley, Geo. E. Cabot and Arthur Lyman are Trus.; cost about $800,000. Architects, Peabody & Stearns, 53 State St.

Memphis, Tenn.—It is stated that the Southern Ry. Co. is to expend $20,000 to overhaul and extend its freight depot at Court and Madison Sts. W. E. Hutchens, Div. Supt., Memphis.

Minneapolis, Minn.—T. B. Walker is preparing to erect a 6-story wholesale house at 1st Ave. N. and 6th St., to cost $125,000.

Utica, N. Y.—The contract for erecting a building for the Utica City National Bank is stated to have been awarded to Ambrose B. Stannard, St. James Bldg., N. Y. City, for $108,000.

Grand Rapids, Minn.—John Beckfelt is reported interested in the erection of an opera house, to cost about $35,000.

St. Paul, Minn.—Geo. Somers & Co. are stated to have purchased a site on 6th and Wacouta Sts., on which they will erect a warehouse and factory to cost $150,000. The building is to be 6 or 8 stories high.

Cleveland, O.—F. C. Bate, New England Bldg., is reported to be preparing plans for a $25,000 building to be erected on Bank and Lake Sts., for P. L. Johnson.

Atlanta, Ga.—Capt. Jas. W. English is reported to have under consideration the erection of an office building on Peachtree and Marietta Sts., to cost about $400,000.

Des Moines, Ia.—The M. Runely Mfg. Co., of Laporte, Ind., is to erect either this fall or next spring a branch house, 4 stories high, 100x132 ft.

DWELLINGS.

Bakersfield, Cal.—Havens & Toepke, Flood Bldg., San Francisco, are stated to have prepared plans for an apartment house to be erected on Chester Ave. and 17th St. for Jewitt & Faraum, to cost $40,000.

Buffalo, N. Y.—Mrs. Porter Norton has secured a permit for the erection of a 2-story brick and stone residence at 41 Gates Circle. The plans provide for a structure 100x70 ft. of colonial style to cost $46,000.

Washington, D. C.—Jas. L. Parsons, 1425 N. Y. Ave. N. W., is stated to have secured the contract for erecting an apartment house on Connecticut Ave. and L St., for $467,000. Architect, Jas. G. Hill.

SCHOOLS.

New Britain, Conn.—B. H. Hibbard, 153 Arch St., is stated to have secured the contract for erecting an 8-room school on Prospect St. Rourke Bros., of New Haven, secured the contract for heating same; total cost, $25,000.

Hartford, Conn.—The plans of John J. Dwyer, 78 Trumbull St., are stated to have been approved for an addition to Wilson St. School, to cost about $16,000.

Peabody, Mass.—Bids are wanted Aug. 15 for $95,000 school bonds. Elmer M. Poor, Town Treas.

Rockingham, Halifax.—Bids are wanted Aug. 16 for the construction of a chapel and annex to Mount St. Vincent Academy. Mother M. Berchmans, Superioress. Maurice Perrault, 15 St. Lambert Hill, Montreal, Archt.

Baton Rouge, La.—The Superv. of the La. State Univ. are stated to have selected W. L. Stevens, of Crowley, to prepare plans for a workshop, and Favrot & Livandais, of New Orleans, to prepare plans for a physics and civil engineering building, at a total cost of $47,000.

Parkersburg, W. Va.—Wm. H. Patton, of Parkersburg, is stated to have been selected as architect for the 5th Ward School, to cost about $40,000.

El Reno, Okla. Ter.—The citizens are stated to have voted to issue $20,000 for a new school.

Port Washington, Wis.—Fred. Fraf is stated to have prepared plans for a 3-story brick addition to the high school, to cost $15,000.

Trenton, N. J.—All bids received July 24 for erecting a school on Fillmore St. are stated to have been rejected and new bids will be received; cost not to exceed $50,000.

Hastings-on-Hudson, N. Y.—Bids are wanted Aug. 15 for the erection of a brick school on Farragut Road. Geo. P. Hemstreet, Secy. Bd. of Educ.

Worcester, Mass.—John P. Kingston, 518 Main St., is the architect for Gates Lane brick school, to be built for this city at a cost of $18,000.

Baltimore, Md.—The Bd. of Awards received the following bids for the erection of a public school at Johnson and Heath Sts.: Brady & Waters, $52,555 (awarded); C. L. Stackhouse, $53,837; C. Sheehan & Sons, $54,144; Frederick Decker & Son, $59,563. Bidders all of Baltimore.

Bids are wanted Aug. 13 for a steam fan system of ventilating and heating the school to be erected at Johnson and Heath Sts. Edw. D. Preston, Inspector of Bldgs.

Middletown, Conn.—The plans of Cady, Berg & See, 31 E. 17th St., N. Y. City, N. Y., are stated to have been selected for the new Lecture Hall at Wesleyan. Plans for a new Science Hall are under consideration by the Trus. The third building to be erected is a new observatory hall to cost $50,000.

Bellefonte, Pa.—Mr. and Mrs. Chas. M. Schwab are stated to have increased the amount of their gift to the State College to $120,000, to be used for the erection of a chapel on the College Campus.

Westfield, Mass.—It is stated that bids are wanted Sept. 1 for erecting a dormitory. Address, E. C. & G. C. Gardner, Archts., Springfield.

Kingman, O.—It is stated that bids are wanted Aug. 30 for erecting a brick school. S. P. Buckley, Clk.

Niagara Falls, N. Y.—Bids are wanted by the Bd. of Educ. until Aug. 20 for erecting a school in the 3d Ward. Carl E. Tucker, Clk.

Boston, Mass.—Bids are wanted Aug. 14 for the mason, carpentry and other work in the following schools: Parkham School, West Bway., and Drake School on C St., both in South Boston; Harvard School, on Devens St., Charlestown, and Chas. C. Perkins School, on St. Botolph St., Back Bay, Boston. R. Clipston Sturgis, Chmn. City Schoolhouse Comrs.

North Freedom, Wis.—It is stated that bids are wanted Aug. 14 for erecting a school. Geo. W. Hackett, Clk.

Austin, Tex.—Bids will be received by the Bd. of Regents of the Univ. of Texas, at Austin, until Sept. 6 for furnishing and installing a steam heating apparatus in the girls' dormitory. T. S. Henderson, Chmn.

Milwaukee, Wis.—Bids will be received by the Bd. of Pub. Wks. until Aug. 14 for erecting a school on 14th and Galena Sts., in 9th Ward. Chas. J. Poetsch, City Engr.

Boone, Ia.—It is stated that bids will be received by J. J. Snell until Aug. 12 for heating apparatus in schools.

Cleveland, O.—Bids are wanted Aug. 29 for $100,000 school bonds. H. D. Coffinberry, Treas.

Kansas City, Mo.—Local press reports state that the Sisters of Loretta will erect new school buildings, to cost about $200,000.

New York, N. Y.—The following bids were opened July 28 by the Dept. of Education for installing, heating and ventilating apparatus in Morris High School, Boro. of Bronx: Baldwin Engineering Co., $55,807; Frank Dobson, $50,500; John Neal's Sons, $49,909; Blake & Williams, $49,680; Williams & Gerstle, $51,800; John Hankin & Brother, $51,295; United Htg. Co., 366 W. Bway., $49,447 (awarded); E. Rutzler, $53,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Canton, O.—City Engr. P. H. Weber writes that the contract for constructing a garbage crematory has been awarded to the Dixon Garbage Crematory Co., Toledo, O., for $19,985.

Vincennes, Ind.—City Clk. T. Robertson writes that the contract for the removal of garbage for 1 year has been awarded to Andrew Nestlehut, of Vincennes, for $2,200.

Holyoke, Mass.—The U. S. Garbage Reduction Co., of Lynn, has made a proposition to the Bd. of Pub. Wks. for the construction of a garbage plant in this city, to cost about $60,000.

Springfield, Mass.—The Bd. of Health has under consideration a proposition from the U. S. Garbage Reduction Co. for the erection of a $50,000 disposal plant in Springfield.

Bloomfield, N. J.—The Bd. of Health is considering the question of the collection and disposal of garbage.

Spokane, Wash.—The question of constructing a garbage disposal plant is said to be under consideration.

Seattle, Wash.—Local press reports state that a crematory, to cost about $75,000, is now being planned by Health Officer Carroll.

Burlington, N. J.—The U. S. Garbage Reducing Co. has applied to Burlington Common Council for permission to erect a plant in that place.

Marietta, O.—Local press reports state that a contract is soon to be let for the construction of a crematory.

Greensburg, Pa.—The Council is said to be preparing a new ordinance for the issue of $25,000 bonds for a garbage plant.

GOVERNMENT WORK.

Light Fixtures.—Separate bids have been asked by the Treasury Dept., Washington, D. C., until Aug. 29 for manufacturing and placing in position certain combination gas and electric light fixtures, for the U. S. Post Office buildings in the following cities: St. Cloud, Minn.; Joliet, Ill.; Hot Springs, Ark.; Oskaloosa, Ia., and Abilene, Tex.

Philadelphia, Pa.—The following bids were opened Aug. 2 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a brick and steel building at the League Island Navy Yard: L. L. Leach & Son, Chicago, $74,731; Henderson & Co., Philadelphia, $79,000; Penn Erecting Co., Philadelphia, $75,400. The bids given were on the building as per specifications; many other bids for deductions, etc., were also submitted.

New York, N. Y.—Bids are wanted at the U. S. Engr. Office until Sept. 3 for dredging in Buttermilk Channel and in Gowanus Creek, N. Y. Harbor, as advertised in The Engineering Record.

Rock Island, Ill.—Bids are wanted at the U. S. Engr. Office until Aug. 30 for constructing and repairing dams and shore protections between Rock Island, Ill., and Burlington, Ia., and between Burlington, Ia., and Hannibal, Mo., as advertised in The Engineering Record.

Ft. Snelling, Minn.—Bids are wanted Aug. 20 for constructing a sewer system at this post. Address Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

New Orleans, La.—Bids are wanted at the U. S. Engineer Office, New Orleans, until Sept. 2 for dredging at Calcasieu Lake, La., and Sabine Pass Harbor, Tex., as advertised in The Engineering Record.

St. Louis, Mo.—The Bd. of Managers in charge of the government exhibit at the Louisiana Purchase Exposition at St. Louis is reported to have approved plans for the government building, which were drawn under the supervision of Jas. K. Taylor, Supervising Architect, Treasury Dept., Washington. Estimated cost of building, $350,000.

Batesville, Ark.—The plans of Capt. Graham D. Fitch, Corps of Engrs., U. S. A., Little Rock, Ark., for locks Nos. 1 and 2 on White River, near Batesville, are reported to have been approved. Probable cost, $132,000.

Washington, D. C.—Among the allotments recently made by the War Dept. for improvements of Army Posts are the following: Hains Mission, Alaska, $260,000; Monterey, Cal., $125,000; Ft. Warden and Ft. Casey, Wash., and Ft. Rosecrans, Cal., each $120,000; Ft. Lincoln, N. D., $90,000; Ft. Meade, S. D., $95,000; Ft. McKenzie, Wyo., $115,000; Ft. D. A. Russell, Wyo., $200,000; Ft. Ethan Allen, Vt., $175,000; Ft. Douglas, Utah, $125,000; Ft. Snelling, Minn., $260,000; Ft. Lawton, Wash., $105,000; Ft. Des Moines, Ia., $240,000; Vancouver Barracks, Wash., $140,000; Ft. Ontario, N. Y., $160,000; Whipple Barracks, Ariz., $120,000; Ft. Riley, Kan., $225,000; Ft. Leavenworth, Kan., $250,000.

Johnson City, Tenn.—Bids are wanted at the Office of the National Home for Disabled Vol. Soldiers, New York City, until Sept. 2 for constructing certain buildings at the Mountain Branch of the N. H. for D. V. S. near Johnson City, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted Aug. 18 for the construction of fireproof floor over the east portico of the U. S. Treasury Bldg. M. E. Ailes, Asst. Secy. Treasury Dept.

Phoenix, Ariz.—Bids are wanted Aug. 26 for furnishing and delivering at the U. S. Indian School, Phoenix, the following supplies: 50,000 bricks, 90 bbls. of cement, 600 electric lamps, 3 electric motors, etc. Chas. W. Goodman, Supt.

Rapid City, S. D.—Bids will be received at the Office of Indian Affairs, Dept. of the Interior, Washington, D. C., until Sept. 2 for furnishing material and erecting a brick employes' quarters and a brick laundry, including plumbing and acetylene gas piping: also a brick dormitory, an addition to brick dormitory and a brick school house, all with plumbing, acetylene gas piping and steam heating, at the Rapid City Indian School. For information address Sam B. Davis, Supt. of School. A. C. Tonner, Acting Comr.

Bremerton, Wash.—The Puget Sound Bridge & Dredging Co. has received the contract for the coaling plant at Puget Sound Navy Yard, for $265,000.

Pensacola, Fla.—Capt. J. C. Sanford, Corps of Engrs., U. S. A., Charleston, S. C., is reported to have in charge the preparation of plans for a $150,000 dredge for use at this harbor.

Tampa, Fla.—The contract for constructing the U. S. Post Office at Tampa has been awarded to Cramp & Co., Philadelphia. For bids opened July 17, see The Engineering Record of July 26.

Washington, D. C.—According to press reports the Navy Department will soon call for bids for a floating dry dock to accommodate a 16,000-ton battleship, to be built in the United States and floated over to the Philippines. The amount available is $1,250,000.

Sault Ste. Marie, Mich.—A Bd. of Government Engrs. is reported to have decided to recommend as the best method of extending the locks system, the construction of an entirely new concrete lock to give passage at one time to 3 of the largest ships on the lakes; the canal above to be widened to 500 ft.

MISCELLANEOUS.

Boston, Mass.—Frederick N. Wales, Clk. Bd. of Harbor & Land Comrs., writes that the contract for building a stone breakwater at the entrance to Apponagansett Harbor on Buzzards Bay has been awarded to E. S. Belden & Sons, 217 Laurel St., Hartford, at $1.07 per net ton of stone.

Wilmington, Del.—Theodore A. Leisen, Ch. Engr. of Parks, writes that the contract for constructing a concrete dam across the Brandywine has been awarded to Simmons & Bro., of Wilmington, for $4,451.

Webster City, Ia.—It is stated that bids are wanted Aug. 25 for constructing Elwich drainage ditch; estimated amount of excavation, 26,000 cu. yds. Edw. E. Fox, Engr.

Chicago, Ill.—The following bids were opened July 28 by Major J. H. Willard, Corps of Engrs., U. S. A., for constructing foundations for 5 locks and 1 aqueduct bridge, walls for 8 locks and piers and abutments for 5 aqueduct bridges and 1 highway bridge: A, Page & Shnable, Chicago, $316,372; B, Bates & Rogers Const. Co., Chicago, $399,848; C, J. A. Hinemann, Chicago, $358,429; D, Cogan & Pound, Chicago, $502,681; E, Capital City Brick & Pipe Co., Des Moines, Ia., $363,642; F, Callahan Bros. & Katz, Omaha, Neb., $364,129. For detail bids see accompanying table. Amount available for this work, $350,000:

Items and Quantities.	F	E	D	C	B	A
Excav., 62,891 cu. yds.	$.35	$.75	$.40	$.37½	$.60	$.34⅓
Rock excav., 9,024 cu. yds.	.80	1.00	1.25	1.25	1.50	1.30
Piles, 17,360 lin. ft.	.40	.45	.45	.40	.45	.39
Pine plank, 57,552 ft. B. M.	25.00	55.00	37.00	28.00	30.70	30.60
Pine timber, 253,666 ft. B. M.	25.00	53.00	31.00	31.00	32.40	32.40
Oak plank, 3,336 ft. B. M.	40.00	60.00	53.00	47.50	44.50	39.00
Oak sheeting, 33,048 ft. B. M.	50.00	65.00	55.00	57.00	62.00	60.00
Bolts, etc., 25,902 lbs.	.04	.04	.05½	.04	.04	.05
Nat. cement con. in found., 4,113 cu. yds.	6.00	5.00	6.00	5.75	5.85	5.25
Port. cement con. in found., 200 cu. yds.	7.00	7.00	8.00	8.70	7.85	7.34
Nat. cement con. in walls, 8,703 cu. yds.	7.70	6.00	9.00	6.90	7.20	5.72
Port. cement con. in walls, 21,219 cu. yds.	8.90	8.50	14.00	8.70	9.20	7.29
Drain pipe: 8-in., 705 ft.	.40	.60	.65	.50	.30	.30
10-in., 825 ft.	.50	.70	.75	.60	.35	.42
Broken stone, 945 cu. yds.	2.50	2.40	3.25	2.75	2.80	2.10
Laying C. I. pipe: 18-in. lengths @12 ft.	3.00	1.00	2.00	15.00	5.00	4.20
24-in., 36 lengths @12 ft.	4.00	1.10	2.50	18.00	8.00	5.40
36-in., 18 lengths @12 ft.	5.00	1.40	3.50	20.00	14.00	9.00
48-in., 36 lengths @12 ft.	6.00	2.00	4.00	22.00	24.00	12.60
Slope paving, 1,309 sq. yds.	4.00	3.00	4.00	2.50	3.50	2.15
Rubble mas., 972 cu. yds.	8.50	4.10	11.00	9.50	7.50	7.30
Back fill., 91,761 cu. yds.	.20	.15	.25	.17	.30	.24

New York, N. Y.—The Bd. of Aldermen has authorized the issue of $200,000 bonds for Thomas Jefferson Park, $50,000 for park at North River and 42d St., $35,000 for comfort stations in Central and Morningside Parks, and $100,000 for park work in the Boro. of Brooklyn.

Portland, Ore.—The contract for constructing a dry dock has been awarded to Robt. Wakefield, of Portland, at a compromise bid of $162,000.

Osceola, Ark.—Bids are wanted Aug. 20 for dredging about 13 miles of drainage canal, involving the removal of about 223,000 cu. yds. of earth. Address John A. Fox, Osceola.

Greenville, Miss.—Bids will be received by the Bd. of Miss. Levee Comrs. until Aug. 25 for constructing about 800,000 cu. yds. of levee work. Nathan Goldstein, Secy.

Boston, Mass.—The following bids were opened July 31 by the Boston Transit Commission for part of Section D, East Boston Tunnel. The dates given are the time of beginning and the time of completing, respectively: A, Jones & Meehan, Boston, $141,555, Aug. 11, 1902; Apr. 11, 1903; B, Metropolitan Cont. Co., Boston, $131,555; Aug. 9, 1902; Dec. 31, 1902; C, P. McGovern, Roxbury, Mass. (awarded), $126,310; Aug. 11, 1902; Feb. 11, 1903. For detail bids see accompanying table:

Items and Quantities.	A.	B.	C.
12,000 cu. yds. earth excav.	$7.00	$7.15	$6.40
3,500 cu. yds. concrete, Port. cem. mortar	14.50	11.40	12.00
30 tons steel rods, etc.	25.00	18.00	100.00
Laying vit. pipe:			
20-in., 560 lin. ft.	1.50	3.50	2.50
15-in., 60 lin. ft.	1.50	3.00	2.25
1,500 sq. yds. coating Port. cem. mortar	1.00	1.10	.75
1,500 sq. yds. tarred felt, pitch, etc.	.50	.25	.75
500 cu. yds. clay boxing	5.00	1.85	1.00
Per cent. on $1,500 worth extra work	25	15	15

NEW INDUSTRIAL PLANTS.

The John Davis Co., 51-79 Michigan St., Chicago, will erect a new plant.

The Columbus, O., Buggy Co. proposes erecting a new plant, which will include three 4-story, 300x100-ft. buildings of mill construction equipped with sprinklers and elevators on the outside of the building. The power plant will include 1,000 H.-P. in boilers, engines and generators. The factory will be operated by electric motors and wood-working and wheel machinery, steam drop hammers, etc., will be installed.

The Chesapeake Development Co., of Baltimore, has been organized with a capital of $1,500,000 to reclaim the timber lands of southern Maryland, using the timber for railroad ties, lumber and fuel. The company wants to correspond with makers of portable saw-mills. Jas. E. Brady, 104 E. Lexington St., Baltimore, Treas.

The Pfaudler Co., 67 Fort St., East, Detroit, Mich., is erecting a plant at Rochester, N. Y., for which two 150-H.-P. boilers served by a brick stack, engines, electric generators, motors, shafting, etc., will be required.

T. E. Nash, Grand Rapids, Wis., is interested in the erection of a saw-mill, and will soon be in the market for machinery, including boilers, engines, shafting, pulleys, etc.

The Butz Fire Plug Co., Piqua, O., expects to erect a 150x75-ft. foundry and a machine shop 75 ft. square.

BUSINESS NOTES.

The Phoenix Iron Works, Portland, Ore., are erecting a 60x80-ft. foundry, a 2-story, 70x100-ft. machine and boiler shop and a 30x50-ft. pattern shop and expects to be ready for business in about six weeks.

The Otis Elevator Co., New York, reports receiving the following orders: Manhattan Ry. Co., four heavy electric passenger elevators equipped with magnet controlling devices for the new station at 110th St. and Eighth Ave., New York; General Electric Co., Schenectady, N. Y., seven electric elevators with Otis motors and controllers; hydraulic plunger automobile lift for stable of Miss Helen Gould, New York; 51 electric elevators and 15 hydraulic elevator equipments.

A new addition to the power plant of the Lewis Institute, Chicago, will consist of a 150-H.-P. engine built by the Ball Engine Co., Erie, Pa., direct connected to a 75-Kw. generator.

G. H. Gest, 277 Broadway, New York, has been awarded the contract for additions to the underground subway system of the Edison Electric Illuminating Co., of Brooklyn.

During the past six months the firm of H. R. Heinicke & Co., No. 160 5th Ave., New York, has completed large brick chimneys for Ware Furniture Mfg. Co., Atlanta, Ga.; Philadelphia Pneumatic Tool Co.; American Snuff Co., Yorklyn, Del., and Kittatinny Hotel, Delaware Water Gap, Pa., and is now at work on similar stacks for Powers & Weightman, East Falls of Schuylkill, Philadelphia, Pa., and the Housatonic Mfg. Co., New Haven, Conn.

The Crocker-Wheeler Co., Ampere, N. J., is increasing its floor space by a new building, which will nearly double the present capacity, permit placing new and heavier machinery to accommodate larger generators and more rapid work on large orders for the smaller standard machines. The new building is of brick, slow burning mill construction, 3 stories in height and intended for the winding departments and light machine tools. A portion of the basement space will be used for experimental laboratories.

The National Biscuit Co., Baltimore, is installing an electric plant, consisting of two 300-H.-P. cross-compound Ball engines direct connected to General Electric generators.

For the Susquehanna Iron & Steel Company's new plant at Columbia, Pa., the Pittsburgh, Pa., Gage & Supply Co. will furnish three 250-H.-P. water-tube boilers. The company has also recently received the following orders: National Steel Co., White Star filtering system for vertical cross compound blowing engines; filtering systems for the Electric Department of the Carnegie Steel Co. Homestead Works, and the Wheeling, W. Va., Steel & Iron Co.

Westinghouse, Church, Kerr & Co. have under fulfilment a number of important contracts for railway, lighting and power properties, including the following: Metropolitan Street Ry., Third Ave. Division, designing Kingsbridge station and installing boiler, engine, condenser and generator equipments; Meriden, Conn., Electric Light Co., remodeling lighting plant, rebuilding and extending boiler and engine room, and installing an entire equipment of new machinery; Lackawanna & Wyoming Valley R. R., designing and constructing one of the most important high-speed interurban roads in the country; American Car & Foundry Co., Berwick, Pa., erecting a car manufacturing plant; Rochester, Auburn & Syracuse Ry., design and construction; Pittsburg & Lake Erie Ry., McKees Rocks, Pa., mechanical equipment for large railroad shops and terminal station; Champion Coated Paper Co., Hamilton, O., and American Smelting & Refining Co., extensive high-pressure steam piping outfits; Nikola Tesla, Wardenclyffe, N. Y., electrical equipment, steam engines, auxiliary apparatus, steam piping, etc.; Walter W. Law, Briar Cliff Manor, N. Y., electrical heating and refrigerating outfits for suburban isolated plant and villa; Phipps Residences, New York, mechanical, electrical, heating and refrigerating outfits for isolated plant.

PRCPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Aug. 11.	Well, Ft. Caswell, N. C.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 12.	Philadelphia, Pa.	Aug. 9
Aug. 12.	Morris, Ill.	Aug. 9
Aug. 13.	Engines, Chicago, Ill.	June 14
	Adv., Eng. Record, June 21, 28.	
Aug. 14.	Well, Niles, O.	July 19
Aug. 14.	Cement, Cheyenne, Wyo.	Aug. 2
Aug. 15.	Dam, etc., Charleston, S. C.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 15.	Kenmore, N. Y.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 15.	Lawton, Okla. Ter.	Aug. 2
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
	Adv., Eng. Record, July 12, 19.	
Aug. 16.	Freeport, O.	Aug. 2
Aug. 16.	Pipe, Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 18.	Blakely, Ga.	July 26
	Adv., Eng. Record, July 26 to Aug. 9.	
Aug. 18.	Whatcom, Wash.	July 19
Aug. 18.	North Hempstead, N. Y.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 19.	Westerville, O.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 20.	Ithaca, N. Y.	July 26
Aug. 21.	Chimney, Cleveland, O.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 21.	Dam, Cheyenne, Wyo.	Aug. 2
Aug. 21.	Manning, Ia.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 22.	Ft. Barrancas, Fla.	Aug. 2
Aug. 28.	Danville, Ill.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 29.	Redfield, S. D.	Aug. 9
Sept. 4.	Farmington, Mo.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 5.	Engine and boiler, Milwaukee, Wis.	July 19
Sept. 6.	Pipes, Washington, D. C.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 6.	Gates, valves, Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Sept. 9.	Houma, La.	Aug. 9
Dec 1.	Pumps, Seguin, Tex.	July 26
——	Pumps, etc., Weatherford, Tex.	Aug. 9
——	Elgin, Tex.	Aug. 9

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 12.	Machinery, New Orleans, La.	June 7
	Adv., Eng. Record, July 7 to Aug. 9.	
Aug. 12.	Construction, New Orleans, La.	June 7
	Adv., Eng. Record, July 7 to Aug. 9.	
Aug. 13.	Defiance, O.	Aug. 9
Aug. 13.	Hartford, Conn.	Aug. 9
Aug. 13.	Norristown, Pa.	July 19
Aug. 13.	Cincinnati, O.	July 19
Aug. 14.	Paris, Ill.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 14.	Cincinnati, O.	July 26
Aug. 15.	St. Louis, Mo.	Aug. 9
Aug. 15.	Lawton, Okla. Ter.	Aug. 2
Aug. 15.	St. Louis, Mo.	Aug. 2
Aug. 15.	Monterey, Nuevo Leon, Mex.	June 21
	Adv., Eng. Record, July 12, 19.	
Aug. 16.	Dunkirk, N. Y.	Aug. 9
Aug. 18.	Ludwick, Pa.	Aug. 9
Aug. 18.	New York, N. Y.	Aug. 9
Aug. 18.	New Britain, Conn.	July 19
	Adv., Eng. Record, July 19 to Aug. 2.	
Aug. 19.	Monticello, Ind.	Aug. 9
Aug. 20.	Brooklyn, N. Y.	Aug. 9
Aug. 20.	Boilers, Boston, Mass.	Aug. 9
Aug. 21.	Peoria, Ill.	Aug. 9
Aug. 21.	Berkley, Va.	July 26
	Adv., Eng. Record, July 26 to Aug. 9.	
Aug. 22.	Monticello, Ind.	Aug. 2
Aug. 23.	Mansfield, O.	Aug. 2
Aug. 25.	Tyrone, Pa.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug 29	Geneva, O.	Aug. 2
Aug. 30.	Washington, D. C.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 2.	Plainfield, N. J.	Aug. 9

BRIDGES.

Aug. 13.	Brooklyn, N. Y.	Aug. 2
Aug. 14.	Houston, Tex.	Aug. 9
Aug. 15.	Indianapolis, Ind.	Aug. 9
Aug. 15.	Providence, R. I.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 16.	Ft. Scott, Kan.	Aug. 2
Aug. 18.	San Jose, Cal.	Aug. 9
Aug. 18.	Bassett, Neb.	Aug. 2
Aug. 18.	Anadarko, Okla. Ter.	Aug. 2
Aug. 19.	Binghamton, N. Y.	Aug. 9
Aug. —	Rutledge, Tenn.	July 26
Aug. 20.	Perryville, Ark.	Aug. 9
Aug. 29.	Indianapolis, Ind.	Aug. 9
Sept. 1.	Armour, S. D.	Aug. 9
Sept. 3.	Parker, S. D.	Aug. 9
Sept. 3.	Substructure, Chicago, Ill.	July 19
	Adv., Eng. Record, July 19.	
Sept. 3.	Superstructure, Chicago, Ill.	July 19
	Adv., Eng. Record, July 19.	
Sept. 5.	Milwaukee, Wis.	July 19
Sept. 9.	Caldwell, Idaho	July 12

PAVING AND ROADMAKING.

Aug. 12.	Milwaukee, Wis.	Aug. 9
Aug. 13.	East Windsor, Conn.	Aug. 9
Aug. 13.	Brooklyn, N. Y.	Aug. 2
Aug. 13.	Cleveland, O.	July 26
Aug. 13.	Cincinnati, O.	July 19
Aug. 14.	Muscatine, Ia.	Aug. 9
Aug. 14.	Glastonbury, Conn.	Aug. 9
Aug. 14.	Paris, Ill.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 14.	Long Island City, N. Y.	Aug. 2
Aug. 15.	Des Moines, Ia.	Aug. 2
Aug. 15.	Medford, Wis.	Aug. 2
Aug. 15.	Fulton, N. Y.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 15.	Vincennes, Ind.	July 26
Aug. 16.	Leavenworth, Kan.	Aug. 9
Aug. 16.	Medford, Wis.	Aug. 9
Aug. 18.	New York, N. Y.	Aug. 9
Aug. 18.	Michigan City, Ind.	Aug. 2
Aug. 19.	Cincinnati, O.	July 26
Aug. 19.	Newport, Ind.	July 26
Aug. 20.	Williamsport, Pa.	Aug. 9
Aug. 21.	Oneida, N. Y.	Aug. 9
Aug. 21.	Cincinnati, O.	Aug. 2
Aug. 23.	Mansfield, O.	Aug. 2
Aug. 24.	Centerville, Ind.	July 19
Aug. 25.	Lorain, O.	Aug. 2
Aug. 25.	Warren, O.	Aug. 2
Aug. 25.	Tyrone, Pa.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 28.	Des Moines, Ia.	Aug. 9
Aug. 29.	Memphis, Tenn.	Aug. 9
Aug. 29.	Dayton, O.	Aug. 9
Aug. 29.	Jeffersonville, Ind.	Aug. 9
Aug. 29.	Waukesha, Wis.	Aug. 9
Aug. 29.	Cincinnati, O.	Aug. 9
Aug. 29.	Memphis, Tenn.	Aug. 9
Sept. 1.	Niagara Falls, N. Y.	Aug. 2
Sept. 3.	Toledo, O.	Aug. 9

POWER, GAS AND ELECTRICITY.

Aug. 15.	St. Louis, Mo.	Aug. 9
Aug. 15.	Rushford, Minn.	July 26
Aug. 16.	Beatrice, Neb.	Aug. 9
Aug. 18.	Columbus, O.	Aug. 9
Aug. 18.	Blakely, Ga.	July 26
	Adv., Eng. Record, July 26.	
Aug. 19.	Boilers, Indianapolis, Ind.	Aug. 9
Aug. 20.	Dexter, Mich.	Aug. 9
Aug. 21.	Koala Zumpur, Malay	July 19
Aug. 25.	National Military Home, Kan.	Aug. 9
Aug. 26.	Washington, Ia.	Aug. 9
Aug. 29.	Detroit, Mich.	July 26
Sept. 8.	Amsterdam, Holland	Aug. 2
——	Elgin, Tex.	Aug. 9

GOVERNMENT WORK.

Aug. 11.	Artesian well, Ft. Caswell, N. C.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 12.	Denver, Colo.	June 28
	Adv., Eng. Record, June 28, July 5.	
Aug. 13.	Freeport, Ill.	July 5
	Adv., Eng. Record, July 5, 12.	
Aug. 14.	Wiring, etc., P. O., Hot Springs, Ark.	July 19
	Adv., Eng. Record, July 19, 26.	
Aug. 14.	Cleveland, O.	July 19
	Adv., Eng. Record, July 19 to Aug. 9.	
Aug. 14.	Dredging, New York, N. Y.	July 19
	Adv., Eng. Record, July 19 to Aug. 9.	
Aug. 14.	Pneu. tube mail serv., Wash., D. C.	July 12
Aug. 15.	Dredg. Erie Harbor, Buffalo, N. Y.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 15.	Dredging, Milwaukee, Wis.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 15.	Ft. Slocum, N. Y.	July 26
Aug. 15.	Cleveland, O.	July 19
	Adv., Eng. Record, July 19 to Aug. 9.	
Aug. 16.	Boat house, West Point, N. Y.	July 26
	Adv., Eng. Record, July 26 to Aug. 9.	
Aug. 18.	Washington, D. C.	Aug. 9
Aug. 18.	Bldgs., Ft. Leavenworth, Kan.	July 26
Aug. 18.	Piers, Cleveland, O.	July 26
	Adv., Eng. Record, July 26 to Aug. 9.	
Aug. 18.	Ft. Howard, Md.	July 26
Aug. 18.	Fergus Falls, Minn.	July 12
	Adv., Eng. Record, July 12, 19.	
Aug. 19.	Wheeling, W. Va.	July 26
Aug. 19.	Denver, Colo.	July 19
	Adv., Eng. Record, July 19, 26.	
Aug. 20.	Ft. Snelling, Minn.	Aug. 9
Aug. 20.	Levee work, Memphis, Tenn.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 20.	New Brighton, Va.	Aug. 2
Aug. 21.	Pipestone, Minn.	Aug. 2
Aug. 21.	Newport, Vt.	July 26
	Adv., Eng. Record, July 26, Aug. 2.	
Aug. 21.	Dredging, Philadelphia, Pa.	July 26
	Adv., Eng. Record, July 26 to Aug. 9.	
Aug. 22.	Boiler plant, Cleveland, O.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 22.	New York, N. Y.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Aug. 22.	Boilers, Hampton, Va.	Aug. 2
Aug. 22.	Ft. Barrancas, Fla.	Aug. 2
Aug. 22.	Dredging plant, Buffalo, N. Y.	July 26
	Adv., Eng. Record, July 26 to Aug. 9.	
Aug. 23.	Fireproofing, Washington, D. C.	Aug. 2
Aug. 23.	Ft. Wright, Wash.	Aug. 2
Aug. 23.	Trestle and tank, Ft. Myer, Va.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 25.	Cincinnati, O.	Aug. 2
Aug. 25.	Harbor work, Savannah, Ga.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 25.	Ft. Des Moines, Ia.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 25.	Post Office, Ellsworth, Me.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 25.	Ft. Riley, Kan.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 25.	Bulkhead, Philadelphia, Pa.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 26.	Supplies, Phoenix, Ariz.	Aug. 9
Aug. 27.	Metal lathing, etc., Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 27.	Repair steamer, Pittsburg, Pa.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 28.	Philadelphia, Pa.	Aug. 2
Aug. 28.	Harbor work, Cleveland, O.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 28.	Breakwater, Cleveland, O.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 28.	Vaults, Washington, D. C.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 28.	Ft. Strong, Mass.	Aug. 2
Aug. 28.	Dredging, Wheeling, W. Va.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 29.	Light fixtures, St. Cloud, Minn.	Aug. 9
Aug. 29.	Light fixtures, Joliet, Ill.	Aug. 9
Aug. 29.	Light fixtures, Hot Springs, Ark.	Aug. 9
Aug. 29.	Light fixtures, Oskaloosa, Ia.	Aug. 9
Aug. 29.	Light fixtures, Abilene, Tex.	Aug. 9
Aug. 30.	Rock Island, Ill.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 2.	Bldg., Johnson City, Tenn.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 2.	Rapid City, S. D.	Aug. 9
Sept. 2.	New Orleans, La.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 3.	Dredging, New York, N. Y.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 3.	Dam, Charleston, S. C.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Sept. 4.	Post Office, Lockport, N. Y.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Sept. 6.	Bremerton, Wash.	Aug. 2
Sept. 10.	Post Office, Anniston, Ala.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Sept. 11.	Wiring P. O., New Brunswick, N. J.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 11.	Htg. P. O., New Brunswick, N. J.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 13.	Dock, Norfolk, Va.	July 26
	Adv., Eng. Record, Aug. 2, 9.	
Sept. 15.	Htg. P. O., Abilene, Tex.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 16.	Htg. P. O., Oakland, Cal.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 17.	Wiring P. O., Abilene, Tex.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 18.	Wiring P. O., Oakland, Cal.	Aug. 9
	Adv., Eng. Record, Aug. 9.	

BUILDINGS.

Aug. 12.	Htg. school, Boone, Ia.	Aug. 9
Aug. 13.	School, Baltimore, Md.	Aug. 9
Aug. 13.	Church, Springfield, Ill.	Aug. 9
Aug. 13.	C. H. plans, Riverside, Cal.	Aug. 9
Aug. 13.	College bldg., Columbus, O.	July 26
Aug. 13.	Hospital, Toledo, O.	July 19
Aug. 14.	Pub. bldg., Buffalo, N. Y.	Aug. 9
Aug. 14.	Htg. pub. bldg., Boston, Mass.	Aug. 9
Aug. 14.	School, Milwaukee, Wis.	Aug. 9
Aug. 14.	School, North Freedom, Wis.	Aug. 9
Aug. 14.	School improv., Boston, Mass.	Aug. 9
Aug. 14.	Pub. bldg., Bath, N. Y.	Aug. 2
Aug. 14.	School, Jackson, Ia.	July 26
Aug. 14.	Court house, Greensburg, Pa.	July 26
Aug. 14.	Hospital improv., Toledo, O.	July 19
Aug. 14.	Hospital, Shreveport, La.	July 19
Aug. 15.	School, Hastings-on-Hudson, N. Y.	Aug. 9
Aug. 15.	Engine house, Erie, Pa.	Aug. 9
Aug. 15.	Bank, San Antonio, Tex.	Aug. 2
Aug. 15.	School, Chicago, Ill.	Aug. 2
Aug. 15.	School, New York, N. Y.	Aug. 2
Aug. 15.	School, Brooklyn, N. Y.	Aug. 2
Aug. 16.	Hospital, Harrisburg, Pa.	Aug. 9
Aug. 16.	Academy, Rockingham, Halifax	Aug. 9
Aug. 16.	School, Rapid City, S. D.	Aug. 2
Aug. 16.	Library, Burlington, Vt.	Aug. 2
Aug. 16.	Hospital, Toledo, O.	July 26
Aug. 16.	Dwellg. plans, Cheyenne, Wyo.	July 5
Aug. 18.	City Hall, La Junta, Colo.	Aug. 9
Aug. 18.	Pub. Bldg., Newark, O.	Aug. 2
Aug. 18.	Court house, Mason, Mich.	Aug. 2
Aug. 18.	School, Springfield, O.	July 26
Aug. 18.	Library, New Brunswick, N. J.	July 26
Aug. 19.	School, Jackson Center, O.	Aug. 2
Aug. 19.	Hospital, Columbus, O.	July 26
Aug. 19.	Library improv., Cincinnati, O.	July 26
Aug. 20.	Pub. bldg., Boston, Mass.	Aug. 9
Aug. 20.	School, Niagara Falls, N. Y.	Aug. 9
Aug. 20.	Bus. bldg., Houston, Tex.	Aug. 2
Aug. 20.	School, Orange, N. J.	Aug. 2
Aug. 20.	Hospital, Massillon, O.	July 26
Aug. 21.	Court House, Jackson, O.	Aug. 9
Aug. 21.	Town hall, Clyde, N. Y.	Aug. 2
Aug. 22.	Hospital, Athens, O.	July 26
Aug. 23.	Mint, Ottawa, Ont.	Aug. 9
Aug. 25.	Library, Galion, O.	Aug. 9
Aug. 25.	Church, Hennepin, Ill.	Aug. 9
Aug. 25.	Court House, Lawton, Okla. Ter.	Aug. 9
Aug. 25.	Hospital, Hollister, Cal.	Aug. 9
Aug. 25.	Pub. bldg., Springfield, O.	Aug. 2
Aug. 26.	Quarantine station, Galveston, Tex.	Aug. 2
Aug. 26.	Pub. bldg., Trenton, N. J.	Aug. 2
Aug. 30.	Library, Boulder, Colo.	Aug. 9
Aug. 30.	School, Kingman, O.	Aug. 9
Sept. 1.	School, Westfield, Mass.	Aug. 9
Sept. 2.	Court House, Kentland, Ind.	Aug. 9
Sept. 6.	Capitol, Harrisburg, Pa.	Aug. 9
	Adv., Eng. Record, Aug. 9.	
Sept. 6.	Htg. school, Austin, Tex.	Aug.
Oct. 6.	City Hall plans, Houston, Tex.	Aug. 9
Oct. 7.	Capitol work, St. Paul, Minn.	Mar. 22

MISCELLANEOUS.

Aug. 11.	R. R. work, Pittsburg, Pa.	Aug. 2
	Adv., Eng. Record, Aug. 2, 9.	
Aug. 13.	Brooklyn, N. Y.	Aug. 2
Aug. 13.	New York, N. Y.	Aug. 2
Aug. 14.	Garb. disp., Reading, Pa.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 14.	El. ry. fran., San Bernardino, Cal.	July 26
Aug. 16.	Garb. crematory, Racine, Wis.	Aug. 2
	Adv., Eng. Record, Aug. 2.	
Aug. 18.	El. ry., San Jose, Cal.	July 26
Aug. 20.	Osceola, Ark.	Aug. 9
Aug. 25.	St. railway work, Cleveland, O.	Aug. 9
Aug. 25.	Webster City, Ia.	Aug. 9
Aug. 25.	Levee work, Greenville, Miss.	Aug. 9
Aug. 28.	St. railway work, Cleveland, O.	Aug. 9
Sept. 2.	St. ry. franchise, Riverside, Cal.	Aug. 9
Sept. 6.	Washington, D. C.	July 19
	Adv., Eng. Record, July 19.	
Sept. 30.	Harbor, Port Adelaide, S. A.	July 5
——	R. R. work, Lake Charles, La.	Aug. 9

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Progress in Civil Engineering.

In his presidential address before the Institution of Civil Engineers, from which extracts have already been printed in The Engineering Record, Mr. Charles Hawksley indulged in a very interesting retrospect covering the progress of civil engineering during the nineteenth century, some portions of which are particularly worthy of consideration in view of what civil engineers have accomplished in this country. Mr. Hawksley naturally confines his observations chiefly to the parts which British civil engineers have played in the development of their profession. This is not only pardonable on the part of the president of the Institution of Civil Engineers but justified by a number of epoch-making accomplishments of the early civil engineers of Great Britain, especially in connection with the development of common roads, the steam engine and railroads.

It is interesting to observe the broad meaning which Mr. Hawksley attaches to the term Civil Engineer, and most important in view of what he would constitute or form the early training of all engineers whom he calls "civil," but who, in the specialized condition of engineering in this country, would be considered as civil, mechanical, electrical and a considerable number of other specialists in engineering practice. As a matter of fact, Mr. Hawksley's position in this matter is historically accurate, and it would probably be better both for the educational training and the general profession of civil engineering in this country if the significance of the broad expression still ruled both in our engineering schools and in our engineering practice. Be that as it may, however, in his consideration of the advances made along all engineering lines the eminent president of the Institution takes a commendably enlightened view of the practice of the profession, and one, it is believed, from which few or no practicing engineers will dissent.

Among the various fields of work which he outlines as having been exploited practically during the nineteenth century, that of "Roads" comes first, and it is first because of the importance attaching to that class of engineering works in the past development of Great Britain. The same general observation is equally applicable to the subject of canals, which comes second in his order of treatment, the third being that of railroads. While we, in this country, have recognized the importance of means of transportation and the exchange of commodities between communities, it was almost at the close of the nineteenth century that the improvement of our common roads came to be recognized in its true character. As a matter of fact, it is of equal importance with the development of railroads. Indeed if our improved common roads had been developed to the extent justified by their real importance they would have become a system of numberless feeders to the railways, not only increasing the value of the latter but giving to the sections of country served enhanced values far beyond those which they now possess.

The construction of steam railroads in this country gave such a stimulus to many branches of industry that the value of common roads and canals has been overlooked, and it is only within a short time that the true part played by both those classes of transportation has been recognized. To some extent, but to a small extent only, has there been a corresponding attitude assumed toward roads and canals in Great Britain. It is perhaps generally conceded now, on the other hand, that the three classes of transportation are not mutually excluding but co-operating elements in the most complete and well-rounded prosperity of any country.

It would have added much to the interest of Mr. Hawksley's retrospect if he had compared some of the modern locomotives and trains to those first used on the Stockton and Darlington Railway in 1825 and 1826. He speaks of the first engine built by Robert Stevenson as weighing 14,560 pounds, whereas a recent locomotive of the decapod type, built for the Atchison system, has a total weight of almost 268,000 pounds, or over eighteen times the weight of its English prototype. A comparison, also, of the weights of the earliest trains with those now being hauled in this country, would be equally interesting and marked. The early railway train was, in fact, but a system of a half a dozen stage coaches drawn along an artificially prepared track as a speed of perhaps eight to ten miles an hour. At the present time in this country it is not uncommon for a modern locomotive to haul a freight train of 2,000 or more tons at what would have been considered a good passenger speed three or four decades ago.

Similarly interesting and significant advances have been made in all lines of civil engineering practice, although that in the special field of electrical engineering shows probably a greater rate of advance in a short period than any other. Among those other fields of engineering work to which Mr. Hawksley calls attention, one of the most striking is possibly that of public water supply. He shows the remarkable progress which has been made, not only through the past century, but during the past fifty years, in serving municipalities with potable water. It was scarcely more than fifty years ago when the appalling conditions of many English manufacturing towns was disclosed by a parliamentary committee, those conditions being due primarily to the absence of suitable water supply, and, secondarily, to the proper disposition of waste products of the community. All that has, of course, been radically changed, and there now exist in Great Britain the most advanced views in regard to public water supplies and the means of securing and maintaining them. It has come to be recognized that no intermittent supply, or one of limited proportions, will answer the needs of a modern English community, any more than it will in this country. Yet a comparison of the figures of daily consumption in the two countries reveals a marked difference which has been the subject of much discussion among civil engineers. Mr. Hawksley observes that "there still exists much misconception in regard to the quantity of water required for domestic purposes with a constant service, unrestricted except in respect to misuse and waste." He goes on to say that as a result of his professional experience he has found that "water distributed for domestic and other nonmetered purposes was," in six towns containing about 1,185,000 persons supplied by private companies, 19 gallons per head per day, "and in the case of ten towns supplied by public authorities and having an aggregate population of 3,961,000 persons, 18¼ gallons per head per day." In this country, where a corresponding supply is supposed to amount to anywhere from 80 to 100 gallons per head of population per day, the English figures seem remarkably small. All civil engineers recognize that in many cities where the consumption rises materially above those figures, as much even as two-thirds of the supply may be waste of one kind or another. Admitting that, however, there still remains a large difference between the English figures and those of American consumption to be explained. Undoubtedly much of this difference in useful consumption arises from the different habits of the two peoples. In this country water is far more lavishly used in the household for bathing and other purposes than in foreign countries, and while there is doubtless some extravagance in the American practice, it is not by any means impossible, indeed it is probable, that the latter is, on the whole, more conducive to improved or better conditions of life. Again, a rather marked feature of Mr. Hawksley's observations upon public water supplies is his apparent preference for the private ownership of municipal water systems or at any rate, his failure to agree with those who prefer municipal ownership. It is a question about which there are certainly two opinions in some quarters in this country.

The whole address of Mr. Hawksley is one abounding in interesting retrospects of British engineering works suggesting comparisons with corresponding American work of at least equal interest. In every respect it is a most timely and pertinent review of engineering progress during the past century, on which both British and American engineers may reflect most profitably, not only in regard to their own practice, but each one in relation to the other.

The Assuan Barrage across the Nile just above the first cataract has been practically completed, a fact that is not only of much engineering interest but also of still more importance in the broader world of commerce. The barrage was so fully described in The Engineering Record of December 30, 1899, that a further account of it is unnecessary in this journal. It is a great masonry weir pierced with 180 openings which are fitted with gates. From August until December the Nile is laden with silt, which would not only speedily choke the reservoir were the stream impounded during these months, but would also cut off from the agricultural lands below the fertilizing deposit which renews their surface during each year and renders them productive to a marvellous degree. Early in December the gates will be closed and for five or six months the flood water will be impounded to be used in irrigating until the rise in the river, beginning sometime during the next July, again furnishes a natural supply to the farmers. The work is the first great material step in the commercial regeneration of this home of primitive civilization to which Great Britain has set her hand.

The New Croton Dam.

Preliminary work on the new Croton dam was commenced in the fall of 1892 and more than three-fourths of the masonry had been laid when, in the summer of 1901, it was decided to modify the design and a part of the work was interrupted for several months. In accordance with the report of a commission of experts, which was published in The Engineering Record of November 30, 1901, it was decided to replace the embankment at the south end by a massive masonry structure which is essentially an extension of the main dam into the solid rock of the hillside. This involves the removal of that portion of the dam which had already been built on this side of the valley and the construction of about 60,000 yards of ashlar and rubble masonry more than was originally contemplated. The work on the north end of the dam is now under full headway, that for the removal and rebuilding of the south end is being vigorously prosecuted and in the middle of the valley a portion of the dam is completed to its full height. These conditions afford comprehensive illustration of the varied operations, some of which are of interest to supplement the extended accounts of work on the structure previously published in these columns.

The original design was for a masonry dam with a straight axis and a length of about 710 feet on top, with a 1,000-foot masonry spillway tangent at the north end, curving nearly 90 degrees and continuing upstream along the hillside approximately following the contours. At the south end a rubble core wall was bonded into the masonry structure and carried down to solid rock in a trench cut in the hillside to the top of the dam. This core wall was protected by flat slopes of rolled earth on both sides, which terminated with a wing wall on the downstream side. The masonry section crossed the river bed and its foundations were carried down to a maximum depth of 135 feet below it. It has a curved batter on both the up and downstream faces, as is shown in the illustrations published in The Engineering Record of August 11, 1898. The spillway is built in steps from 3 to 9 feet high on the downstream face.

About 32,000,000,000 gallons of water will be impounded by the dam and form a lake about 19 2/3 miles long and 130 feet deep at the dam, and will submerge 3,425 acres of farm land, several houses and roads, of which the latter are to be replaced by others now under construction. The base of the dam is about 216 feet in maximum width and the crest is 144 feet above the top of the back-fill on the upstream side or 300 feet above the lowest part of the foundations. There will be a 20-foot roadway on top with a stone parapet on each side and a gate house at each end. The original quantities included 1,100,000 yards of earth, 300,000 yards of rock, 670,000 yards of masonry and 900,000 yards of backfill and embankment at an approximate total cost of about $5,000,000. The core wall and the heart of the masonry dam and spillway are made of large rubble masonry laid in Portland cement mortar. The faces are dimensioned quarry-faced granite stones up to 80 cubic feet, in courses from 20 to 36 inches high. The coping, cornice, gatehouse trimmings, etc., are cut stone.

The spillway and the main dam section were not changed by the modification of the design, but all of the earth and core dam at the south end was ordered replaced by a continuation of the regular section of the masonry dam. This involved the removal of about 10,000 yards of rubble core wall masonry and the excavation of about 300,000 yards of earth, some of which had been backfilled around the core wall, and an unknown amount of rock to carry the foundation down to sound rock. About 60 feet of the upper part of the wing wall will be removed, but the remainder will be allowed to stand as it will be below the surface of the finished slope.

On the south side of the valley the main dam has been carried up to its full height and practically finished for a length of about 700 feet. Cut stone arches of 19 feet span have been built there on the top of the downstream face and surmounted with the coping and cornice, ready for the final cresting of stone railing along the roadway. A concrete elliptical sewer, about 4½ feet wide and high is built on top of the dam under the center of the roadway and receives the latter's drainage through transverse inlets and discharges into the spillway on the downstream side. From the top of the completed section the masonry is racked off to lower levels at both ends.

At the south end a small timber tower is seated on top of the masonry and carries one end of the 700-foot Lidgerwood cableway with a head tower on the hillside. The north end of this main cable enters a deep slot cut in the solid masonry and engages a steel cross bar built into the masonry which is farther loaded by a large quantity of dimension stone piled on top. The cableway is only about 10 feet above the top of the dam and is used at present for removing the materials of the core wall as it is demolished. About 80 feet east of this cableway is a 1,150-foot cableway with its north tower seated on the dam near the spillway, and about 75 feet west of the first mentioned cableway, which is nearly in the axis of the dam, is a cableway of 1,465 feet span with its north tower on the side of the hill beyond the spillway channel. Both these last two cableways were manufactured by the Trenton Iron Company and have been used chiefly for delivering stone to the masons and will be used for the same purpose for the lower part of the additional work.

View Looking North.

The lowest parts of the main cables are about 130 feet above the river bed and so are unable to handle materials for the top of the dam. Up to their highest working level the masonry was laid by as many as thirty independent stiff-leg derricks with 40 to 60-foot booms of 5 to 10 tons capacity operated by individual two-drum hoisting engines of the Lidgerwood, Crook, Mundy, Ryan & McDonald and Donegan & Swift makes. Each derrick built up the masonry within its convenient radius to a height of 15 feet above its base and was then, with its engine, picked up by the cableway and set on top of the upper part of the masonry, and so on.

On the finished part of the dam one stiff-leg derrick is now seated at the roadway level to handle the arch and cornice stones, and for any other work to be done there. North of it there is a traveler seated on two 3-foot longitudinal tracks about 15 feet below the roadway. It has a horizontal framed platform about 20 feet wide and 30 feet long and has three masts, one in the center of the upstream side and one in the center of each end. The masts are braced together and to the platform, which is heavily ballasted, and each has a 10-ton boom. The side boom is used for hoisting stone and mortar from the material tracks on the upstream side of the dam about 150 feet below its crest. The end booms build the masonry, one of them carrying it up to the roadway level and the other one building it to the level of the traveler tracks, which are extended northward on it as it rises. North of this traveler there are two more which are similar to it except that they have no side booms. One is 45 feet below the top of the dam, and the other is in use on the spillway; each builds 15 feet below its track on one side and 15 feet above it on the other, and when they have completed their zones they will be removed.

All the stones in the faces of the dam must conform to the required course thicknesses but may vary within limits in their other directions. They are numbered consecutively at the contractors' granite quarry about six miles away, and about 32,000 have so far been cut. Each stone has its number marked on it with red paint and its dimensions in black paint, and a record is kept of the dimensions, when the stone was cut, by whom and when it was set in the dam. The coping stones are carefully fitted and their joints are calked with oakum and pointed with cement.

The quarry track comes down the valley at an elevation about 10 feet above the river bed at the dam and an opening was left in the upper part of the spillway wall to let it pass through and another for it to pass to the lower side of the main dam. The latter opening is about 20 feet wide and 20 feet high, with a full-centered brick arch roof 2 feet thick. The stones in the dam which form the sides of this tunnel are set slightly oblique to its axis so as to make offsets of 3 to 6 inches at each joint and prevent the formation of any continuous water passage when the masonry is eventually filled in solid there. The roof arch is also offset 6 inches at two places in transverse planes for the same purpose, which incidentally provides a very great shearing resistance for the pressure on the filling. A similar opening 26 feet wide and 18 feet high is left in the line of the river diversion to pass the water until the dam is completed, when a cofferdam will be built on the upstream side, and masonry will be filled in solid and grouted under pressure. An extremely heavy flood last winter proved to be too much for the waste opening and filled it and the track opening and backed up to a height of 2 feet above the top of the track and 12 above the river tunnel, but did not cause much damage.

The excavation for the extension of the masonry dam which will replace the earth and core-wall dam will be about 150 feet deep and is being made by four crews of shovelers and one 1½-yard steam shovel. All spoil is loaded into 2½-yard side-dump cars and drawn by locomotives to spoil banks 1,000 feet or more upstream, where it is dumped down the side of the valley. The steam shovel is working on a wide berm about 70 feet above the bed of the river and at the foot of a very steep bank about 70 feet high. The material is sand and gravel with a small amount of clay, cemented to a very hard bank which will stand almost vertical. When wet it washes down and makes a dense sticky mud which, when dried, pulverizes easily and is so fine that it leaks badly through the cracks of the steam shovel bucket.

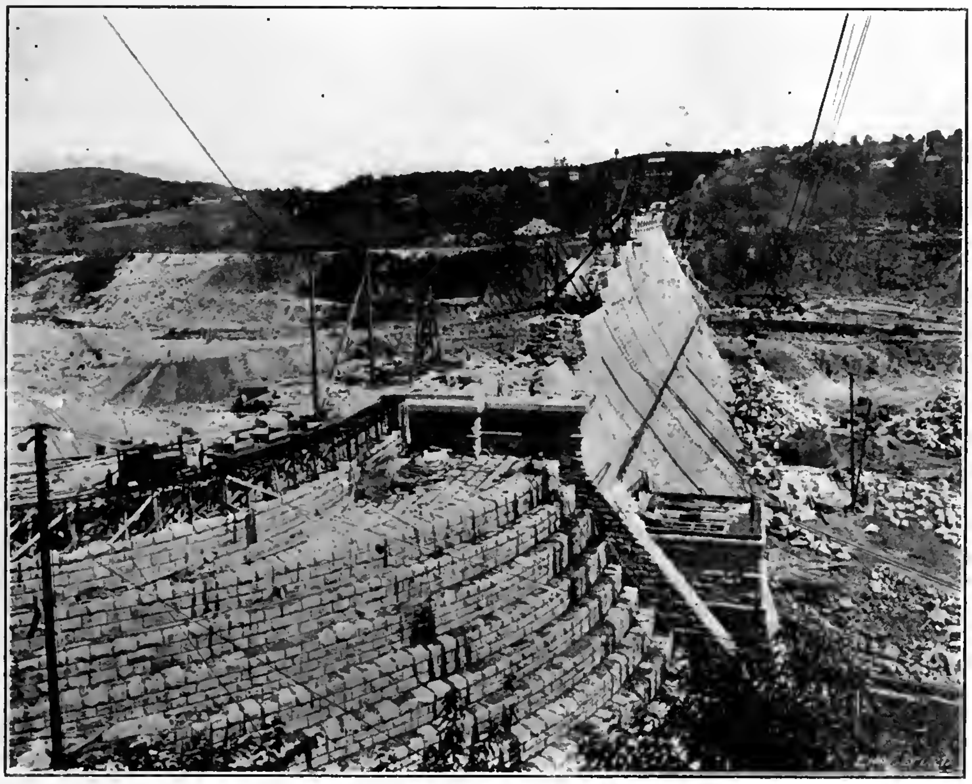
To facilitate digging, the bank is shattered with dynamite in advance of the steam shovel. A row of holes about 20 feet apart is made at the track level and another row about 30 feet above them: they are inclined slightly upwards from the horizontal and are 2 or 3 feet in diameter at the beginning, 6 inches at the end and are about 20 feet long. They are rapidly washed out by one man with a flexible 1-inch hose and 20 feet of 1-inch steel pipe having a 5/16-inch nozzle through which he plays a 300-pound hydraulic jet. The holes are ordinarily made in about 1½ hours each, and a 50-pound box of dynamite put in the end, and sand tamped in. Several holes are fired at once and shatter the bank so that the steam shovel can penetrate it easily, but they do not throw it down. A third row of holes is made in the surface of the ground parallel to the top of the bank and about 20 feet back from the edge. These are square pits, dug with shovel and pick to a depth of about 15 feet, charged, tamped and fired in the usual way.

Steam and water pipes are bracketed out from the curved downstream face of the dam, and ladders and scaffolds are suspended there for the masons to point the course joints. Access is had to the top of the dam from the hillsides at both ends and by stairways up the face to the gatehouse and by a diagonal line of stones which project a few inches in successive courses near the south end. All the derrick engines are furnished with steam from a 400 horse-power battery of boilers in a power house about 300 feet below the dam, from which the mains extend without jacketing about 500 feet in both directions to the opposite ends of the dam. The present consumption of coal is about 500 tons a month, including that used at the quarry and by the locomotives. The present force works one shift per day and includes about 100 stone cutters and masons and 500 other employes and laborers and 75 horses.

In the revised design of the dam the length of spillway is 1,000 feet; masonry dam, 1,000 feet; embankment and core wall, 300 feet; making a total length of 2,300 feet. Two hundred and fifty feet of spillway is at elevation 196 feet, and 750 feet is at elevation 200. The maximum flow line will not exceed elevation 206. The elevation of roadway on top of dam is 216 feet, and the lowest point of the foundation is 84 feet below the Croton datum, making the height 300 feet. The top of the dam is 166 feet above the bed of the Croton River, and the lowest point of the foundation is 134 feet below the bed.

The old Croton dam, which was constructed in the years 1837 to 1843, is located 3¼ miles above the new Croton dam. The reservoir back of it has an area of 498 acres and a capacity of 2,000,000,000 gallons. The elevation of the crest of this dam is 166.67 feet. The new Croton reservoir will encompass the old reservoir and have a capacity of 32,000,000,000 gallons. The total area of its watershed will be 373.32 square miles. The area of this new reservoir will be 3,425 acres, while its length (new Croton dam to Croton Falls) will be 19 2/3 miles. The Muscoot dam now building will form a dividing wall about midway of the reservoir.

The accompanying view looking north is made from a progress photograph taken July 23, 1902, and gives a specially good idea of the curved batter of the downstream face and its great height as compared with that of the man standing in the center of the foreground. The wing wall on the downstream side has been torn away at the left and the core wall has been demolished at the right, and the debris from this masonry is seen scattered in the foreground. It is being handled and removed by the boom derrick and the cableway, and the excavation is to be carried down there to solid rock for the foundations of the masonry extension. The steam shovel is at work south of the point of view at about the level of the foreground. In the background the gate chamber is seen at the left and a portion of the spillway masonry, curving upstream, at the right.



View Looking South, Showing Spillway and Gate Chamber.

The view looking south is at the same date and shows the north end of the masonry dam, its connection with the curved spillway and the gate chamber. The broad horizontal triangular surface of the spillway is not its top, but is the level directly below the bridge span of 200 feet on which the roadway is to be carried across the spillway to the north side of the valley. The buttress at the left of this level is the abutment pier which terminates in a beveled course for the skewbacks of the cut-stone arch which has been designed to form the bridge. On the upper part of the spillway a timber trestle has been terraced up on one of the offset steps for the material track on which a construction train is shown. The arrangement and operation of the traveling derricks on top of the dam masonry is seen, together with the successive steps in which the masonry is being completed. The 1,465-foot span cableway is seen parallel with and beyond the downstream face of the dam. The high curved bank in the background is where the steam shovel is excavating for the extension, and its spoil is dumped from the end of the bank on the left. The lines indistinctly seen across the downstream face of the dams are steam and water pipes, ladders and scaffolds which will be removed.

The revised estimate of total cost of the dam and auxiliary work is about $6,500,000, of which about $1,200,000 remains to be expended. Considerable work has been done in clearing and preparing the area to be submerged and in building new highways and several bridges are to be built, some of which are to have long spans and high abutments.

The dam was designed and its construction commenced under direction of Mr. Alphonse Fteley, past-president of the American Society of Civil Engineers. Mr. W. R. Hill is now chief engineer and Mr. Charles S. Gowan is division engineer in charge of construction. Messrs. Coleman, Breuchaud & Coleman are the contractors, and Mr. Jules Breuchaud of that firm directs the work. Mr. J. B. Goldsborough is the contractors' superintendent.

The Electrolysis of Iron Pipes in and around Boston has led the Metropolitan Water and Sewerage Board to advocate the use of the double trolley system by the electric railways.

A Silent Water Heater, so called, an apparatus designed by Messrs. Nachtigall and Jacoby for heating a body of water by steam, is described in the "Practische Maschinen Constructeur." It consists of two disks enclosing an annular space, the whole submerged in the water. Steam is admitted by means of a pipe into the center of the device and issues into the annular space through an opening extending entirely around the periphery of the steam space. The upper and lower walls of the annular chamber are pierced by a number of holes through which the water to be heated is drawn by a sort of suction action by the steam issuing from the peripheral opening. The water coming in contact with the steam, condenses it, becomes warmed and flows at increased velocity in the direction of the steam, escaping into the main body of the water through a peripheral opening between the disks, which lack meeting at the edges by the amount of the opening. The apparatus is, in brief, a special form of jet condenser, of small dimensions, designed to heat water without noise.

The Water Supply of the Michigan Asylum for the Insane at Kalamazoo.

By Geo. S. Pierson, M. Am. Soc. C. E.

The Asylum for the Insane at Kalamazoo is situated upon a plateau lying at an elevation of about 170 feet above the level of the Kalamazoo River, and about 140 feet above the general level of the city of Kalamazoo. It lies so high above the general level of the city that it cannot well be supplied with water from the city water-works. There are about 1,500 to 2,000 persons at the Asylum and there is required for normal use about 250,000 gallons of water per day. A much larger quantity should, of course, be available for fire protection.

About 30 years ago an open well was constructed in a ravine near the Asylum buildings, which lies about 100 feet below the general level of the grounds on which the principal buildings stand. This well consists of a brick curb resting upon a wooden shoe. A pumping station was established at this well, and the water forced to the Asylum grounds and buildings. Although never productive, this well furnished sufficient water for the ordinary requirements of the Asylum for some 10 or 15 years.

When the increased demands of the Asylum and the decreased production of the well combined to make the supply inadequate, tubular wells were driven in an area extending some 700 or 800 feet up the valley from the well, and these were connected into a common pipe line and discharged into the well to supplement its supply. These wells were generally from 80 to 100 feet deep, and when first put down they yielded a fair amount of water. Owing to some peculiarity in the stratum in which the well screens lay, however, the screens soon corroded so as to prevent almost entirely the flow of water of the driven wells. This corrosion was so rapid that within a couple of years the driven wells would practically cease to produce. As these wells became inoperative from this cause, others were put down with like results. After a few years of this procedure it became apparent that no permanent supply could be maintained in this manner except at a very great cost.

At about this time a water tower was constructed so as to afford better fire protection and help out the limited water supply by its storage capacity. This water tower consisted of an iron tank having a capacity of about 250,000 gallons, and the bottom of the tank rested on brick masonry 100 feet high above the general level of the ground upon which the Asylum buildings stand.

After a few years more the increased demands and failing supply combined to produce a shortage of water even when the pumps were run continuously and advantage taken of the storage of water during the hours of least consumption.

It had been clearly demonstrated that no adequate supply could be obtained by driven wells without putting down a new series of wells each year or two at a considerable yearly expense. This is a peculiarity of certain strata which has been observed in numerous instances in some sections of lower Michigan. It is not generally true of strata which lie nearer the surface.

At about the time the standpipe was erected at the Asylum grounds, the entire power plant of the institution was reconstructed. A large central steam and power plant was installed which furnished steam for heating, electric current for lighting and electric power for various purposes. At this time, two new 500,000-gallon geared pumps were installed at the pumping plant near the old open well, operated by electric power.

No surface water supply could well be brought within reach of this new pumping station. It was therefore necessary to deliver an adequate supply within reach of the present pumping station from ground waters or to abandon the pumping station.

Investigations were therefore made of the strata over an area extending some 1,500 feet up the valley from the old open well, by sinking test wells at various points and taking out samples of earth at each foot or so in depth as the wells were driven. Previous experience with wells in this area had indicated that the only available water-bearing strata probably lay within 50 feet of the surface or at a depth of about 80 to 100 feet. As these investigations had reference more particularly to the feasibility of procuring a supply by an open well, the test wells were generally sunk to a depth of about 50 feet, at which point they usually entered clay. No regular and sharply defined stratification was revealed by the test wells. Generally, however, at a depth of 30 to 40 feet, fairly coarse material was found. The appearance of this was not as favorable to the passage of large quantities of water as might be desired, but owing to the difficulties which had been met in securing an adequate supply by any other means, it was determined to sink an open curb at a point where the conditions seemed most favorable. After this point was selected, additional test wells were sunk and samples taken at three points equidistant from each other in the circumference of the proposed curb.

The plan of the well is shown in the illustrations. The well was built in the following manner: An excavation was first made to the water line. A heavy 6x6-inch iron angle was assembled in the bottom of the excavation, and upon this was erected a steel shell 25 feet high and 25 feet in diameter at the shoe. This shell was lined with a brick wall laid in Portland cement mortar. The brick wall rested upon the iron angle and was anchored to the iron shell at frequent intervals by anchor irons bolted to the shell and extending nearly through the brick work. The curb was built intact above the water line and the masonry allowed to set before any attempt was made to sink it.

Upon the top of the curb was bolted a ring formed of heavy oak planks and upon this was fastened a curved iron T-rail, which served as a track on which a dredge platform revolved. The dredge was operated entirely by hand. It consisted of a framework of timbers supported entirely by an axle which lay on two beams crossing the dredge platform and by a windlass and ropes fastened to the lower end of the dredge frame. The dredge could be raised or lowered slightly by raising the bearings on which the axle rested and could be swung from the shoe of the curb to the center by operating the windlass. It was a plain bucket dredge constructed of link chains and steel buckets, and was of such a length as ordinarily to reach a trifle below the shoe. The dredge was operated by four men, two on each crank, working at short shifts. During the operation of the dredge it was continually revolved about the circular track.

During the sinking of the curb there was no motion of any kind perceptible to the eye. By revolving the dredge so as to keep it working at the points where the curb was highest it could be kept almost precisely level; probably at no time during the process of sinking was the curb more than 3 or 4 inches out of level. The rate of sinking was a little less than one foot per day. No attempt was made to keep the water out of the curb during the process of sinking, and, during the latter part of this process, the water stood three feet higher inside the curb than outside. The dredge buckets were perforated so as to prevent the reduction of the water level inside the curb and thus maintain an increased pressure within the curb in order to prevent the inflow of sand under the shoe. With the exception of one or two men the labor was performed entirely by Asylum patients, Mr. Turnbull, the engineer at the Asylum, being in direct charge of the work.

The stratum at the point where the shoe finally rested was composed of gravel intermingled with some sand of varying degrees of

View of the Kalamazoo Asylum Well during Process of Sinking.

fineness. This was excavated as deeply below the shoe as possible, and considerably deeper at the center than near the shoe. The bottom was then covered with coarse screened gravel, then a layer of still coarser screened gravel and small stones, and finally with a layer of cobblestones.

As a protection against evil disposed or irresponsible persons, the well is lighted entirely by a skylight surrounding the finial, no openings being left in the wall.

The new well is 900 feet from the old well at which the pumping station is located. The two are connected by a siphon. It would have been very desirable to lay the siphon continually ascending from the new well to the old, as at this point a small air pump could readily have been installed to keep the siphon free of air. The static level of the water in the new well is a number of feet above the static level of the water in the old well, however, and it was not practical to do this. The siphon is, therefore, laid continually descending from the new well to the old and the air in the siphon collects in the air chamber in the new well shown in Fig. 2.

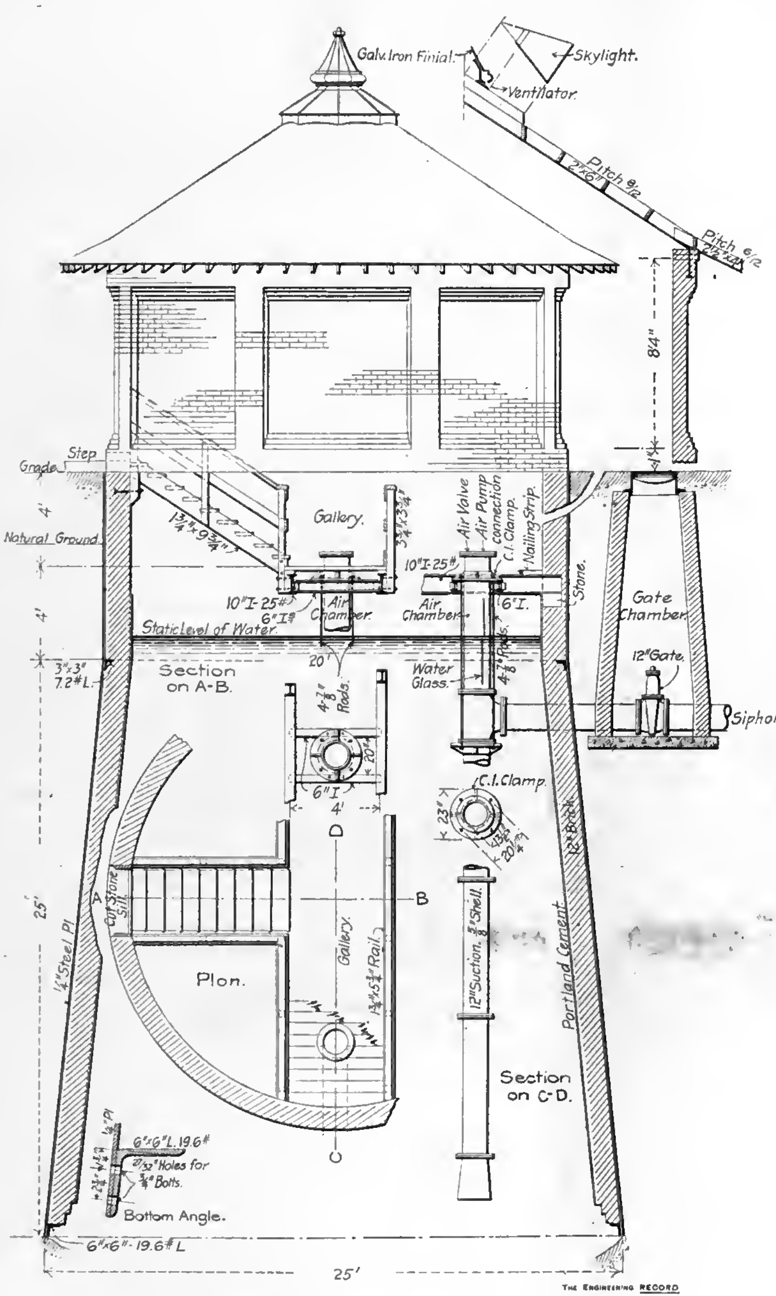
The pumps at the pumping station are operated intermittently, usually for three or four hours in the morning only. When the pumps are idle the level of the water in the new well rises to approximately the point shown in the figure, and forces the air out of the air chamber through a small air valve which operates automatically by gravity. At the same time an automatic valve and float closes the lower end of the siphon where it discharges into the old well, as pumping is suspended and the water level in the old well rises. This is to prevent the continued overflow from the new well into the old and the backflow of water into the ground from the old well, as well as to allow the water in the new well to rise to as high a point as possible for the purpose of relieving the siphon of air, as already described.

There appeared to be some doubt as to whether this method of exhausting the siphon of air would be adequate, especially with continued use and when large quantities of water were being drawn, and an air pump connection was therefore placed in the head of the air chamber for use in case the previously described method should prove inadequate. Up to the present time, however, it has proved entirely adequate and the operation of the two wells simultaneously has been entirely automatic, and, as the engineer says, "I used to go up there once in a while and look at the gauges, but they have always been all right, and I don't go there at all now." There are glass water columns on the air chamber, so that it can readily be seen by inspection whether or not any air is in the siphon line.

In the lower end of the siphon line is set a branch which is connected directly to the suction line of the pumps so that the pumps may draw exclusively from the new well, using the siphon line merely as a suction line if it is desired to do so, which is quite improbable.

Approximate tests of the capacity of the new well indicate that it will furnish about 1,000,000 gallons a day.

The method of increasing the water supply at a point where a pumping station is already established which has been described, has been used by the writer in other cases. Fifteen years ago a plant similar in the essential details was constructed by him on a considerably larger scale, the siphon being 24 inches in diameter and 2,900 feet long. This siphon has a lift of 20 to 25 feet and has been in operation without interruption for the past fifteen years.



Details of the New Well at Kalamazoo.

Another Tunnel under the Thames at London has just been completed after three years' work. It is for workmen who cross between Millwall and Greenwich, and is 1,217 feet long and 11 feet in diameter. It is 60 feet below the high-water level and its crown is 13 feet below the river bottom. It was driven under air pressure by a shield started from the north side. The entrance at either end is a shaft 35 feet in diameter with stairways and an electric elevator. The contractors were J. Cockrane & Sons, and the cost was $600,000.

The Marine Water-Tube Boiler is referred to as follows in a report of the British Admiralty committee appointed to consider certain questions concerning marine boilers: "In the course of their investigations the committee have watched the Babcock & Wilcox boilers fitted in the S. S. "Martello" of the Wilcox Line, employed in the Atlantic trade between Hull, Boston and New York, and copies of the reports of their inspections have from time to time been forwarded to their Lordships. These inspections have taken place at the end of every round voyage for 14 months, and the committee's opinion is that these boilers have stood the test of usage in the mercantile marine extremely well. The vessel has run about 91,000 miles since the boilers were put in, and has usually been less than a week in port at either end; the only repairs required have been those of the ordinary upkeep of any boiler, such as fire-bars, brickwork, etc., and only six tubes have required renewal. This opinion is strengthened by the inspection of boilers of the same type fitted in the "Numidian," the "Buenos Ayres," and the "Turret Cape." In the case of the last named vessels, the boilers have been in use seven years, and cannot have been as well looked after as they would have been in the Navy, and their condition when examined recently was satisfactory. The committee have also examined and tested boilers of the same type in H. M. S. "Sheldrake," and find that, although they have been in use for four years, their condition is good and they have given little trouble. From the information which has been brought to the notice of the committee, it appears that water-tube boilers are being very little used in large ships belonging to the mercantile marine, and that their use in such ships is increasing very slowly. In the British mercantile marine, the only type of water-tube boiler installed in ocean going vessels is the Babcock & Wilcox, in some ships of the Wilson and the Petersen-Tate Lines, and in three ships of the Allan Line; in these last, however, only one water-tube boiler is fitted in each vessel to assist the original cylindrical boilers. In the United States mercantile marine, Babcock & Wilcox boilers are used to a small extent, principally in the ships plying on the Great Lakes, and in the American Navy many Babcock & Wilcox boilers are in use."

Two Recent Water-Power Plants on the Arve River, France.

Two water-power plants have recently been developed on the Arve River in France to furnish power for an electric railway running from Fayet to Chamonix, this road now giving tourists direct communication by railway between Geneva and the picturesque valley at Chamonix. In general the plants comprise waterways tunneled in the rock, as is characteristic of many of the water-power plants in these mountainous regions of Europe. In both plants enlargements are provided in the waterways to allow for the deposition of sand and gravel, one of the decantation chambers, as they are called, being subterranean. In the electrical end of the work an unusual method of regulation has been resorted to. A description of the railway as well as of the power plants is given in two recent issues of "Le Genie Civil."

The road has a total length of 11.8 miles and contains two heavy grades, one of 9 feet in 100 in a length of 7,070 feet, and the other of 8 feet in 100 in a length of 4,547 feet. The elevation of Fayet is 1,904 feet; that of Chamonix, 3,404 feet. One of the power plants is located 3.1 miles distant from Fayet near Servoz, and the other 5 miles distant near Chavants.

The Servoz works utilizes the upper 128 feet of a 584-foot fall, of which an electro-chemical establishment at Chedde uses the remaining 456 feet. A diversion of the River Arve has been designed to obtain a delivery of 423.6 cubic feet of water per second, so that 4,500 horse-power measured on the turbine shafts can be realized in summer. During winter, the discharge of the river drops to 211.8 cubic feet per second, so that the water power can only furnish the turbines with 2,250 horse-power. The corresponding section of the road, however, only required, according to estimate, 1,380 horse-power, and the road is not operated during winter, that is, at times of low water. The water, which is impounded by means of a dam, is admitted into a tunnel of large cross-section, to provide for sedimentation, then passes through a second tunnel to a covered forebay from which are taken four penstocks, 3.28 feet in diameter, leading to the power house. A double needle dam, which permits the passage of sand and gravel, has been built, a former dam of stop planks having been carried away by high waters. The intake to the first tunnel is guarded by two grills of flat iron, 2.75x0.31 inches, with 0.95-inch spaces for one and 0.78-inch spaces for the other. The delivery into the tunnel is regulated by means of three gates, 7.1 feet wide, placed immediately behind the grills.

The first tunnel or decantation chamber is 755 feet long and has a constant cross-section, the water having a width at the entrance into the tunnel of 20.67 feet and a depth of 8.85 feet, and at the extremity, a width of 15.75 feet and a depth of 11.8 feet. The wet section being about 183 square feet, the resulting velocity with 282.4 cubic feet flow per second is 1.54 feet per second, which is considered sufficiently slow to allow for sedimentation. In continuation of the chamber there is an emptying canal by which the chamber is cleared of the accumulated deposits, this work being done every week, for about five hours, during which time the operation of the works has to be interrupted. The second tunnel is 1,640 feet long and has a capacity of discharging 423.6 cubic feet of water per second at a velocity of 7.87 feet. The second tunnel empties into a water chamber from which a branch is taken to the forebay for the Servoz works and another for the Chedde works.

The power house contains four turbines of 320 horse-power each, operating at full load at 460 revolutions per minute and two 60-horse-power turbines making 520 turns per minute. The turbines are mounted on horizontal shafts and are direct connected to the generators. The turbines are fitted with draft tubes and the tail water is carried away to the Chedde works. The generators are 6-pole direct-current dynamos arranged for partial separate excitation, the method of regulating the machines being very interesting. The main turbines are not provided with any regulation and cannot therefore maintain a constant speed. At no load, their speed is 615 revolutions per minute, and when developing 340 horse-power, 448 turns. The fields of the dynamos carry two windings, one passing a determined fraction of the total dynamo current and the other the current from the separate exciting dynamo. At no load, the field excitation is produced only by the practically constant current from the independent dynamo and is regulated to give at no load speed 550 volts. When a train enters upon the section of the road supplied by the works, the turbines slacken up in accordance with the load and the dynamos turn more slowly; but their excitation is reinforced by the current which they set up and the reinforcement will be greater the more the reduction in speed. The scheme is that speed changes are compensated by variations of the excitation and a pressure has been obtained constant within 5 per cent., from 570 volts at no load to 540 volts at 440 amperes. The normal working of the dynamos is 370 amperes. The exciter turbines are controlled by regulators, and the exciter dynamos are of 40 kilowatts capacity at 120 volts.

The Chavants works utilizes a fall of 308 feet in which during the favorable season, a discharge of 406 cubic feet per second is available, corresponding to 10,650 horse-power on the turbine shafts. The water is diverted for this water-power development by means of a dam 9.84 feet high, curved upstream. From the intake the water is first passed through a tunnel 3,585 feet long, then through a decantation or settling chamber and finally through a second tunnel 3,460 feet long. Both tunnels, which pass through a more or less compact rock, are 8.2 feet wide and 9.84 feet high. Their entrances are protected by grills. The settling chamber is open, located in a depression of earth, and has a length of 403.5 feet and a width of 32.8 feet. The bottom of the chamber has an inclination of 1 in 100 in the direction of its length and also a transverse pitch of 1 in 10, in order to concentrate the deposits toward one of the walls of the chamber to facilitate their removal. The velocity of flow in this chamber does not exceed 1.9 feet per second and it takes about 3½ minutes for the water to pass through the chamber. It is cleared as in the other works, during interruptions of the service.

At the extremity of the second tunnel the water is delivered into an open forebay, which has a width of 18 feet. Its length is only 11.15 feet, but it is arranged for increase with enlargement of the plant. At the forebay an overflow is provided for the disposal of excess water, designed to take the maximum flow of water. From the forebay the water is led in two penstocks each supplying a pair of turbines. The penstocks are built in sections each 21.3 feet long and 2.62 feet in diameter, of boiler steel. The thickness of the plates varies from 0.23 inch at the forebay to 0.43 inch at the bottom near the power house.

The generating units consist of four horizontal 320-horse-power turbines directly connected to six-pole 200-kilowatt dynamos and two 60-horse-power turbines driving two 40-kilowatt dynamos for exciting purposes and local lighting. Ordinarily, one of the exciter units is in reserve and the road service requires three of the four generators. The same system of regulation has been applied to the Chavants works. When the dynamos operate at no load, their speed is 600 revolutions per minute and the tension 550 volts. The speed falls to 450 turns and the tension rises to 680 volts when the load reaches 290 amperes. The high voltage is to compensate for the losses in the feeders, which in this case are quite long.

Tests of Special Properties of Mortar.

In connection with the construction of the Wachusett dam, the Metropolitan Water and Sewerage Board has been conducting a series of continuous tests of cement which have now lasted for over five years for some brands. The results are summarized in the report for 1901 of the chief engineer, Mr. F. P. Stearns, who also gives the following notes concerning some special investigations:

In view of the very large amount of mortar to be used in the dam and the importance of having it as water-tight and strong as possible, extensive experiments were begun early in 1901, to determine the permeability and strength of mortars made of the natural and Portland cements which were to be used in the construction of the dam, mixed with different proportions of coarse and fine sands.

The experiments on permeability were made by placing the mortar in cast-iron cylinders, 22 inches long and about 6 inches in diameter. After the mortar had set, caps were bolted to the tops of the cylinders and water was admitted to the cylinders between the caps and the mortar with a pressure of 74 pounds to the square inch. There were 144 cylinders used in the experiments, and the apparatus was so arranged that the water pressure could be applied to 24 cylinders at a time. The applied water was first filtered through sand, to remove all suspended matter.

There were 1,494 briquettes made and broken, to determine the tensile strength of the mortars. It was found that the use of a sand with a very large proportion of coarse particles and a much smaller percentage of the finer grades makes a mortar both less permeable and stronger than where a larger proportion of the finer grades is used, provided the proportion of sand to cement does not exceed 3 to 1.

In addition to the experiments upon permeability and strength of mortars, other experiments were made to determine the relative strength of mortars used immediately after wetting and mixing, and when used at different intervals up to two hours after they are first wet and mixed. These experiments were very extended, as they were made with mortar mixed with different grades of sand, with Portland and natural cement, with slow-setting and quick-setting cement, and with mortar that was worked continuously from the time of mixing until it was put into the molds, and also with mortar which was not worked after it was mixed until just before it was put into the molds. The briquettes were broken at the end of fourteen days, twenty-eight days, and three months after mixing.

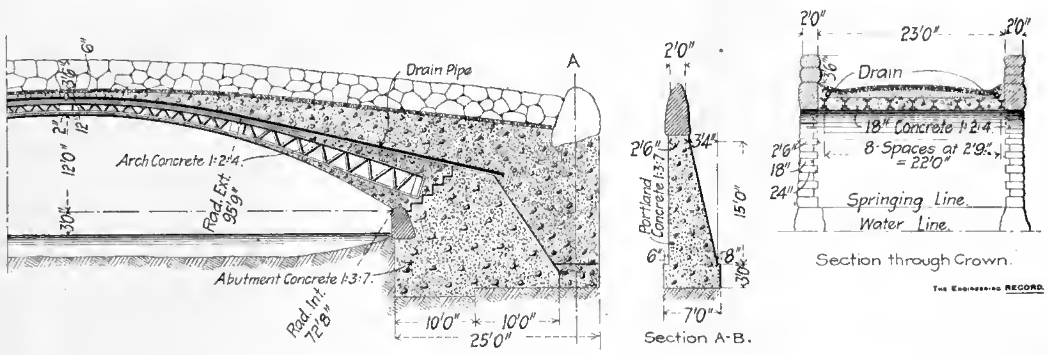
It was found that when the cements, both Portland and natural, were so manufactured as to take the initial set slowly, the strength of the mortar was not diminished by a delay of two hours in putting it into the molds; and when the mortar was worked continuously to the time of filling the molds, there was an increase in strength occasioned by the delay. When the cements were so manufactured as to take the initial set quickly, the results obtained with the quick-setting Portland cement were not materially different from those obtained with the slow-setting cement, except that when the mortar was not worked there was a slight loss of strength in the briquettes molded at the end of one and a half and two hours, and at no time was there much gain in strength occasioned by delay in filling the molds. The results obtained with the quick-setting natural cement were less favorable, as the briquettes broken at the end of fourteen days showed a great loss of strength when there was much delay in molding the briquettes. At the end of three months, however, the briquettes made with mortar which had been worked continuously from the time of mixing showed slightly greater strength than that put into the molds immediately, and the loss of strength of the mortar not worked was not very marked except for the 1½ and 2 hour periods.

The Cost of Pumping for the Metropolitan Water system of Boston during 1901 was $2.52 per million gallons pumped, as compared with $9.64 in 1897. A saving of $0.82 per million gallons was effected over the cost during 1900, this reduction being brought about by the discontinuance of the smaller stations and by the introduction of more economical machinery and methods at the few large stations. The 1901 report of the Metropolitan Water and Sewerage Board states that the total quantity of water pumped during the year was 40,018,920,000 gallons.

The Manifold Power Systems of the Edison Electric Company, of Los Angeles, Cal., will be an interesting combination of electric works when completed. In addition to its present station, there is a hydraulic plant nearly finished in Mill Creek Canyon near Redlands, which has a canal capacity of 1,100 miner's inches, an effective head of 1,935 feet and machinery of 4,000 horse-power. On the Kern River 110 miles from Los Angeles, a dam will be built to divert 300 second-feet into a canal leading to a 20,000-horse-power station. There will be at least two three-wire transmission lines and the voltage will probably be around 60,000. At Los Angeles there will be an 18,000-horse-power receiving station. It is also proposed to build at once a new steam plant in the city to work in connection with the company's several hydraulic plants. It will have an ultimate capacity of 5,000 kilowatts in four or five units, the first installation to be 2,000 kilowatts. Water-tube boilers with economizers and superheaters will be employed, with oil-burning furnaces. It has not yet been decided whether direct-connected condensing engines or steam turbines will be used. Surface condensers will be installed, and a large traveling crane will span the engine room. The management of the company's affairs is in the hands of the president, Mr. John B. Miller, who supplied the above information.

The Rock Creek Concrete-Steel Arch, Washington.

Although the people of Washington have been disappointed by Congressional delay in pushing work on the concrete-steel Memorial bridge designed by Prof. W. H. Burr, an attractive structure of this sort on a much smaller scale has recently been constructed over Rock Creek in the National Park. Its general design and appearance are well shown in the accompanying illustrations. It is a segmental arch of 80 feet span and 15 feet rise and carries a 23-foot roadway; the clear width between the parapets is 23 feet and the width over all is 27 feet. The locality where the structure stands made it desirable to build a boulder bridge, if possible, for aesthetic reasons, but as only $17,500 was available for the purpose it was necessary to adopt some less expensive type of construction, that selected being a Melan concrete-steel arch with a boulder facing, the concrete of the soffit being darkened strongly by lampblack to harmonize with the face of the stones.



Half Longitudinal Section showing Parapet and Wing Walls.

The proportions of the concrete used in the several parts of the bridge are stated on the drawings. The boulders measure from about one-fifth cubic foot upward in size and were required to be "loose rock which shall be hard, sound, durable and of a quality to be approved by the Engineer, whose edges have become weathered or water-worn, or both, and are more or less rounded. The boulder face of each stone shall project at least 2 inches beyond the neat lines of the bridge, and this projection shall not exceed 15 inches, nor shall it be greater than one-half the least horizontal dimension of the stone. All joints shall be scraped and brushed clean of mortar to the depth indicated by the Engineer. The mortar shall consist of 1 part Portland cement and 2 parts sand. The backs of all boulders shall be plastered with a layer of mortar as specified, at least one-quarter inch thick, immediately before ramming the concrete against them." No serious trouble was experienced in securing the boulders.

The arch stones are from 3 to 4 feet deep, 1½ to 3 feet wide and 1½ to 2 feet long, all dimensions being exclusive of the projections beyond the neat lines. The joints were dressed so as not to exceed 1½ inches at any point for at least two-thirds their depth and two-thirds their length, and were roughly pointed. Each stone was attached to the top of the adjacent steel girder by a ¾x¼-inch steel cramp cemented for at least 2 inches in a hole in the stone. The outside girders were bound together, just before the concrete was put about them, by means of four ¾-inch wire ropes. A number of arch stones were made by splitting boulders into two pieces, the fresh face of each being turned toward the girder.

The requirements for the abutments, spandrels and wing-walls stated that no dressing would be required on the stones for such parts, for which only well-shaped boulders, laid on their broadest bed, were allowed. Dressing was permitted, however, if the stones could not be bedded properly without it, and, as a matter of fact, was necessary in most cases. The parapet contained a number of through stones, and these were used exclusively for its top.

A CONCRETE-STEEL BRIDGE OVER ROCK CREEK, WASHINGTON, D. C.

The effect of the structure is striking, and it is greatly admired. It was designed a year ago under the supervision of Capt. Lansing H. Beach, Engineer Commissioner of the District at the time, and built under his direction and that of Col. John Biddle, his successor, assisted by Capt. H. C. Newcomer; Mr. W. J. Douglas is the engineer of bridges of the department. The contract was placed with Messrs. Talty & Allen, of Washington, at $14,890, exclusive of steel and royalties, and the total cost, including inspection, was $17,500.

A Solid-Floor Single-Track Plate-Girder Bridge.

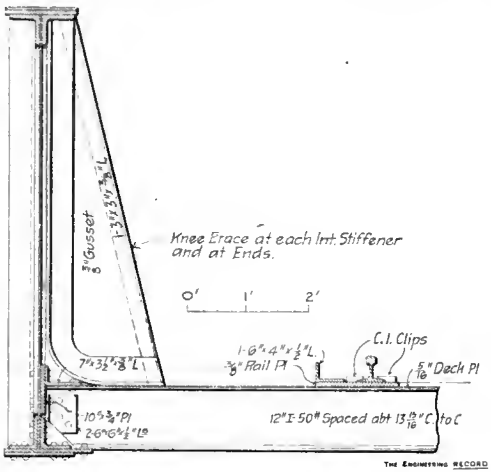
Bridge No. 421½ of the Lake Erie & Western Railroad is a single track through plate girder of 75 feet span out to out, with abutments skewed 37 degrees 10 minutes to the bridge axis and the track on a 2-degree horizontal curve. The girders are 15½ feet apart on centers and have rounded upper corners. The webs are 7 feet deep, shop spliced in three sections and stiffened by pairs of 5x3½-inch vertical angles and fillers from about 7 to 10 feet apart. The flanges are of the ordinary T-shaped section made with pairs of 6x6x¾-inch angles and pairs of 14x¾-inch cover plates. The bed plates at both ends have ¼-inch sheet lead packing on the masonry and at one end there are ten 2-inch rollers under each girder. The girders are sway-braced by solid gusset plates reaching from the top flange to the solid floor and riveted to the inside vertical web stiffener angles, which are curved at right angles at the bottom and form continuous connections which are riveted to the top flanges of the floorbeams.

The span is proportioned for a dead load of 1,700 pounds per lineal foot, a live load of two 100-ton consolidated locomotives followed by 3,000 pounds train load per lineal foot and an impact of 15 per cent. for the girder and of 25 per cent. for the floor. These produce a maximum moment of 2,007,300 pounds in the flanges and an end shear of 124,700 pounds.

The bridge floor is carried on 12-inch 50-pound I-beams about 14 inches apart, which, at each end, have pairs of vertical angle clips shop-riveted to their webs and field-riveted to a 10x¾-inch continuous reinforcement plate riveted to the girder web just above the edge of the flange angle, as shown in the detail cross-section. The lower corner of the floorbeam is cut off at 45 degrees to clear the bottom flange angle, but is left long enough to engage the upper side of a special 17½x⅝-inch flange plate which is riveted to the bottom side of the flange angles above the regular 14-inch cover plate and projects about 3½ inches to take one row of rivets in the floorbeam flanges.

The entire upper surface of the floorbeams is covered with flat 5/16-inch steel deck plates extending from girder to girder and from end to end of the span. These plates are riveted to the top flanges of the floorbeams and their edges are secured by the wide flange of a 7x3½-inch horizontal angle field-riveted to them and to the web on the girder, so as to form a finish and a stiffening to the floor. Each floorbeam has a moment of 504,000 pounds and an end shear of 9,500 pounds, which is taken by the four double-shear rivets through its web and the eight single-shear rivets through the web of the girder. The lower flange of the floorbeam is kept 1/16 inch above the top of the 17½-inch flange plates to prevent the latter from receiving any bearing load. The rails are secured by cast steel clips and are seated on ⅜-inch bearing plates 16¼ inches long above every floorbeam. These plates are alternately 6 and 10 inches wide and receive also the 6x4x½-inch guard angles. This arrangement permits the track to be located at pleasure between the girders, affords a stiff and watertight floor and occupies remarkably little vertical space, the base of rail being only 14 9/16 inches above the bottoms of the rivet heads in the lowest part of the girder.

On account of the great skew, one girder projects about 21 feet beyond the end of the other at each abutment, and for this distance the floorbeams, which are riveted to the long girder, require special supports at their other ends. This is afforded by riveting them to the webs of special 12½-inch plate girders seated on and anchored to the abutment masonry. The shore edge of the deckplate is parallel with the face of the abutment from the end of each girder nearly to its intersection with the track where, on the side nearest the long girder, it makes an angle of 127 degrees and 10 minutes, crosses the track at right angles, makes a right angle and follows parallel and close to the guard rail for about 9 feet, and then intersects the edge which is parallel with the face of the abutment at an angle of 142 degrees and 50 minutes. This brings the floor square with the track at the end of the bridge and parallel with the abutment each side of the track. An abutment wall follows the angles of the end of the floor and carries the girders under each of the intersecting sides above described. The girder parallel to the track is supported at both ends and in the middle and has flanges made of single 5x3½-inch angles. The oblique girders are web-connected by oblique vertical angle-plates, with the webs of the longitudinal and



Section through Solid Plate Floor.

transverse girders and with the ends of the main span girders.

This bridge was designed and built by the King Bridge Company in accordance with the requirements of the engineering department of the Lake Erie & Western Railroad Company.

A Plan of the Venetian Campanile, drawn by Mr. W. Hilton Nash in 1875 from measurements he made, has been published by the "Builder." It gives the outer wall as measuring about 37 feet on a side and 4 feet thick. The inner wall was 3 feet 9 inches from it and 3 feet 9 inches thick. He states in a note accompanying the sketch that there were serious cracks in the structure which he attributed to unequal pressures caused by the decay of the timbers bonding the two walls together.

The Comprehensive Study of the Quality of Water has been undertaken by the Division of Hydrography of the U. S. Geological Survey, with the corporation of laboratories in different parts of the country. The division has been carrying on investigations of the quantity of water available in the various States, which have already proved of much value in projects for power development. The examination of the quality of the water will increase the usefulness of these investigations by supplying information desirable in estimating the availability of streams as sources of supply for potable or manufacturing purposes, and for this reason the new venture is to be commended. In order to secure uniformity in the work, Dr. F. H. Newell, who is in charge, has issued a circular advising the adoption of the analytical methods recommended by the special committee of the American Public Health Association, already given in detail in this journal.

The Mechanical and Electric Equipment of the Pittsburg & Lake Erie R. R. Terminal, Pittsburg.—II.

In the issue of The Engineering Record of August 2 the mechanical plant of the Pittsburg terminal station of the Pittsburg & Lake Erie Railroad was described at some length, making it necessary to defer to the present issue the account of the heating and ventilating system which has been provided. As explained in the preceding article, the terminal includes a seven-story headhouse with the station proper on the first floor and the general offices of the road on the floor above. The building contains many finely decorated rooms, and being located in a very smoky section of Pittsburg, a special effort was made to keep the interior clean. A greater part of the window sash is stationary, the balance being fitted with hinges and locks and all joints of all windows carefully packed with felt to prevent the leakage of air from the outside. A very elaborate system of ventilation was accordingly installed, involving the use of seven fans, by means of which a plenum is maintained in the building, to insure that very little air enters except through the designed channels.

The building is warmed by hot water, the direct system being employed in warming offices, with indirect radiation for the waiting and other public rooms. The offices, however, are also supplied with fresh air, but this is tempered and intended for ventilation only. The air circulating system is supplied with three blowers in the basement of the station building, the fans receiving fresh air through air shafts dropping from intakes above the roof. All the air is washed by water and tempered. By one fan it is then delivered through supplementary heaters and thence into the waiting room and adjoining spaces, all of which are, as stated, warmed by the air supply; by the other two fans it is discharged to tempered air shafts which rise through the building to distributing systems in each story for the ventilation of the offices. The exhaust of the air is effected by means of disk fans, one in the basement drawing air from the waiting room and three on the roof, two for the general office systems and the third for the toilet rooms, which is discharged independently into the atmosphere. Provision has been made for an internal circulation of the air in the offices during periods of unoccupancy, as on holidays and Sundays, by dampers, which close off the fresh air inlets and allow the practically unvitiated air rising through vent shafts to reach the intake shaft and pass downward to the basement to be recirculated. In this case the two roof exhaust fans belonging to the office system are shut down and the two blowers corresponding need only be run at a slower speed.

The methods and apparatus for the distribution of air can probably be understood from the basement, ground-floor and sixth-story plans, which are reproduced in accompanying drawings. For the passage of ducts, suspended ceilings over the corridors are resorted to, as indicated in the sixth-story plan, resulting in the concealment of the duct work. In the basement there has been a close utilization of space, the building resting on made ground and bringing heavy latticed girders of the foundation in the basement story. All the fresh air is received through two intake shafts, each of which delivers to a room in the basement where the tempering and washing apparatus is installed. In each case, the water-spray method of dirt elimination is employed and the cold air is first warmed slightly so as to prevent any freezing in the washing apparatus.

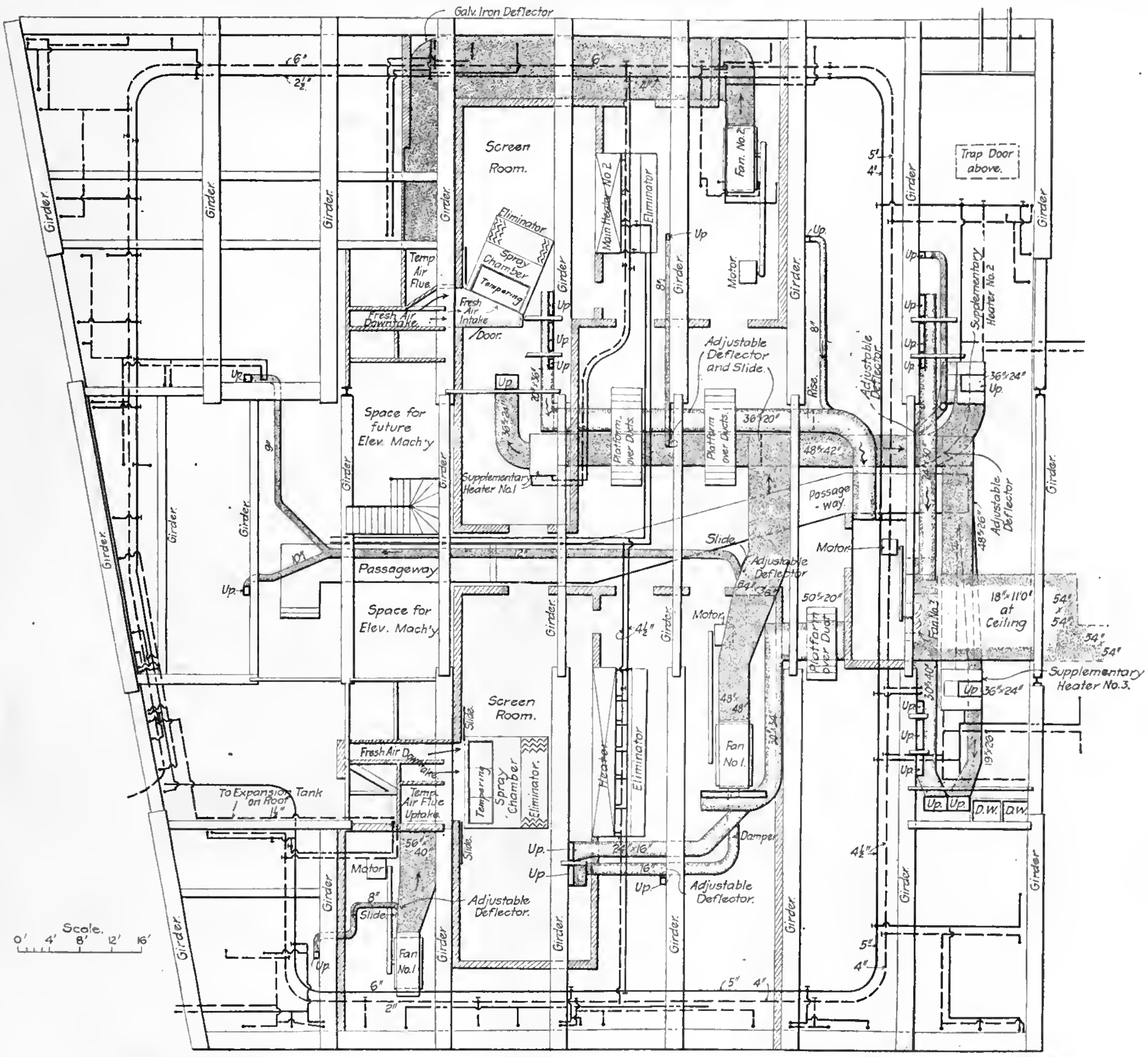
After leaving the washing apparatus the air is passed in each case through a stack of tempering radiators and then enters a fan room. The fans being located within the rooms are of the double-inlet centrifugal blower type and have a single discharge outlet connected with galvanized iron duct work for the distribution of the air. One blower is located in one room while two are in the other, one of these, No. I A, being for the waiting room system. The blowers, which are of the New York Blower Company's make, are belt driven from electric motors.

The initial tempering stacks consist of ordinary hot-water indirect radiators and are ordinarily only used when the washing apparatus might become frozen. The washing apparatus is of the R. H. Thomas patent, built by Messrs. pivots and turned by means of a connecting bar so that these baffles may be adjusted at any desired angle from 45 degrees to a line parallel with the current of air.

The main heater consists of Excelsior indirect radiators designed to warm the air to 70 degrees. Immediately beyond these, in the fan room, is a second set of eliminators, consisting of three rows of galvanized iron baffles also pivoted and connected to a controlling lever. These are intended for summer use to effect as full a separation of water from the air as possible and thus to reduce its humidity; in this connection arrangement has been made to supply the tempering coils with cold water for cooling the incoming air.

Fan No. 1 A, which supplies the waiting room, delivers chiefly to three different points between filled with granulated cork, all joints made tight by the use of elastic cement. At the ceiling of every story except that of the ground floor, the tempered air shafts connect with a duct which runs above a suspended ceiling in the corridor supplying the various offices through registers about 8 feet above the floor.

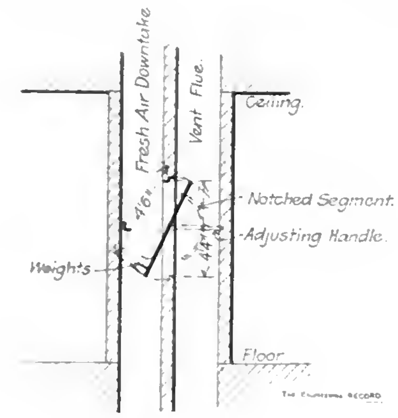
In the waiting room there are four points of egress for the air. The air is then carried along in a suspended basement ceiling duct from each point of exit and is led to an exhaust chamber of about 1,386 cubic feet capacity. In it is installed a Blackman fan belted to an electric motor. The air from this fan is delivered through a 1½x11-foot duct, which is run underneath the flooring, to a vertical flue in one corner of the trainshed, and there discharged 10 feet above the trainshed floor.



VENTILATION AND HEATING IN THE P. & L. E. R. R. STATION BUILDING, PITTSBURG.
WESTINGHOUSE, CHURCH, KERR & CO., ENGINEERS AND CONTRACTORS.

Thomas & Smith, of Chicago, and consists of a water spray chamber and an eliminator which is a collection of vertical baffles around which the air has to pass, depositing in so doing the surplus water carried in the air. The spray chamber contains four rows of spray heads forming a water curtain through which the air has to pass. The water is supplied by a direct-acting steam pump, and is caught in a steel tank on the floor of the chamber from which the water is run to waste. The sprays are enclosed in an iron casing with a thick glass window at each end. The first four rows of the eliminator are of copper tinned over, while the remainder are of galvanized iron arranged on in that room. As indicated in the basement plan, there are three supplementary heaters, each of Sterling hot-water indirect radiators, beyond which the air is lead to large registers of special design, in the waiting room, each register 16 square feet in area. The other blowers, Fans No. 1 and 2, which supply the offices throughout the building, deliver, as shown in the basement plan, to two tempered air shafts, which are carried upward through the building alongside the fresh cold-air down shafts. The proximity of these two air passages required some insulation between them. The partition consists of galvanized-iron sheets fitted on wooden frames with a 2-inch space

For the floors above the vent registers are similarly located at the floor, and the air is carried in wall flues to the suspended ceiling of the corridor. These connect with two vent flues running to the attic. There they discharge into the space over the top-story corridors and in that manner deliver the vitiated air to Fan No. 5, which is of the Blackman type. Fan No. 6 has been set above the ceiling of a kitchen in the top story on a vertical shaft, as shown in an accompanying cut, and is direct connected to a motor placed below it. A grating is provided below the latter, sufficiently strong to bear the weight of a man, and the air is admitted from below through it. The exhaust air from the adjoining dining rooms is led into the room through flaps, so as to insure an air flow in one direction only and thus to prevent the composite odors of the kitchen from diffusing through the building. In general

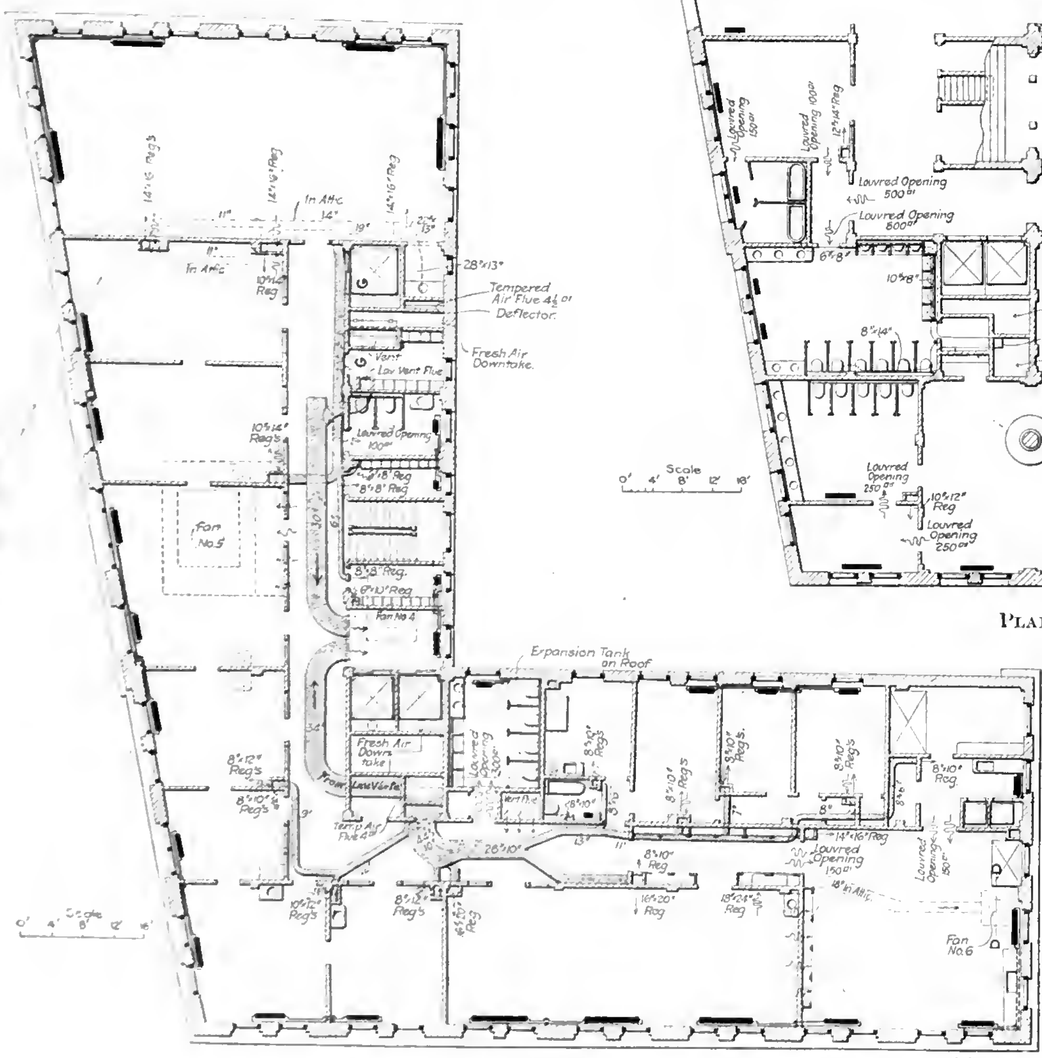


Section G-G. 6th Floor.

the air is changed once in fifteen minutes in those rooms which are continuously occupied.

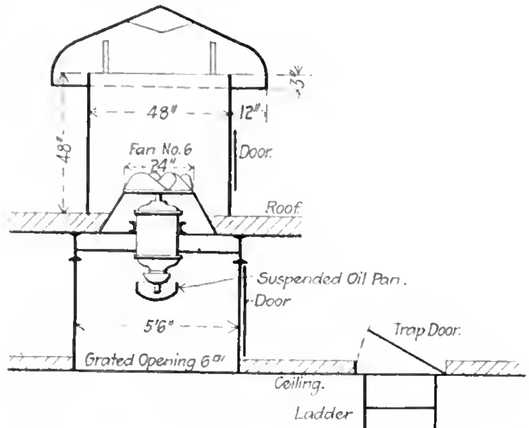
The withdrawal of air from the various toilet rooms is accomplished by a system of flues and ducts separate from the rest of the building. The air is brought to the top story in two main-vent flues, which are joined by duct work in the space over the corridor to a separate fan chamber containing Fan No. 4. This fan is also of the Blackman type. The flue connecting the fan with the outside air is of galvanized iron and is fitted with a discharge top.

The heating of the building is accomplished



PLAN OF THE TOP STORY.

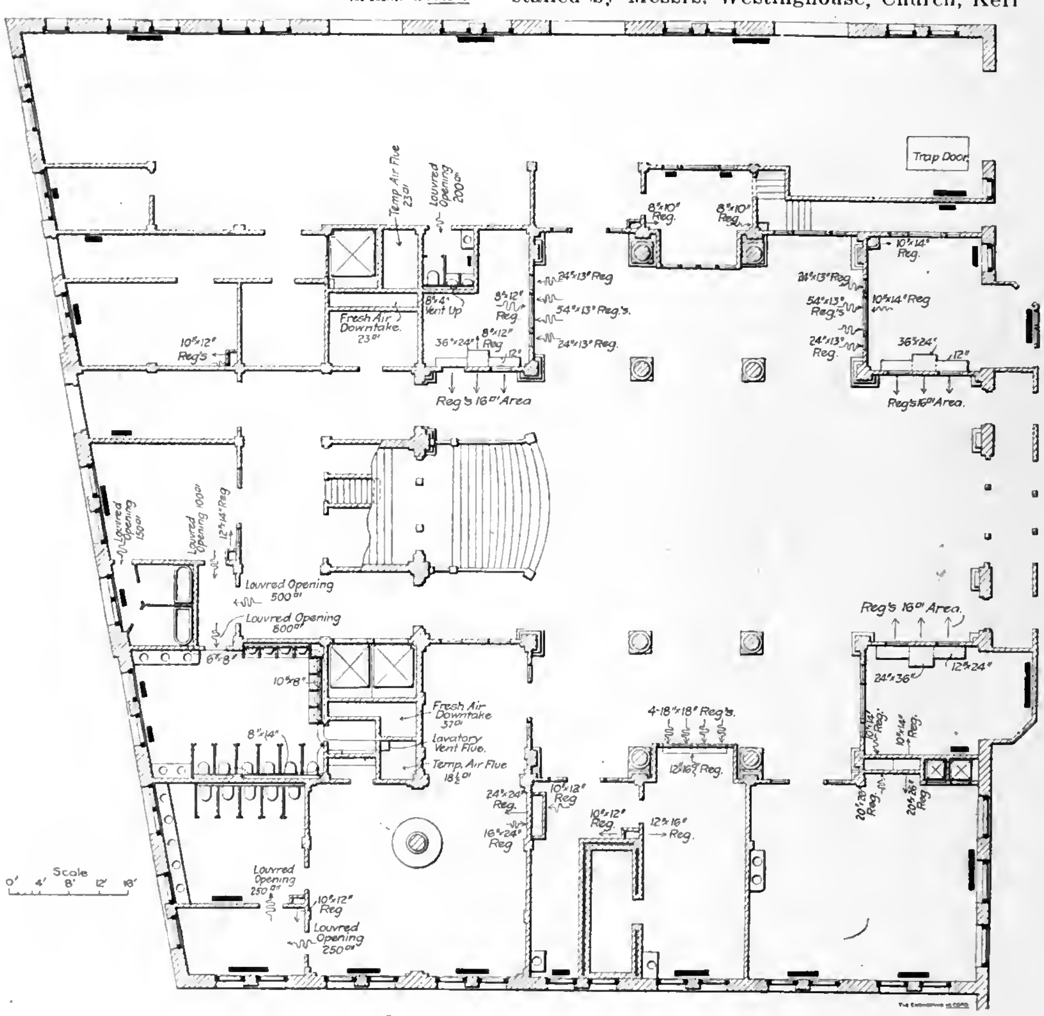
primarily, with the exception of the waiting room, which is warmed exclusively by the hot-water indirect method, through hot-water direct radiation, as already stated. Exhaust steam from engines, pumps, etc., in the powerhouse is utilized in a large heater of the closed type, also in the powerhouse, for warming the circulating water. An auxiliary heater is provided for heating the water to a higher temperature on extra cold days and when the supply of exhaust steam is insufficient. Baldwinsville centrifugal pumps, installed in duplicate



Section D-D 6th Floor Plan.

and each driven by a Westinghouse steam engine, are employed to circulate the warm water through the system. The supply and return mains at the pumps are 6 inches in diameter. The latter reach the building through a tunnel joining the power and headhouse. The supply main runs around the outside of the building wall in the basement and supplies the various riser lines for different sections of the structure as well as the tempering and heating stacks. The return main travels parallel with the flow main, the latter decreasing in size as it continues around the basement and the return main increasing in size from the first return pipe connection to its final diameter of 6 inches. The direct radiators are of the Detroit pattern and in many cases two and three radiators on each floor are connected to one pair of risers. An open expansion tank of steel is provided above the top story.

The work described was designed and installed by Messrs. Westinghouse, Church, Kerr



PLAN OF THE GROUND FLOOR.

& Company, of New York, under the supervision of Mr. J. A. Atwood, chief engineer of the Pittsburg & Lake Erie Railroad, and Mr. A. R. Raymer, assistant chief engineer.

The Admission of Trade Refuse into sewers has recently been made the subject of special regulation by the Town Council of Halifax, England, as described in "The Surveyor." The regulations provide that all liquid trade refuse from factories shall be passed through suitable settling tanks, which are to be constructed and at all times maintained by the owner. The resulting effluent is to be free from any substance which may be injurious to the sewers or the sewage, create a nuisance, or may be dangerous to health. All suds are to be treated for the removal of grease. The maximum daily quantity of effluent which may be passed from any factory into the sewer is to be agreed upon before any connection with the sewer is made.

Cellar Bracing in the New York Stock Exchange.

The New York Stock Exchange, on Broad Street near Wall Street, occupies an area approximately equal to 150 feet square and has in all fourteen floors and a roof about 140 feet in maximum height above the New Street curb. As some of the stories are merely galleries and others are below the level of the streets, the building may be considered as a ten-story structure. It is noteworthy for the spacious Board Room which occupies a large part of the whole building. The riveted steel trusses which support the upper stories have been fully described in The Engineering Record of May 17. It is also remarkable for the character and depth of its foundations and the great depth of the cellar floor below ground-water level; these foundations and the methods of constructing adopted by Mr. John F. O'Rourke, the contractor, were described in The Engineering Record of September 28, 1901. Some of the features of the special construction involved in providing suitable bracing to resist the hydraulic pressure which it was assumed might be developed against the walls below the ground-water line will be described in this article. The framework of the building is of steel and conforms to the general design indicated in the longitudinal and transverse sectional elevations published in the preceding articles, but there are so many variations and irregularities in the different stories that the design is very much complicated and cannot be advantageously farther described. Above the first floor the construction corresponds to that of ordinary steel-cage office buildings, and standard details are generally adopted for beams and columns, roof and floor design, etc. Below the basement level special bracing was introduced and interesting methods were used in the erection.

After the site was cleared it was excavated to a depth of about 20 feet below the New Street curb and a solid concrete wall 7 1/3 feet thick was carried down around these sides of the lot to the solid rock at a maximum depth of 60 feet below the New Street curb or about 48 feet below the assumed ground-water level. This wall was built in separate sections from 24 to 30 feet long and about 50 feet high, constructed in wooden pneumatic caissons, which were sunk successively in both directions from a starting point at the northwest corner. The caissons overlapped each other at the corners of the lot and the intermediate ones had closely abutting ends. The adjacent sides or ends of all the wall sections were keyed together by vertical concrete cylinders 5 feet in diameter, which united them with strong water-tight joints and practically formed a monolithic dam around three sides of the lot with its ends abutting against the adjacent side wall foundations of the Commercial Cable Building.

The caissons were carried through the hardpan, which was from 5 to 11 feet thick, and the surface of the solid rock was dressed until it was sound and satisfactory. The footings were very carefully cleaned, grouted and concreted under pneumatic pressure. A good contact and tight joint were thus obtained, and as the hardpan is very refractory and considered nearly equal to concrete the lower part of the wall was firmly secured against lateral displacement until the bracing was put in place. It may be considered as a vertical beam built in at the bottom and subjected to a horizontal distributed load due to the pressure of the ground water on the outside. When the caissons were sunk the water pressure was of course balanced on opposite sides, but when the excavation for the cellar was carried down nearly 50 feet below the water level the walls would have been subjected to a large unbalanced lateral thrust, as the water was gradually pumped down inside them.

Special observations and experiments convinced Mr. Amory Coffin, M. Am. Soc. C. E., who was in charge of the design, that no matter how slight might be the clearance between the exterior vertical surface of the wall and the earth or hardpan, the full theoretical hydrostatic pressure due to a saturated backing extending from the base to the ground-water level should be assumed as acting over the whole wetted vertical surface, and the computations were made and the structure proportioned on that basis.

As the excavation was leveled up solid with concrete to the top of the cellar floor, the part thus refilled was not considered in calculating the height and pressure of the ground water, and the wall was figured as a retaining wall 36½ feet high from cellar floor to lowest ground-water line, which varied inexplicably about 4 feet on different sides of the lot. The weight per cubic foot of the saturated backing was assumed at 120 pounds and the pressure was calculated by the empirical formula: Pressure $= \frac{1}{4} h^2 \times 120$, which gives 20 tons per lineal foot as against 20.8 tons for water pressure applied at one-third of the height from the bottom to the top, say 12 feet. The larger value was accordingly used and the resultant total pressure, applied 12 feet above the bottom, is 41,600 pounds per lineal foot. The wall has a net width, inside the caisson, of 7 1/3 feet, and assuming its weight to be 54,540 pounds per lineal foot the wall has a moment of stability of $54{,}540 \times 3\ 2/3 = 200{,}000$ foot-pounds. The moment of stability is equivalent to a moment with a horizontal force of 14,666 pounds with a lever arm of 12 feet. The center of moments was therefore taken at the inner lower corner of the wall and this horizontal force being applied at a height of 12 feet was considered as diminishing the thrust by that amount, thus leaving 24,940 pounds unbalanced thrust, equals 12.47 tons per lineal foot.

In providing resistances for this outside pressure the wall was assumed to be divided into lower, middle and upper sections by two horizontal lines 7 and 23 feet above the cellar floor. The unbalanced pressure on the upper part, about 13 feet high, averages 255 pounds per square foot and equals 1.7 tons per lineal foot, as indicated in the large diagram, and is resisted by the C tier of floorbeams. The pressure in the middle part, 16 feet high, averages 810 pounds per square foot and equals 6.48 tons, which is transmitted through horizontal distributing girders on the sides of the wall and is resisted by the beams and special struts in the A tier of floorbeams which receive equal and counterbalancing thrusts from the opposite walls and so are in equilibrium under heavy pressure. The pressure in the lower part, 7 feet high, averages 1,230 pounds per square foot and equals 4.28 tons per lineal foot, which is resisted by the shearing strength of the concrete and the efficiency of the wall in transverse flexure which transmits it to react on the bed rock. These calculations were all made on the assumption that the wall is unloaded; this was true for some time after it was built, but before the excavation was completed and the maximum hydrostatic pressure was developed, the superstructure was commenced, and this added materially to the weight and stability.

The interior columns of the building are arranged in six north and south rows and four east and west rows, and all of them have concrete footings carried down to solid rock at about the same depth as the outer dam, in wooden pneumatic caissons, surmounted by removable wooden cofferdams, most of which were cylinders from 6 to 8½ feet in diameter and nearly 40 feet high above the top of the concrete pier at the bottom. After the interior piers were built up to the proper level they were capped by I-beam grillages and the steel columns were erected on these inside the protecting cofferdams, the column bases being about 38 feet below the level of the ground water. The D tier of beams, about 42 feet above the cellar floor and 5 feet above the ground-water line, was first erected and forms the basement floor; afterwards the beams, girders and struts at the C B and A levels were erected by special methods as the excavation advanced.

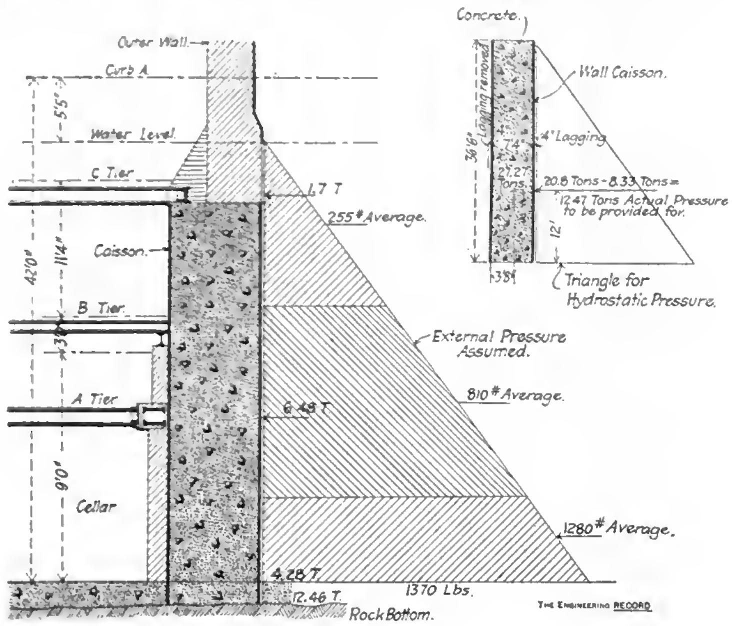
Sumps were dug and several steam pumps installed which gradually removed the water from within the outer walls or dams, and as these were efficient in excluding the outside water the ground-water level was gradually lowered and the excavation carried down to the hardpan through soft wet mud.

At about the level of the C tier there was an old safe-deposit vault about 110 feet long from east to west, 23½ feet wide and 9 feet high. It was built of granite and wrought iron, had an estimated weight of 1,200 tons and rested directly on the earth and sand just above the water level. The lower rows of columns were arranged to clear this structure, and when they had been erected a continuous line of box girders was set on the caps of the row on the south side. A similar line of girders was set on top of the next row of columns to the south, both lines of girders not being parallel but reaching nearly across the lot from west to east. The girders support 18-inch transverse I-beams which rest across their top flanges and carry longitudinal I-beams for the floor of a new steel vault, which was built to replace the old one and receive its contents before the latter was removed.

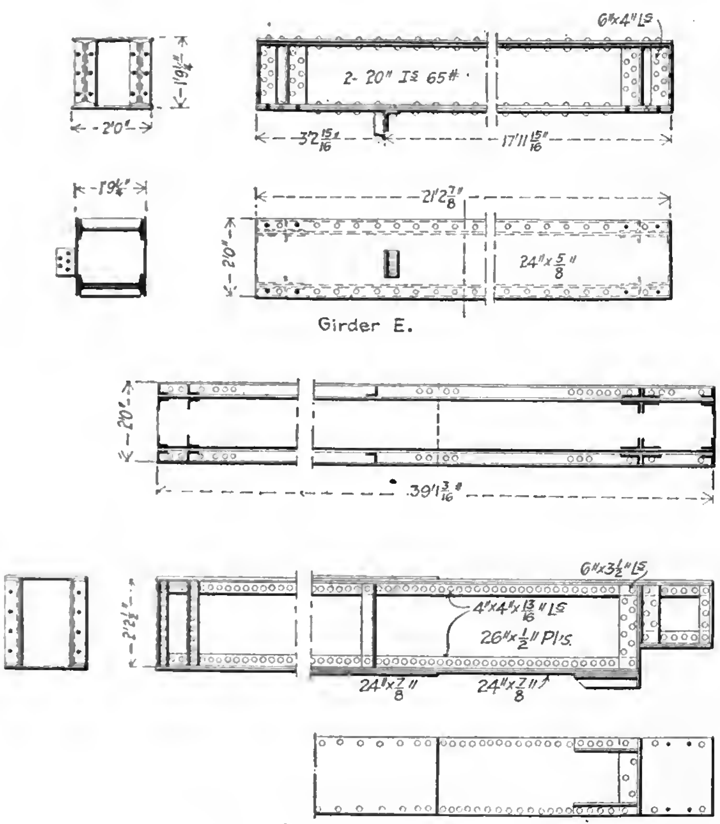
The water was pumped down as far as possible in the excavation and narrow transverse drifts were made in a north and south direction below the original water line in the soft mud under the old vault. Temporary 24-inch I-beams about 7 feet apart were worked into the drift and wedges driven above them to support the vault. Their south ends were seated on the north line of box girders between the 18-inch permanent I-beams, and their north ends were supported on vertical wooden shores and blocking. The excavation was then continued under the old vault and all the earth removed for several feet below it, so that space was afforded to set the permanent beams and girders of the C tier. These were supported on the tops of the lower sections of two north and south rows of columns parallel to and just beyond the walls of the old vault. The vault walls were not parallel to the rows of columns in the upper tiers of the new building so that it was necessary to offset the upper sections of these columns from the lower sections and the latter were capped with beam box-girders, on the upper flanges of which were seated the upper sections of the columns from 1 to 5 feet eccentric with their corresponding lower sections. Some of these columns interfered with the old walls and slots had to be cut in the masonry to receive and permit the erection of the superstructure before the old vault was vacated.

After the completion of the C tier of beams and girders the excavation was continued about 15 feet deeper to the bottom of the A tier, the outer concrete walls being unsupported and subjected to an unbalanced outside pressure which was resisted by the transverse strength of the concrete. The wooden lagging of the inner sides of the cofferdams was removed, exposing the concrete surface, and double-web horizontal distributing girders were set parallel to the wall and about 3 inches clear of it. They were suspended from the C tier by pairs of ¾-inch vertical screw-rods engaging 4x3-inch oak cross pieces or saddles under the girders. Lines of horizontal struts in the planes of both rows of columns were then set across the lot at the level of the distribution girders and were field-riveted to the columns at their intersections and took bearing on the girders. After the bracing system was complete horizontal boards were fitted between the lower edges of the girders and the face of the wall and concrete was rammed in solidly between the girder and the wall to make a continuous bearing. Open holes about two inches by four placed eight feet apart were made in the concrete and asphalted to serve as weep holes to drain any water that might collect on the face of the wall through the lower story.

The columns were set so accurately and were so correctly made at the shops that no reaming in the field was necessary to fit the rivet holes in the connecting struts. As the columns were set a long time in advance at the bottom of deep wells, and were rigidly connected by the upper tiers of beams before these struts

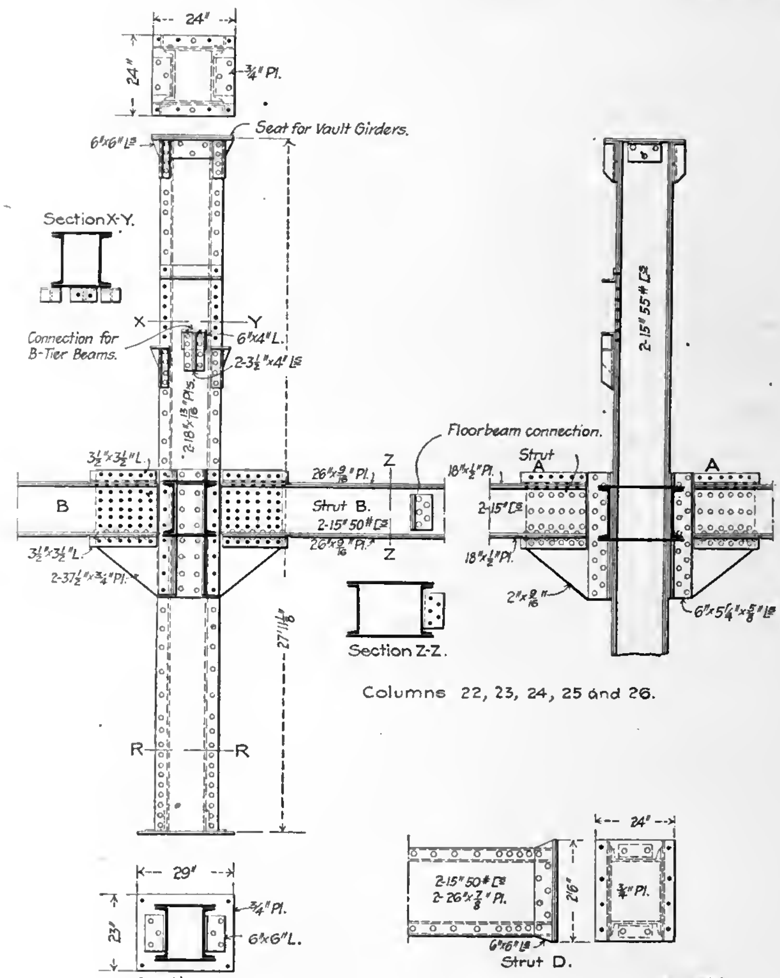


Application of Force and Reaction.

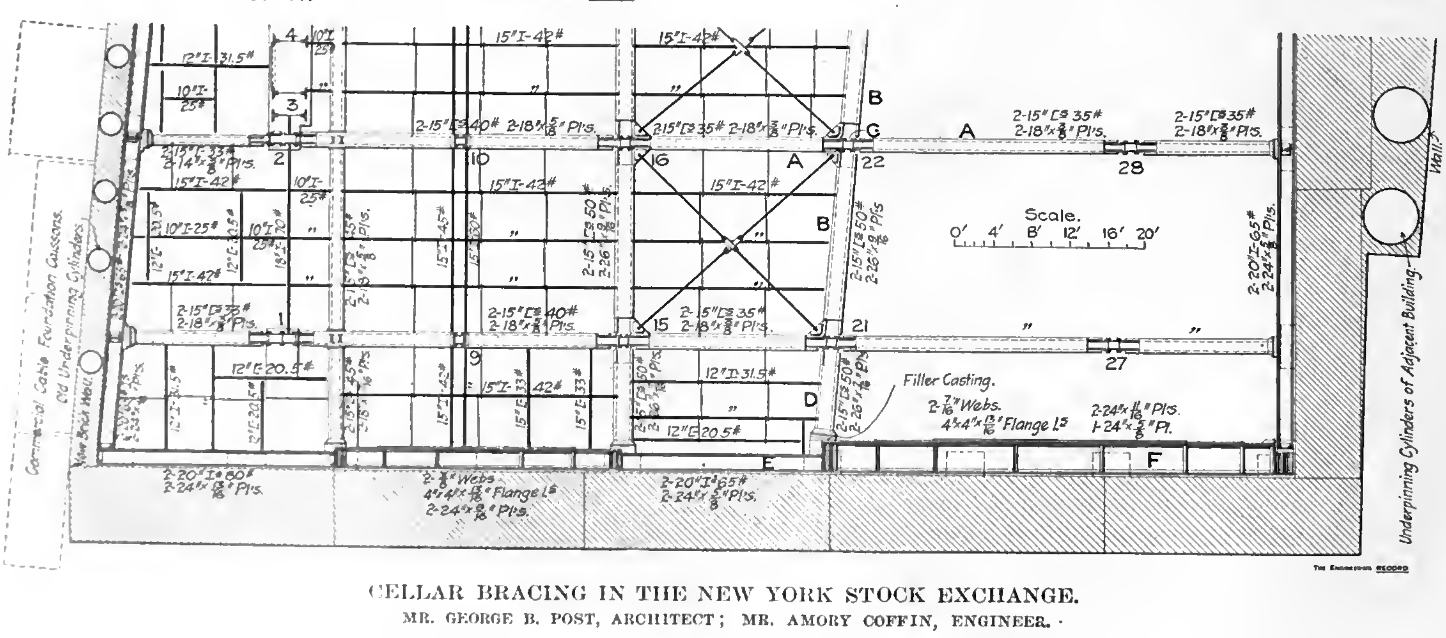


Girder E.

Girder H.



Columns 22, 23, 24, 25 and 26.



CELLAR BRACING IN THE NEW YORK STOCK EXCHANGE.

MR. GEORGE B. POST, ARCHITECT; MR. AMORY COFFIN, ENGINEER.

were assembled to them, this fact reflects great credit on the excellence of the leveling and alignment by the contractor's engineer, Mr. John C. McCord, and his foreman, Mr. Frank Harbison.

The B tier was erected simultaneously with the A tier but was not a full tier and was not calculated to receive any thrust from the walls. It was not continuous across the building but extended only over the boiler room and could not therefore transmit the thrust to an equal reaction. After the A tier was finished, the excavation was completed to hardpan and was leveled up with broken stone from 2 to 5 feet thick, in which were laid 2-inch tile drain pipes with open joints all pitching to a collecting basin in the center of the lot. This basin is a bell-shaped casting 3½ feet in diameter at the bottom and 3½ feet high. The bottom is open with an outside horizontal flange seated on the rock, and the top has a manhole and cover 16 inches in diameter at the level of the cellar floor in which it is set. The sides are perforated with 180 staggered 1-inch holes in nine horizontal rows, through which the water collected by the drain pipes enters and is pumped out when necessary. The excavation has been completed for several months and very little pumping has been required. On top of the stone filling there is 6 inches of concrete, then a water-proofing layer of five-ply felt laid in hot tar and flashed up to the water level on the facing of the outside walls. The facing is of common red bricks, and is really a separate wall 8 inches thick and 4 inches clear of the concrete dam-wall, leaving an air space between them in which any seepage or leakage water can collect and drain off to the sump through the open tile pipes.

On the south side of the lot the excavation was bounded by the caissons of the Commercial Cable Building, but the old wall adjacent to that had been underpinned by cylinder piers sunk by the Breuchaud process to bed rock when the Commercial Cable Building was built. These piers were allowed to remain under the new wall and lintels were put across them to carry the masonry above their tops. The new wall is about 3 feet thick at the base, completely enclosing the cylinders, and the horizontal distributing girders on its face receive the thrust from the caissons of the Commercial Cable Building, which counterbalances the pressure from the opposite side.

The general dimensions and arrangement of the distributing girders and reaction struts in tier C are shown by the diagram on tier A, which is typical of the whole tier. On the north side of the building tier C supports the sub-basement floor and its girders and beams act as struts. One panel of the A tier is X-braced with 1½-inch square rods with clevis ends pin-connected to horizontal plates which are riveted in the angles between transverse and longitudinal struts and serve as knee-braces to stiffen them laterally. Where the rods intersect they have pin connections to the ends of 7x1-inch flat bars which allow them to cross without too much eccentricity. The other panels of this tier are unbraced except by the floorbeams and hollow tile and concrete floor construction.

The detail given of column 22 and its connections is typical of the general features of the columns and struts at the A tier. All the struts are made of pairs of channels with top and bottom cover plates and closed rectangular cross-sections. The east and west girders B B have jaws which are field-riveted to the vertical plates on the faces of the columns, and, as the channels are not wide enough to receive a sufficient number of rivets, they are extended and at the same time their flanges are directly connected by side angles riveted on the tops and bottoms and serving to extend the cover plates. The north and south struts A A have drop ends which serve as knee-braces to resist sway strains, and have vertical flange angles field-riveted to the faces of the columns.

The outer ends of the struts take bearing against the cover plates of the distributing girders with flat base plates bolted to them as indicated in the detail of the strut marked D in the general plan. Where the struts abut on the ends of two girders of unequal depth, as at D, the shallow girder is filled out with a webbed casting.

The lighter distributing girders are made with a pair of I-beams and two cover plates, as shown in the detail of girder E. At the ends where the struts take bearing they are reinforced by web-stiffener angles riveted across the I-beams and having their ends milled to bear on the flanges. All the distributing girders are supported on brick piers built up from the cellar floor like buttresses on the face of the inner wall and terminating at the under sides of the girder. At the corners of the cellar, the east and west girders are connected to the north and south girders with notched joints, as shown in the detail of girder H, which is similar to girder F, shown on the general plan, but is on the opposite side of the building.

A very interesting feature of this building is the well in which the plunger for the direct-acting ram of the sidewalk ash-elevator is operated. This required to be sunk to a long distance below the cellar floor and a hole 14 inches in diameter and 36 feet deep was drilled through the solid rock by a Calyx drill. The core was broken out and removed by the drill bit and the hole has smooth true walls and is used without lining. A similar well 14 inches in diameter and 7½ feet deep was drilled in another part of the cellar by the same machine to receive the plunger of the coin-lift. The drilling was done by the Otis Elevator Company.

For the information given in this article The Engineering Record is indebted to Mr. George B. Post, architect, and to Mr. Amory Coffin, engineer for the structural masonry and steel work of this building.

A List of Bids Received by the Corps of Engineers, U. S. A., during the fiscal year ending June 30, 1901, has been published as House Document 161 of the first session of the 57th Congress. It gives the full tenders for works, material and labor received during the year.

Condensing Water Pumps of an unusual type, employed in the power station of the Newcastle, England, street railway, were described by Mr. Charles Hopkinson in a paper before the Institution of Civil Engineers. Cooling towers could not be used for legal reasons, and satisfactory tenders for a plant with reciprocating pumps were not received, so a unit was adopted consisting of a centrifugal pump, electric motor and turbine, mounted on a single shaft with the motor in the middle. The pump runner is 23⅝ inches in diameter and receives its supply from a suction pipe on each side, so as to avoid any axial thrust in the shaft; while the turbine has a 13½-inch runner and discharges through two draft tubes, arranged one on each side for the same purpose. The axis of the pump shaft is 8¼ feet above the mean water level of the river from which the water is drawn, and 78¾ and 90¾ feet below the condensers. The return water from the condensers passes through the turbine and saves about 42½ per cent. of the power needed to circulate the water were it not employed.

An Important Decision Concerning River Pollution by Sewage.

Condensed from decision of Ohio Supreme Court, in Balliett vs. City of Mansfield, 63 N. E. Rep. 86.

The plaintiff sued for alleged violations, by the defendant, of his rights as a riparian proprietor. He is owner of two valuable farms, by or through which runs a small natural water course, known as the Rocky Fork of the Mohican River. Both of the farms are naturally adapted to, and have been used for, agricultural and grazing purposes. Each farm is improved, and each has on it a dwelling house, barn, and other suitable buildings. One of them, known in the case as the "home" farm, is occupied by the plaintiff as his family residence, and had been for many years before the alleged encroachments on his rights by the defendant. The other he rents to tenants, who occupy and cultivate it. The waters of this natural stream were accustomed to flow by and through these farms, supplying them and their occupants with pure and wholesome water in sufficient quantities for all domestic, agricultural, and other suitable purposes for which pure and wholesome water is generally used and needed upon a farm, until they were polluted and corrupted by the alleged acts of the defendant.

The wrong complained of is, that the defendant, a city of something over 18,000 inhabitants, and situated on or near the water course above the plaintiff's farms, by a system of sewerage emptying into the stream, caused to be collected and discharged into the stream the sewage of the city, or a large part of it, which was carried down the stream to the plaintiff's farms, where it accumulated and remained in large quantities. As a result of this alleged wrong of the defendant, the water was polluted, and rendered unfit for domestic and other ordinary uses; and, in time of freshets, the filth was washed out by the force of the stream and deposited on the plaintiff's lands, destroying the grass and herbage, and causing offensive and unwholesome smells, which materially interfered with the comfortable and proper enjoyment of the premises by the plaintiff and his family.

The suit was defended chiefly on the ground that the stream was corrupted, in part at least, by other independent sources, over which the defendant had no control; though the contention apparently most relied on in argument here is that the city cannot be held liable for the acts complained of, in any event. In the court's instructions to the jury the defendant's liability was confined to such substantial injury as the plaintiff actually sustained in consequence of the alleged misconduct of the defendant, and his measure of recovery, if the issues were found in his favor, was limited to such an amount as would reasonably compensate him for the material interference with the comfortable enjoyment of his home farm, the proper and necessary use of the water to which he had hitherto been accustomed, including any additional expense rendered necessary in watering his stock, and the loss of his grass and herbage. His damages to the rented farm, the jury were instructed, could not exceed the actual loss resulting from a diminution in the rents. The charge given covered, substantially, all of the instructions requested by the defendant, except, probably, the second one, which reads as follows: "The right of plaintiff to have the water descend on him in its pristine clearness must yield to the demands of a denser population and the march of civilization."

So that it must be accepted as established by the verdict and judgments below that the injury of which the plaintiff complains was caused by the defendant, as claimed, and that, in consequence thereof, he sustained substantial damage of that special nature and degree which would enable him to maintain action therefor if inflicted by an individual or private corporation. And he is not without like remedy against the defendant, unless, as claimed by its counsel, it has a paramount right, either by legislative grant, or from necessity for the preservation of the public health, safety and welfare, to subject the water course to the uses it has made of it, without accountability for the destruction or material impairment of the property rights of lower riparian owners.

The statutory authority for this immunity, it is contended by counsel, is found in sections 2232 and 2370, of the Revised Statutes. The former section provides that a city may enter upon and hold real estate without its corporate limits, among other enumerated purposes, "for sewers, drains and ditches, and for this purpose the corporation shall have power to appropriate, enter upon and take private property, lying outside of the corporate limits." The latter section authorizes municipal corporations to adopt a system of sewerage, "the main or principal sewers having their outlet in a river or other proper place."

The lawful exercise of the power conferred on municipal corporations to enter upon and take private property for any of the purposes enumerated by the former section requires a legal appropriation, as that section indicates, involving the assessment of compensation for the property when taken without the owner's consent. The stream in question in this case is not a river, a term that may import a stream of sufficient volume and flow to carry off sewage emptied into it, and thus preserve the purity of its water; nor, as will be hereafter noticed, can that be a suitable place for the deposit of sewage, within the contemplation of the law, where that will result in the creation of a public or private nuisance. But the right of the plaintiff to redress for the injury done him lies back of any mere authorization by the statute of the defendant's acts which inflicted the injury, and rests upon the constitutional guaranty which secures the inviolability of private property, and the right of the owner to compensation when taken for any public use. Indeed it appears to be a settled principle of universal law, independent of constitutional provision, that the right to compensation for private property when taken for a public use is an inseparable incident of the ownership of property.

It is declared in Pumpelly v. Canal Co., 80 U. S. 166, that: "By the general law of European nations and the common law of England it was a qualification of the right of eminent domain that compensation should be made for private property taken or sacrificed for public use. And the constitutional provisions of the United States, and of the several States, which declare that private property shall not be taken for public use without just compensation, were intended to establish this principle beyond legislative control." And it was there held that: "It is not necessary that property should be absolutely taken, in the narrowest sense of that word, to bring the case within the protection of this constitutional provision. There may be such serious interruption to the common and necessary use of property as will be equivalent to a taking, within the meaning of the constitution. The backing of water so as to overflow the lands of an individual, or any other superinduced addition of water, earth, sand, or other material or artificial structure placed on land, if done under statutes authorizing it for the public benefit, is such a taking as by the constitutional provision demands compensation."

In that case, a statute of Wisconsin authorized the construction of a dam across Fox River, in order to improve its navigation. The dam, which was constructed in accordance with the provisions of the statute, caused the water to overflow the plaintiff's lands, on account of which he suffered substantial injury, for which he brought suit. It was claimed by the defendant that the damages sustained by the plaintiff were "such as the State had a right to inflict in improving the navigation of Fox River, without making any compensation for them." Mr. Justice Miller, in resolving this contention against the defendant, said: "The argument of the defendant is that there is no taking of the land within the meaning of the constitutional provision, and that the damage is a consequential result of such use of a navigable stream as the government had a right to for the improvement of its navigation. It would be a very curious and unsatisfactory result if, in construing a provision of constitutional law always understood to have been adopted for protection and security to the rights of the individual as against the government, and which has received the commendation of jurists, statesmen and commentators, as placing the just principles of the common law on that subject beyond the power of ordinary legislation to change or control them, it shall be held that if the government refrains from the absolute conversion of real property to the uses of the public it can destroy its value entirely, can inflict irreparable and permanent injury to any extent, can, in effect, subject it to total destruction, without making any compensation because, in the narrowest sense of that word, it is not taken for the public use. Such a construction would pervert the constitutional provision into a restriction upon the rights of the citizen, as those rights stood at the common law, instead of the government, and make it an authority for invasion of private right under the pretext of public good, which had no warrant in the laws or practices of our ancestors." And the learned justice, referring to the case of Gardner v. Newburgh, 2 Johns. Ch. 162, observed that: "In the case of Gardner v. Newburgh, Chancellor Kent granted an injunction to prevent the trustees of Newburgh from diverting the water of a certain stream flowing over plaintiff's land from its usual course, because the act of the legislature which authorized it had made no provision for compensating the plaintiff for the injury thus done to his land. And he did this though there was no provision in the constitution of New York such as we have mentioned, and though he recognized that the water was taken for a public use. After citing several continental jurists on this right of eminent domain, he says that while they admit that private property may be taken for public uses when public necessity or utility requires, they all lay it down as a clear principle of natural equity that the individual whose property is thus sacrificed must be indemnified. And he adds that the principles and practice of the English government are aqually explicit on this point. It will be seen in this case that it was the diversion of the water from the plaintiff's land which was considered as taking private property for public use, but which, under the argument of the defendant's counsel, would, like overflowing the land, be called only a consequential injury." And Mr. Justice Miller concludes that: "If these be correct statements of the limitations upon the exercise of the right of eminent domain, as the doctrine was understood before it had the benefit of constitutional sanction, by the construction now sought to be placed upon the constitition it would become an instrument of oppression rather than protection to individual rights. But there are numerous authorities to sustain the doctrine that a serious interruption to the common and necessary use of property may be, in the language of Mr. Angell in his work on water courses, equivalent to the taking of it, and that under the constitutional provisions it is not necessary that the land should be absolutely taken."

Authors who have fully investigated the subject are quite agreed in their conclusions that riparian rights are property rights, and therefore property, in the legal signification of the term, and within the meaning of the constitution.

In 1 Lewis, Em. Dom. Sec. 60, that author says that, "All the authorities agree" that small streams incapable of navigation "are wholly private property, and that the title of the riparian owner extends to the middle of the stream." And in section 61 it is said that, "It may be laid down as a well-settled principle that every proprietor over or past whose land a stream of water flows has a right that it shall continue to flow to and from his premises in the quantity, quality and manner in which it is accustomed to flow by nature, subject to the right of the upper proprietors to make a reasonable use of the stream as it flows past their land. This right is a part of his property in the land, and in many cases constitutes its most valuable element. It necessarily follows, therefore, that any violation of this right in the exercise of the power of eminent domain is a taking of private property for which compensation must be made." In section 62, the rule is stated as follows: "Where the waters of a stream, or any part thereof, are taken or diverted to supply a city or village with water, or for the use of a canal or railroad company, or to improve a highway by land, or to make a new channel, either for the improvement of navigation or for the protection of a public road, or for any other public use, compensation must be made to the inferior proprietors on the banks of the stream who are injured thereby. The only dissenting case which has come to our notice is that of Commissioners v. Withers, 29 Miss. 21, 64 Am. Dec. 126, in which the supreme court of Mississippi held that it was not a taking to divert a stream of water from the plaintiff's property into a new channel for the purpose of improving navigation. This decision is so palpably wrong that we do not think it requires discussion." "According to principles heretofore laid down," says the same author, in section 84, "it follows that an injury to riparian rights for public use is a taking for which compensation must be made. 'These riparian rights founded on the common law are property, and are valuable, and, while they must be enjoyed in due subjection to the rights of the public, they cannot be abridged or capriciously destroyed or impaired. They are rights of which, when once vested, the owner can only be deprived in accordance with the law of the land, and, if necessary that they be taken for public use, upon due compensation.' "

In Mills, Em. Dom., where the same doctrine is maintained, it is said, section 79, that: "Riparian rights are property. Of this property the owner cannot be deprived without just compensation, nor can the State itself exercise such a power of deprivation, or confer it upon some subordinate municipality, without making compensation for the property taken." And in section 182 of the same work it is laid down as settled law that: "The legislative authority to do an act resulting in damages to the property of an individual cannot be sustained, without the payment of damages, on the simple claim that the legislature cannot authorize that which is improper. It is beyond the power of the legislature to authorize the infliction of an injury without compensation. Charters should not be construed as evincing any legislative intention to authorize an injury, or to shield the corporation from a common law action, in case compensation is not provided. The fact that compensation is not provided should not lead the court to suppose that all injuries not provided for were declared by the legislature to be consequential, and therefore not subject to compensation."

In Gould, Waters, Sec. 204, after declaring the right of riparian proprietors to have the stream "flow as it is wont by nature, without material diminution or alteration," it is maintained that: "They may insist that their rights to thus use the water shall be regarded and protected as property. The right to use the water in its natural flow is not a mere easement or appurtenance, but is inseparably annexed to the soil itself. It does not depend upon appropriation or presumed grant from long acquiescence on the part of other riparian proprietors above and below, but exists jure naturæ as parcel of the land."

Wood, Nuis. Sec. 332, speaking of the property rights of riparian owners, says they are rights "in the owner of the soil which cannot be violated with impunity; rights which are distinct from those enjoyed by the public generally, and which exist, not because of any special property in the water, but because of the ownership of the land over or through which it flows, and the rights that are necessarily created thereby." These property rights, it is said in the next section, "may be the subject of sale or lease like the land itself." And in section 427, speaking more directly to the question involved in this case, the author says: "The pollution of water by artificial drainage which causes sewerage to flow into a stream, spring or well, whether done by a municipal corporation or an individual, constitutes a nuisance which entitles the owner to damages therefor, the rule being that a municipal corporation has no more right to injure the waters of a stream or the premises of an individual than a natural person."

This subject is discussed in Ang. Water Courses, where the doctrine announced in the quotations already made from other standard authors is fully upheld. In sections 457, 458, that author says: "Among the variety of legal titles which, in this country, have often been involved in controversies respecting the rights of riparian proprietors on inland streams and rivers, is the important one entitled 'eminent domain,' or the right which the government retains over the estates of individuals to appropriate them to public use. It is obvious that the government of no state can administer its public affairs in the most beneficial manner to the community at large if it cannot, on particular emergencies and for public utility, exercise at least a qualified power of disposing of, or of impairing in value, the property of an individual citizen. To this power, according to Vattel, 'men have impliedly yielded, though it has not been expressly reserved.' But it is a rule founded in equity, and is laid down by jurists as an acknowledged principle of universal law, that a provision for compensation is a necessary attendant on the due exercise of the power of the lawgiver to deprive an individual of his property without his consent." Section 458: "In England, notwithstanding the transcendent power of its parliament, the law on this subject has been administered on the above just and equitable principles. In the familiar instance of an act of parliament for promoting some specific object or undertaking of a public nature, as a turnpike, navigation, canal, or railway, the legislature scruple to interfere with private property and compel the owner of the land to alienate it, without providing a reasonable price and compensation for so doing. 'If a new road,' says Blackstone, 'were to be made through the grounds of a private person, it might perhaps be extensively beneficial to the public; but the law permits no man, or set of men, to do this without consent of the owner of the land.' In vain may it be urged that the good of the individual ought to yield to that of the community, for it would be dangerous to allow any private man, or even public tribunal, to be the judge of this common good, and to decide whether it be expedient or no. Besides, the public good is in nothing more essentially interested than in the protection of every individual's private rights, as modeled by the municipal law. In this and in similar cases the legislature alone can, and, indeed, frequently does, interpose, and compel the individual to acquiesce. But how does it interpose and compel? Not by absolutely stripping the subject of his property in an arbitrary manner, but by giving him a full indemnification and equivalent for the injury thereby sustained. The public is considered as an individual, treating with an individual for exchange. All that the legislature does is to oblige the owner to alienate his possessions for a reasonable price, and even this is an extension of power which the legislature indulges with caution."

It would not be a profitable extension of this opinion to quote from the numerous cases cited in the text-books already extensively quoted to sustain the text. The substance of the many learned opinions of able courts is given in the quotations already made. We will add to them only a brief extract from the able opinion of Ruger, C. J., in Seifert v. City of Brooklyn, 4 N. E. 321, 324, "It is a principle of the fundamental law of the State," says that learned judge, "that the property of individuals cannot be taken for public use except upon the condition that just compensation be made therefor, and any statute conferring power upon a municipal body, the exercise of which results in the appropriation, destruction or physical injury of private property by such body, is inoperative and ineffectual to protect it from liability for the resultant damages, unless some adequate provision is contained in the statute for making such compensation. The immunity which extends to the consequences, following the exercise of judicial or discretionary power, by a municipal body or other functionary, presupposes that such consequences are lawful in their character, and that the act performed might in some manner be lawfully authorized. When such power can be exercised so as not to create a nuisance, and does not require the appropriation of private property to effectuate it, the power to make such an appropriation or create such nuisance will not be inferred from the grant. Where, however, the acts done are of such a nature as to constitute a positive invasion of the individual rights guaranteed by the constitution, legislative sanction is ineffectual as a protection to the persons or corporation performing such acts from responsibility for their consequences. It has been sometimes suggested that the principle illustrated in the maxim, 'Salus populi est suprema lex,' may be applied to and will shield the perpetrators from liability for damages arising through the exercise of such power, by a municipal corporation; but we apprehend that this maxim cannot be thus invoked. The cases where such a doctrine can be properly applied must, from the very nature of the principle, be confined to circumstances of sudden emergency, threatening disaster, public calamity, and precluding a resort to remedies requiring time and deliberation. Whart. Leg. Max. 89; Mayor, etc., v. Lord, 17 Wend. 285. It is suggested in the latter case that even in such an event, under the principles of the constitution, the public would be liable for the damages inflicted. However this may be, we are quite clear that the theory that a municipal corporation has the right, in prosecuting a scheme of improvements, to appropriate without compensation, either designedly or inadvertently, the permanent or occasional occupation of a citizen's property, even though for the public benefit, cannot be supported upon the principle referred to. If the use of such property is required for public purposes, the constitution points out the way in which it may be acquired, when there is no such imminence in the danger apprehended as precludes a resort to the remedy provided, and the only mode by which it can be lawfully taken in such cases is that afforded by the excuse of the right of eminent domain."

There appears to be no diversity of opinion upon the proposition that riparian rights are property that may be the subject of bargain and sale, either with or separate from the land; that these rights constitute a part of the owner's estate in the land, and materially enter into the actual value; and that any injurious invasion or impairment of those rights amounts to a taking of the owner's property. It follows that no legislative sanction can justify the taking of such property, either directly or indirectly, though it be required for a public use, without adequate provision for a just indemnity to the owner. To entitle the owner to such indemnity, it is not necessary that his entire interest in the particular property be taken. The value of property consists in the owner's absolute right of dominion, use, and disposition for every lawful purpose. This necessarily excludes the power of others from exercising any dominion, use, or disposition over it. Hence, any physical interference by another with the owner's use and enjoyment of his property is a taking, to that extent. To deprive him of any valuable use of his land is to deprive him of his land, pro tanto. So that the principle of the constitution is as applicable where the owner is partially deprived of the uses of his land as where he is wholly deprived of it. Taking a part is as much forbidden by the constitution as taking the whole.

There is a line of authorities which sustains the right of action in cases like the one before us, and places it upon the ground that such acts as those complained of here constitute a nuisance, which municipal corporations cannot, any more than individuals, be allowed to create or maintain. To this proposition, Judge Dillon, in his work on Municipal Corporations, section 1047, adds the weight of his great authority: "It is, perhaps, impossible to reconcile all of the cases on this subject, and courts of the highest respectability have held that if the sewer, whatever its plan, is so constructed by the municipal authorities as to cause a positive and direct invasion of the plaintiff's private property, as by collecting and throwing upon it, to his damage, water or sewage which would not otherwise have flowed or found its way there, the corporation is liable. This exception to the general doctrine, when properly limited and applied, seems to be founded on sound principles, and will have a salutary effect in inducing care on the part of the municipality to prevent such injuries to private property, and will operate justly in giving redress to the sufferer if such injuries are inflicted. Accordingly, though a municipality having the power to construct drains and sewers may lawfully cause them to be built so as to discharge their refuse matter into the sea, or natural stream of water, yet this right must be so exercised as not to create a nuisance, public or private. If a public nuisance is created, the public has a remedy by a public prosecution; and any individual who suffers special injury therefrom may recover therefor in a civil action. If, therefore, deposits from sewers constructed by a city cause a peculiar injury to the owner of a wharf or dock, by preventing or materially interfering with the approach of vessels and the accustomed and lawful use of the wharf or dock, the city is liable to the latter in damages."

In Wood, Nuis. Sec. 427, the rule is stated as follows: "The pollution of water by artificial drainage which causes sewage to flow into a stream, spring, or well, whether done by a municipal corporation or an individual, constitutes a nuisance which entitles the owner to damages therefor, the rule being that a municipal corporation has no more right to injure the waters of a stream or the premises of an individual than a natural person. . . . The pollution of water by discharging waste from mills and manufactories, or, indeed, in any way, creates an actionable nuisance, and the legislature has no power to authorize the pollution of the water of a stream without compensation to the owners of the land through which such stream flows, as such use is a taking of property, within the meaning of the constitution. It has been held in numerous cases that a municipal corporation is liable for the wrongful diversion of surface water from its natural channel to the premises of another, as well as for discharging its drainage or sewage upon private property."

Other commentators of acknowledged authority maintain the same rule. A few only, of the many reported cases which sustain this doctrine, will be noticed.

The case of Chapman v. City of Rochester, 18 N. E. 88, is not substantially different from the one before us. There "plaintiff owned and occupied certain premises, across which ran a stream fed by springs of pure water. He collected the water of said stream into an artificial basin, and used it for domestic purposes and the propagation of fish, and in winter procured from it a supply of ice. Defendant thereafter constructed sewers, through which not only surface water, but the sewage from houses and water closets, was discharged into said stream above plaintiff's land, rendering its water unfit for use, and covering its banks with filthy and unwholesome sediment. Held that these acts constituted a nuisance to restrain which, as well as to recover his personal damages, plaintiff could maintain an action."

Morgan v. City of Danbury, 35 Atl. 499, is much like the preceding case. There "the plaintiff, a riparian mill proprietor, alleged that the defendant, without making him any compensation or attempting to acquire any of his rights, was discharging and threatened to continue to discharge in still greater quantity, waste matter, sewage, and other noxious, corrupt, and impure substances from its sewers into the stream, so as to pollute it and seriously damage his land and mill privilege; that such discharge poisoned and corrupted the air of the neighborhood and endangered the health of the plaintiff, his workmen, and others, and had already partly filled his dam with filth and prevented him from disposing of his land for building purposes; and prayed for an injunction against the continuance of the nuisance, and to restrain the pollution of the waters of the stream. The trial court found these allegations to be true, that the plaintiff's injuries could not be adequately compensated in damages, and that the acts complained of constituted a public nuisance, and granted an injunction restraining the defendant, after 20 months from the date of the decree, from discharging any sewage into the stream above the plaintiff's premises, and from polluting the waters by any such discharge." And it was there held "that the right to deposit a thing in any place must always be dependent, not only on the nature of the thing deposited, but on the nature of the place in question and the uses to which that has already been put; and that if the stream was, from whatever cause, in such a condition that the defendant's discharge of sewage there worked a nuisance, it had no right to use the stream for such purpose."

And see Seifert v. City of Brooklyn, supra; City of Jacksonville v. Doan, 33 N. E. 878; Inman v. Tripp, 11 R. I. 520; Good v. Altoona City, 29 Atl. 741; Owens v. City of Lancaster, 37 Atl. 858; Mason v. City of Mattoon, 95 Ill. App. 525.

The right of the plaintiff to the relief awarded him by the judgments of the lower courts is sustained by the case of Rhodes v. City of Cleveland, 10 Ohio, 160. That suit was brought against the city to recover damages for so cutting its drains as to cause the water to overflow and wash away the plaintiff's lands. The trial court charged the jury that the plaintiff could not recover, "unless he showed, either that the city acted illegally, or, if within the scope of authority, that it acted maliciously." In reversing the judgment founded on the verdict for the defendant, this court held that, "Corporations are liable like individuals for injuries done, although the act was not beyond their lawful powers." The grounds of the decision are stated in the opinion by Lane, C. J., as follows: "That the rights of one should be so used as not to impair the rights of another, is a principle of morals which, from very remote ages, has been recognized as a maxim of law. If an individual, exercising his lawful powers, commit an injury, the action on the case is the familiar remedy; if a corporation, acting within the scope of its authority, should work wrong to another, the same principle of ethics demands of them to repair it, and no reason occurs to the court why the same remedy should not be applied to compel justice from them." That decision is founded upon the broad principles of common justice and constitutional right. It is applicable to, and decisive of, this case.

No argument can be required to prove that, if the plaintiff's riparian rights are property for which, when injured by an individual, the latter may be held liable therefor in an action, they are none the less property when so injured or taken by the public; nor that those acts which, when done by an individual constitute a deprivation of the owner of his property, are equally so when done for the benefit of an aggregation of individuals that go to make up the population of a municipal corporation. Nor can it add anything to the defendant's prerogatives, nor take anything from the plaintiff's rights, to call the injury he has suffered consequential. The owner is nevertheless deprived of substantial property interests, and no name by which the acts that produce that effect may be called can destroy or diminish his constitutional right to indemnity.

The question whether the injury constitutes a taking of property depends upon its effect on the owner's proprietary rights, and not upon the length of time necessary to produce that effect. They may be as effectually taken by continuing acts extending over a considerable period of time as by a single act.

The case of Rhodes v. City of Cleveland, supra, has been repeatedly approved and followed in subsequent decisions of this court. In McCombs v. Town Council of Akron, 15 Ohio, 474, 479, Read, J., after stating that "the sole question in this case is whether a municipal corporation can be made liable for an injury resulting to the property of another, by an act of such corporation, strictly within the scope of its corporate authority, and unattended by any circumstance of negligence or malice," with his usual clearness and force, says: "The case of Rhodes v. City of Cleveland, 10 Ohio, 159, 36 Am. Dec. 82, with admirable good sense and strength of reason, answers this question by asserting that corporations are liable, like individuals, for injuries, although the act was not beyond their lawful powers. The late learned Chief Justice Lane, who pronounced the opinion of the court in that instance, accounts for the older cases upon the ground that courts were hampered by the mystic notion attached to corporate seals, by which corporations withdrew themselves from responsibility, and cast it upon their agents. A sort of transcendentalism which enveloped both the courts and the profession in a mist growing out of the airy nothingness of the subject-matter enabled corporations, like the pestilence which walketh unseen, to do their mischief and escape the responsibility. It is refreshing to the jurist, and important to the rights of individuals, that these confused notions are yielding to a clearer light and more solid reason." The learned judge further said: "We recognize the doctrine of that case, as laid down by this court, as founded in the most solid reason, right and morals, and a majority of the court have not the slightest disposition to impair its obligation, but by the light of such example and assurance, hope that the whole subject-matter of corporations will, in the end, be reduced to the control of incontestable principle." In City of Dayton v. Pease, 4 Ohio St. 80, 94, speaking of both of the above cases, Ranney, J., said: "In each of those cases, the liability of a municipal corporation, acting through subordinate agents, within the scope of its authority, and without malice or negligence, was enforced, where the acts of such agents resulted in injury to the property of private individuals. The propriety of investing such corporations with the power to improve their streets, resulting often in indirect injury to private property, is conceded; but the cases rest upon the clear principle of right and justice, which requires compensation to go hand in hand with public benefit. And when in the lawful exercise of these powers private property must be injured for the common benefit of all, all should be held liable to make reparation; and, in the view of the judges who concurred in these decisions, the principle was not without support from that section of the constitution of the State which secures the inviolability of private property."

We are satisfied, after the most careful consideration we have been able to give this case, that the judgments below are correct, and they are affirmed. (The judgments referred to awarded Balliett $400 damages.)

The Intermittent Sewage Filtration Plant at Clinton, Mass., produced a better effluent in 1901 than in 1900, according to the report of the Metropolitan Water and Sewerage Board. The sewage treated has been much more dilute than during the preceding year. The purification has in every respect been better during the last half of the year than during the first. The percentages of oxygen consumed and albuminoid ammonia removed from January to June were 87 and 87, and from July to December 95 and 96 respectively. The free ammonia removed from January to June was 70 per cent. and from July to December was 93 per cent. The nitrogen as nitrates in the effluent was, in parts 100,000 from January to June, 0.5383, and from July to December, 1.3213. The cost per million gallons filtered during the year was $8.29.

The Glendive Highway Bridge.

The highway bridge across the Yellowstone River at Glendive, Dawson County, Montana, is about 1,237½ feet long and has four through pin-connected fixed-truss spans of about equal length, the longest two being 311 feet 2 inches center to center of piers. It replaces an older structure built on the same axis and with piers in nearly the same position. The old piers were all pairs of steel cylinders sunk a few feet below the river bottom and filled with concrete, except one circular pier which supported a draw span about 325 feet long over all. Three of the old channel piers were removed and those at the ends of the bridge were retained for abutments for the new superstructure. The channel piers were replaced by long and narrow concrete piers about 45 feet high; a pair of old pier cylinders on an island were retained and built up with a special riveted steel superstructure to the same level as the tops of the new piers and steel extensions were seated on the abutment piers and braced to small new piers on shore to support the ends of the end spans. The old span at the west end of the bridge was retained and was raised about 7 feet above its original position and the other three spans were built new.

At the west end of the bridge the concrete in the old cylinder piers was excavated to a depth of about 2 feet and 18 inches of fresh concrete filled in and a vertical post seated on it eccentric with the cylinder to correspond to the revised position of the span. Horizontal flange angles were riveted on all sides of the post at both top and bottom to receive the base and cap plates, which were stiffened by short vertical diaphragm channels riveted into the ends of the post with their ends milled to bearing on the plates. The cap plate was planed and had two guide angles on the sides to engage the ends of the roller frame under the expansion end of the truss. The posts were connected by top and bottom lateral struts and X-bracing in the transverse plane. The bent thus formed was braced longitudinally by vertical triangular trusses with their bottom chords connected to the tops of the columns in a second transverse bent seated on new concrete piers 3 feet in diameter, which were built in steel cylinders sunk on shore. These trusses were connected by stiff bracing in the inclined and horizontal planes of the top and bottom chords, and rigidly connected the two bents. The bottom of the shore bent was anchored to bolts built into the concrete and was adjustable for height by loose T-shaped filler plates with their edges trimmed to pass between the anchor bolts and permit them to be inserted between the pier top and column base.

At the east end of the bridge the old cylinder piers were extended to new grade in a similar manner but with a difference of detail in the columns and bracing. The columns were about 9 feet long over all, and had no caps but were bored to receive the end lower chord pins of the main bridge trusses. The longitudinal bracing trusses were made entirely of 12-inch channels, field-riveted together with double gusset plates on the flanges. The trusses were braced similarly to those at the west end, but their shore ends had shoe plates seated directly on top of the new concrete piers and anchor-bolted to them in the same way, with adjustable packing plates without the interposition of a vertical bent.

The old pier on the island was built up by vertical columns made with iron channels and two wide cover plates in longitudinal planes. They are connected by horizontal top and bottom struts and X-bracing in the transverse vertical plane and have extended base plates seated on new concrete in the tops of the cylinders to which they are field-riveted through bent angles. After the columns were set in the pier cylinders concrete was filled around the feet of the columns up to the edges of the shells and rounded up to make a finished upper surface.

Mr. C. F. Loweth was the chief engineer for the reconstruction of the bridge and designed the substructure and superstructure.

Personal and Obituary Notes.

A. M. Carter, city engineer of Fargo, N. D., died August 4 after a severe attack of pneumonia.

The Coahuila & Pacific Railroad was formally opened August 11. Under the reorganization announced at that time, Mr. T. S. Abbott remains as chief engineer, at Saltillo, Mex.

Mr. P. D. Fitzpatrick has tendered his resignation as assistant chief engineer of the Illinois Central Railroad to become superintendent of concrete work and arches for the Katterjohn Construction Co.

Mr. F. F. Vandevort has resigned his position as general manager of the Chester Iron & Steel Works, of Chester, Pa., and Mr. Walter B. Ferrier, of the Carnegie Steel Works, has been elected to succeed him.

Francis Newberry Holbrook, M. Inst. M. E., died at his home in New York City, August 12, of brain fever. He was born fifty years ago in Connecticut and was graduated from the School of Mines of Columbia University.

Mr. George F. Sever, M. Am. Inst. E. E., adjunct professor of electrical engineering at Columbia University, has been appointed consulting electrical engineer to the Department of Water Supply, Gas and Electricity of New York City.

Mr. William E. Dickey, late past assistant engineer, U. S. N., announces that after August 25 he will represent The Goulds Manufacturing Co., of Seneca Falls, N. Y., and The West Point Boiler Works, of Pittsburg, at 16 Murray St., New York.

Lorenzo Russell Clapp, M. Am. Soc. C. E., died suddenly in Brooklyn, August 13, of apoplexy, at the age of 60 years. He was identified chiefly with sewerage and water-works construction in Brooklyn, where he was with the city engineering department for fifteen years. During the civil war, he served in the United States Navy.

In the death of Joseph Bond, president of the American Radiator Co., Chicago lost one of her prominent business men and useful citizens. He was born at Ware, Mass., in 1852, and was a descendant of one of the oldest families of the Bay State. He was educated in public and private schools, and at the age of eighteen entered business life. From 1875 until 1880 he was engaged in the hardware trade at Waltham, Mass. He removed to Buffalo a year later, and became connected with a firm manufacturing heating appliances. He was soon made treasurer of the concern, and that position he held until 1892, when he went to Chicago to assume executive control of the then newly organized American Radiator Co. The growth and prosperity of this concern are largely due to Mr. Bond's tireless industry, his thorough knowledge of the technical side of the business, and his unusual organizing ability. Under his direction the company steadily extended its operations and scope, employing 3,500 men and having factories and branches in several cities in the United States, and in England, Germany and France. Mr. Bond made a science and an art of his work, exhaustively studying the principles of manufacturing steam and hot water heating materials, and introducing new methods into that special industry. He was prevented by his close application to business from taking that part in public affairs for which his intelligence and integrity conspicuously fitted him, but he was a keen observer and an interested student of political, economic and social questions. He was a trustee of the Chicago University and took a deep interest in its progress.

The Removal of Soil at the site of the Wachusett Reservoir is the subject of numerous statistics in the report of the Metropolitan Water and Sewerage Board. The total amount of soil removed and to be removed is estimated to be about 6,900,000 cubic yards, from approximately 4,200 acres. Of this, the total amount removed from the reservoir in previous years was 2,278,723 cubic yards, from 1,358 acres; in 1901, 1,309,925 cubic yards were removed, from 758 acres; making a total from the beginning of work to the end of 1901 of 3,588,648 cubic yards, or 52 per cent. of the total. The plant employed in this work toward the end of the season, exclusive of horses and carts, included 27.3 miles of 3-foot-gauge track, 25 8 to 16-ton locomotives, 720 cars of 1¾ to 3½ cubic yards' capacity, a 70-horse-power hoisting engine and a 50-horse-power hoisting engine.

The Working of the Intermittent Sewage Filtration Plant at Brockton, Mass., is described in the annual report for 1901 of the City Engineer, Mr. Charles R. Felton. The work accomplished by the filter-beds, based on the quantity of sewage purified and its strength as represented by the albuminoid ammonia, has been 43 per cent. more in 1901 than in 1900, and five times as great as that accomplished in 1896. The sludge raked from the beds has been sold to farmers for fertilizer, $150 being received for the year's product. Three acres of the filtration area planted with yellow corn yielded a net profit of $45.36. One acre was planted with sunflowers, and about 33 bushels of seed were secured and disposed of at a slight profit. The surface sand of several of the beds has become discolored, owing to the large amounts of waste blacking discharged into the sewers from the shoe factories. This, however, does not impair the efficiency of the beds in any way. Analyses of the effluents from the three drains gave as the average percentage of albuminoid ammonia removed from the sewage 98.1, 98.8, and 98.7.

The New Garbage Crematory of Winnipeg, Man., is described as follows in the 1901 report of the City Engineer, Mr. H. N. Ruttan: The crematory consists of 4 cells, connected with a chimney 3½ feet square and 80 feet high. Each cell is provided with a coal grate and garbage grate, the coal grate being at the front of the cell and lower than the garbage grate. The material to be burnt is dumped onto the garbage grate through an opening in the top of the furnace above it. This opening is large enough to take in horses. As the garbage is consumed, that behind is gradually drawn forward onto the coal fire. At the entrance of the smoke flue to the chimney is a fire to consume fumes and gases from the burning garbage. The crematory is enclosed by a suitable frame building, with wagon approaches to the top of the furnaces, constructed by the Works Department at a cost of $3,755.34. This includes sewers, catch-basins and other contingencies. The contract price of the work, done by the Toronto Furnace & Crematory Company under the supervision of this department, is $10,290.

CONTRACTING NEWS

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OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvi, xvii, xviii and xxvii.

WATER.

Lecompte, La.—This village has voted to install water works at a cost of $8,000. Ira W. Sylvester, of Alexandria, La., Consulting Engr.

Salt Lake City, Utah.—S. B. Milner, Pres. of the Twin Falls Land & Water Co., writes that the irrigation system which it is proposed to build will cost about $1,600,000.

Charleston, W. Va.—City Recorder W. W. Wertz writes that plans are being made for municipal ownership of the waterworks. Estimated cost $175,000 to $250,000. Address, A. D. Mead, Councilman.

Grinnell, Ia.—Bids are wanted Aug. 22 for the construction of a dam, to be approximately 400 ft. long, 22 ft. high and 16 ft. wide on top, as advertised in The Engineering Record.

Kansas City, Mo.—Bids are wanted Sept. 1 for furnishing and erecting complete on foundations provided by the city, 1 vertical triple expansion condensing crank and flywheel pumping engine of 15,000,000 gal. capacity in 24 hours, against an average head of 145 lbs. Hydrostatic pressure; steam pressure at throttle, 155 lbs. Baxter Brown, Secy. Bd. of Pub. Wks.

Wilmont, Minn.—Engr. in Charge M. B. Haynes, of Mankato, writes that the following bids opened Aug. 5 for the construction of water works were all rejected: Allan Black & Co., St. Paul, $6,980; W. D. Lovell, Des Moines, Ia., $6,790; Des Moines Iron & Bridge Co., Des Moines, $7,036.

Lidgerwood, N. Dak.—City Aud. John Nuding writes that J. J. Flather, University of Minnesota, Minneapolis, is the engineer in charge of proposed water works construction, estimated to cost $8,000.

South Deerfield, Mass.—Water Comr. J. B. Bridges writes that contracts will be let after Sept. 1 for the construction of water works, estimated to cost $30,000. Engrs. in Charge, Clapp & Abercrombie.

New Windsor, Colo.—C. F. Finley, of the Poudre Valley Reservoir Co., writes that the contract for constructing a ditch and reservoir has been awarded to J. A. Banning, 1417 Bway., Denver, for about $200,000.

Beaumont, Tex.—The Riceland Irrigation Co., of Beaumont, has been incorporated, with a capital of $150,000, its purpose being to construct, maintain and operate lakes, reservoirs, etc., for irrigation, mining, etc. Incorporators: A. Oswald and Roscoe L. Oswald, of Jefferson County, Tex.; C. A. Walker and others, of Jackson County, Tex.

Abingdon, Ill.—The City Clk. writes that water mains are to be laid at a cost of $2,800. Geo. C. Morgan, of Chicago, Engr. in Charge.

Charleston, S. C.—The American Pipe Mfg. Co., Philadelphia, Pa., has extended the time for receiving bids for the construction of a dam and reservoir at Charleston, until Aug. 25, as advertised in The Engineering Record.

Portsmouth, O.—Bids are wanted Sept. 2 for all material and labor for installing an intake crib, to be located in Ohio River, together with necessary suction pipe, etc., as advertised in The Engineering Record.

Ithaca, N. Y.—Bids are wanted by the Ithaca Water Works Co. until Sept. 1 for building a concrete dam in Six Mile Creek, as advertised in The Engineering Record.

Joliet, Ill.—Bids are wanted Aug. 25 for constructing a 1,000,000-gal. storage reservoir. H. A. Stevens, City Engr.

Mendota, Ill.—Mayor E. S. Browne writes that the city proposes to construct water works at a cost of $15,000. The contract is practically let for 2 120-H.-P. boilers, but bids will be received Sept. 1 for a 100-ft. circular brick stack and brick building. F. H. Hamilton, Engr. in Charge, Springfield, Ill.

Marietta, O.—Local press reports state that City Engr. E. Frank Gates is preparing plans for a reservoir.

Philadelphia, Pa.—Local press reports state that the lowest bid received by the Dept. of Pub. Wks. on Aug. 12 for building the proposed new pumping station at Lardner's Point was from Geo. C. Dietrich at $725,000; time for completion, 250 days.

Columbus, Ga.—An ordinance before the City Council provides for a vote on the proposition to issue $250,000 bonds for the construction of a municipal system of water works.

Henry, Ill.—Mayor A. G. Humphrey writes that none of the bids received Aug. 10 for the construction of a system of water works were accepted. Action has been postponed until Aug. 21; specifications will be changed and new bids asked.

Allegheny, Pa.—D. L. Fulton, Dir. Dept. of Pub. Wks., writes that the contract for erecting an addition to Howard St. pumping station has been awarded to H. A. Kunze, 14 E. Diamond St., for $20,490.

Chester, Ill.—The City Council is reported to have granted a franchise to the Chester Light, Water & Ice Co. for the laying of water mains.

Saginaw, Mich.—An appropriation of $500 has been made for the purpose of making tests of the proposed pure water supply from a chain of wells.

Los Angeles, Cal.—Bids are wanted Sept. 8 for the following cast-iron water pipe and specials: 6,975 pieces of 4 to 36 in. pipe, weighing from 20 to 400 lbs. per ft. and 60 short tons of specials to be used with pipe. Wm. Mulholland, Supt. of Water Wks.

Minneapolis, Minn.—The Council on Aug. 8 adopted a resolution providing for the issue of $250,000 bonds for the purpose of improving the water supply of the city.

Goshen, Utah.—The Goshen Irrigation & Canal Co. has filed articles of incorporation. Capital, $100,000. The officers are: Hans Jasperson, Pres.; Geo. White, Vice-Pres.; John Jasperson, Sec. and Treas.

Sault Ste. Marie, Mich.—Press reports state that $125,000 water, $40,000 sewer and $35,000 street bonds have been sold.

New Brighton, Pa.—The Citizens' Improv. Asso. has taken steps to build a municipal water works.

Blue Ridge, Ga.—See "Sewerage and Sewage Disposal."

Memphis, Tenn.—Consulting Engrs. J. A. Omberg, Jr., Arthur Hider and A. T. Bell, employed by the city to report upon the water works of Memphis, have submitted their reports, in which estimates are given as follows: To duplicate present plant, $2,402,164; auxiliary plant (compressed air), $292,000; auxiliary plant (steam), $225,125; independent station, $856,750; Mississippi River plant, $2,461,000; extending mains to Riverside Park, $105,542; service connections and meters, $304,332; to meet insurance requirements, $269,586; depreciation of present plant, $386,270; value present plant (not including real estate), $2,015,894.

Wausa, Neb.—The matter of establishing a water system is said to be under consideration.

Austin, Tex.—The City Council on Aug. 4 voted to purchase the plant of the old water company for $175,000.

Oakland, Cal.—The City Council has passed an ordinance appropriating $40,000 for the immediate improvement of 12th St. dam.

North Plainfield, N. J.—Boro. Clk. Frank Rowley writes that on Aug. 12 it was voted to issue $10,000 fire protection bonds.

Lancaster, Pa.—The Special Water Com. has decided to ask Samuel M. Gray, of Providence, R. I., to visit this city and explain his recommendations for a new standpipe and a duplicate force main.

Toledo, O.—Members of the Water Works Bd., with Supt. T. R. Cook, have visited the sand filtration plants in other cities with a view to installing a similar plant at Toledo.

New London, Wis.—Bids are wanted by the Mayor and City Council until Aug. 28 for furnishing material, f. o. b. cars, for a water works plant, as advertised in The Engineering Record.

Zelienople, Pa.—Bids are wanted Aug. 21 for furnishing material and constructing a system of water works, as advertised in The Engineering Record.

San Antonio, Tex.—The San Antonio Water Works Co. is reported to have made an appropriation of $227,000 for improvements, including the erection of a pump house 25x72 ft. on Market St., the drilling of 5 12-in. artesian wells and the installation of a 10,000,000-gal. pump and a 15,000,000-gal. pump. The contract for drilling the wells has been let to Judson Bros. Geo. W. Brackenridge, Pres. of Co.

Aberdeen, Wash.—At the recent election bonds to the amount of $100,000 were voted for refunding the present municipal indebtedness, the improvement of the water works system, constructing a modern sewerage system and building a bridge across Chehalis River.

San Francisco, Cal.—City Engr. C. E. Grunsky has submitted to the Bd. of Pub. Wks. his report on the city's water supply. Tuolumne River is reported to be the most feasible source of supply, and estimates given were as follows: Cost of bringing a supply of 60,000,000 gal. of water per day to the city, $30,724,000; distributing system to cost $1,057,000; city pumping station, $5,318,560, with pipe laying, gates, tunnels, etc., making a total of $39,531,000. Estimated cost of maintenance, $585,200 per year.

Portsmouth, N. H.—The Bd. of Aldermen is stated to have passed an ordinance for the issue of $50,000 bonds for the construction of an additional water plant, supply to be taken from Peverly Brook in Newington.

Vernal, Utah.—The Ashley Valley Irrigation & Reservoir Co. has been incorporated, with a capital of $50,000.

Pittsburg, Pa.—C. E. Holland, of New York, Capt. J. M. Murphy, of Harrisburg, and others, are said to be forming a new company, with a capital of $10,000,000, to supply Pittsburg and vicinity with pure water.

El Paso, Tex.—Jonathan S. Dodge and associates have asked the City Council for a 40-year franchise for a water works system, with permission to acquire the old plant.

Denver, Colo.—The Water Co. has taken out permits with the Bd. of Pub. Wks. for the laying of over 3 miles of water mains.

Schulenburg, Tex.—The Attorney General has approved an issue of $11,000 city water works bonds.

Coopersburg, Pa.—This Boro. has voted to borrow $19,000 for municipal water works.

Waco, Tex.—The City Council on Aug. 7 passed an ordinance providing for the issue of $200,000 bonds for the construction or purchase of a water works plant.

Rockwall, Tex.—The Attorney General has approved an issue of $12,000 city water works bonds.

Menno, S. D.—Bonds to the amount of $4,000 were voted for a system of water works.

Columbus, O.—The contract for furnishing not more than 1,400 or less than 800 tons of water pipe has been awarded by the Bd. of Pub. Wks. to the U. S. Cast Iron Pipe & Fdy. Co. at its bid of $33.50 per ton.

Hempstead, L. I., N. Y.—The Town Bd. has passed a resolution requesting the Jamaica Water Supply Co. to furnish 15 additional hydrants in the Floral Park Water Supply Dist.

Winnipeg, Man.—The Water & Light Comr. recommends the construction of a storage reservoir having a capacity of 10,000,000 gal.

Campbellsville, Ky.—Press reports state that the City Council is receiving bids for water works and an electric light plant.

Mullica Hill, N. J.—The Mullica Hill Water Co., principal office, Mullica Hill, has been incorporated, with a capital stock of $25,000. Incorporators: Eugene N. Howell, J. W. Howell, Fred. Blackburn and others.

Penngrove, N. J.—The Boro. Council has approved plans and specifications for the water works and electric light plant, for which $35,000 bonds were recently voted.

Georgetown, Del.—The Sussex Water Co. has been incorporated, with a capital of $25,000, to establish, maintain and operate water and light plants in Georgetown and other Sussex Co. towns. Chas. W. Cullen, of Georgetown, is said to represent the Co.

Whitesboro, Tex.—This city will grant a franchise for water works. An artesian water supply can be had at a depth of 400 to 800 ft. Population, 2,000. Address, O. T. Cartwright, City Secy.

Greenville, Pa.—The water works of this place have been purchased by Ernest Acheson, of Washington, Pa.; J. N. Clark, of Washington, and others, for approximately $60,000. It is stated that $20,000 will be expended in improving and extending the plant.

St. Louis, Mo.—The Malvern Water & Improv. Co., of St. Louis, has been incorporated to establish and operate water, sewer and lighting systems. Capital stock, $5,000. Incorporators: Chas. W. Smith, Alfred W. Syrett, Jas. J. McDonald and others.

Quanah, Tex.—The Attorney General has approved the issue of $8,000 water works bonds.

Tabor, Ia.—This place is reported to have voted $6,000 bonds for water works.

Conrad, Ia.—It is stated that water works are to be built.

Concord, N. C.—This city has decided to expend about $70,000 for the construction of water works. J. L. Ludlow, of Winston, N. C., is said to be Engr. in Charge.

Philadelphia, Pa.—Local press reports state that bids for building the fire-main pumping station to be located at the foot of Race St. will be asked soon.

North Milwaukee, Wis.—Village Clk. W. E. Chase writes that on Aug. 12 it was voted to issue $30,000 bonds for water works improvements.

Orillia, Ont.—Town Treas. C. E. Grant writes that on July 31 it was voted to issue $18,000 bonds for water works improvements and $30,000 bonds for an electric light plant.

Stuttgart, Ark.—The Stuttgart Water & Electric Light Co. has filed a certificate increasing its capital stock from $10,000 to $50,000. Chas. Williamson is Pres. of the company, Emil Reinsch, Vice-Pres., and A. W. Harper, Secy.

Chicago, Ill.—Local press reports state that the Bd. of Trus. of the Sanitary Dist. of Chicago will receive bids about Oct. 15 for constructing a dam for preserving the Joliet water power and to build an extension to the main channel at Lockport. The latter work, it is stated, will involve excavating and building of concrete walls on each side of the canal for about 7,000 ft. south of the bear-trap dam.

City Engr. Ericson estimates the cost of installing the new high-pressure fire protection system downtown at $567,250.

Local press reports state that contracts will soon be let for 3 pumps, each having a daily capacity of 2,500,000 gal., to be installed at the Chicago Ave. Pumping Station. Estimated cost, $350,000.

New York, N. Y.—Bids were opened Aug. 7 by Robt. G. Monroe, Water Comr., for furnishing and laying water mains in various streets. Some of the largest items and prices of lowest bidder are as follows: 2,900 tons straight pipe at $31, 70 tons branches at $56, 3,300 cu. yds. rock excavation at $.25, 40,000 cu. yds. earth excavation at $.25, 40,000 cu. yds. filling at $.25, laying 17,000 ft. of 20-inch pipe at $.51, laying 13,500 ft. of 12-inch pipe at $.27, laying 45,000 ft. of 6 inch pipe at $.16. The bidders and the totals are as follows: Contract awarded to H. Lipps, Jr., $152,117.30; F. V. Smith Cons. Co., $174,855; Norton & Dalton, $165,141; Cunningham & Kearns, $166,456; F. Thilemann, Jr., $178,997.50.

Columbus, O.—Julian Griggs, Ch. Engr., Dept. of Pub. Improvements, writes that the following bids were opened Aug. 8 for constructing a concrete masonry dam: A, Chas. Louis Cornwell, Louisville, Ky., total exclusive of cement, $184,678 with lake sand (awarded); $177,934 with river sand; B, S. Casparis, Jns. Westwater & Co., Columbus, total exclusive of cement, $190,250; total including cement, $302,650; C, A. W. McDonald & Co., Steubenville, O., total exclusive of cement, $207,074; total including cement, $347,574. For detail bids of above bidders see accompanying table:

Items and Quantities.

	A	B	C
Earth excav.:			
Dry, in found., 7,000 cu. yds.....	$.50	$.60	$.35
Wet, in found., 6,000 cu. yds.....	1.25	1.50	.85
Rock excav. in found., 15,000 c. yds.	1.50	1.50	1.05
Concrete masonry:			
56,200 cu. yds., lake sand........	2.69	2.75	3.27
56,200 cu. yds., river sand.......	2.57	....	....
56,200 cu. yds., including cement..	....	4.75	5.77

Bids received on Portland cement, 56,200 bbls., were as follows: Columbus Macadam Co., Columbus, for "Giant," $2.13 in bbls., $2.28 (awarded) in cloth, $1.98 in paper; totals, $119,706, $128,136 and $111,276, respectively; Kelly Island Lime & Transport Co., Cleveland, on "Lehigh," $2.21 in bbls., $1.94 in cloth, and $2.04 in paper; totals, $124,202, $109,028 and $114,648, respectively. Other bids received for Portland cement were as follows: *a*, 40,000 bbls.; *b*, 4,000 bbls.; *c*, 20,000 bbls.: J. P. Carlisle, Columbus, *a* on "Diamond," $2.35, total $94,000; *b* on "Medusa," $2.38 in cloth or $2.40 in paper, totals $9,400 and $9,600, respectively; A. Hamilton and E. W. Parker, Columbus, O., *c* on "Alpha," $2.75 in bbls. or $2.50 in cloth, totals $55,000 and $50,000, respectively.

Lewiston, Idaho.—City Engr. Ernest McCullough writes that the following bids were opened July 24: *a*, for a pump capable of lifting 1,000,000 gal. in 24 hours against a head of 220 ft.; *b*, for one with 50 per cent. more capacity; *c*, for a 125-H.-P. boiler: Laidlaw-Dunn-Gordon Co., *b* \$2,600, *a* \$2,200 f. o. b. Cincinnati. W. D. Hofius & Co., Seattle, Wash., offered three second-hand Worthington steam pumps capable of raising 1,500,000 gal. 600 ft. in 24 hours for \$2,500 each f. o. b. Seattle. Dean Steam Pump Co., Holyoke, Mass., *b* \$2,295, *a* \$2,098 f. o. b. Lewiston. Bradley Engineering Co., Spokane, Wash., representing Stillwell-Bierce & Smith-Vaile Co., offered f. o. b. Dayton, O., *a* \$1,210 with following extras: Lagging steam cylinder, \$50; revolution counter, \$50; 3 gauges, \$55; surface condenser, \$385; vertical air pump, \$455; *b* \$1,455 with following extras: Lagging steam cylinder, \$50; revolution counter, \$50; 3 gauges, \$55; surface condenser, \$575; vertical air pump, \$455. Canton Steam Pump Co., Plain duplex pump, \$500; compound duplex steam pump, \$700 f. o. b. Canton, O. A. V. Kniser & Co., Philadelphia, offered 2 second-hand Worthingtons, capacity 3,000,000 gal., at \$5,500 each f. o. b. Philadelphia, Pa. D'Olier Engineering Co., Philadelphia, \$4,200 for De Laval Steam Turbine f. o. b. Lewiston. Henry R. Worthington, f. o. b. Lewiston, *a* \$2,130, *b* \$2,560. Bradley Engineering Co., *c* f. o. b. Dayton, O., horizontal return tubular, \$925. New Jersey Fdy. & Mch. Co., *c* f. o. b. Lewiston, \$1,560.

Power pumping propositions were as follows: Deane Steam Pump Co., power pump for \$1,600, with a 60 H.-P. motor, for \$1,158, and a 95 H.-P. motor for \$2,218, electric motors. Westinghouse Electric & Mfg. Co., Seattle, Wash., power pump for 1,500,000 gal., \$3,000, with electric motor, \$3,212; total, \$6,212; 1,000,000-gal. pump, \$2,000, and motor \$2,500; total \$4,500; for a 2,500,000-gal. pump, \$5,500, and motor, \$3,937; total, \$9,437, all to be f. o. b. factory. Bradley Engineering Co., Spokane, Wash., f. o. b. Dayton, O., power pumps, \$1,750 and \$2,290, but no figures on motors.

SEWERAGE AND SEWAGE DISPOSAL.

West Carthage, N. Y.—Bids are wanted Aug. 30 for the construction of a sewer system, as advertised in The Engineering Record.

Wapakoneta, O.—Bids are wanted Aug. 25 for furnishing necessary labor and material for improving Blackhoof St. by the construction of a sewer with all appurtenances. Chas. E. Fisher, Village Engr.

Kansas City Mo.—Ordinances have been passed, and in a short time contracts will be let, for the following sewer construction: Sewer Dist. No. 208, which includes 13,500 ft. of pipe and 2,127 ft. of brick sewers, 55 manholes, 45 catchbasins and 7 flush tanks, cost \$30,000; also Sewer Dist. 221, which includes 18,000 ft. of pipe and 3,500 ft. of brick sewers, 69 manholes, 62 catchbasins and 7 flush tanks, cost \$36,000. R. W. Waddell, City Engr.

New York, N. Y.—Bids are wanted Aug. 19 for furnishing material and making alterations to a sewer in 51st St., between Park and 5th Aves. Engr.'s estimate of the work is as follows: 760 lin. ft. of 3-ft 6-in.x2-ft. 4-in. brick sewer, Class 1, and 30 lin. ft. of 3-ft. 6-in.x2-ft. 4-in. brick sewer, Class II; 36 lin. ft. of 12-in. salt glazed vitrified stoneware pipe culvert, etc. Geo. Livingston, Comr. of Pub. Wks.

Santa Rosa, Cal.—J. W. Keegan, Chmn. Sewer Com., writes that the sewer system is to be extended, at a cost of \$4,000.

Ft. Dodge, Ia.—Press reports state that bids are wanted for the construction of an 18-in. storm water sewer.

South Bend, Ind.—Press reports state that preparations are being made to reclaim the Kankakee marsh, southwest of the city, by the construction of a drainage canal which will be 17 miles in length and cost about \$85,000.

Mission Valley, Ia.—Local press reports state that Harrison and Pottawattamie Counties have decided on plans for a system of canals which will drain 100,000 acres of land in Ia.

Duquesne, Pa.—Boro. Engr. S. A. Taylor, of Pittsburg, writes that the contract for constructing 4,600 ft. of 8 to 12-in. pipe sewers, with 13 manholes, 6 catchbasins and 4 flush tanks, has been awarded to Homan & Cardwell, of Duquesne, at 84 cts. to \$1.10 for 12-in. pipe, 64 cts. for 10-in. pipe, 58 cts. to \$1.90 for 8-in. pipe, 42 cts. to 60 cts. for 6-in. connections, \$30 and \$38 for manholes, \$60 and \$65 for flush tanks; total, \$7,291.

West Point, N. Y.—Major J. B. Bellinger, Q. M., U. S. M. A., writes that the contract for 348 ft. of 20-in. cast iron pipe laid, has been awarded to E. A. Matthews, 13 Park Row, New York City, at \$14.25 per lin. ft.

Portsmouth, O.—City Engr. B. C. Bratt writes that the contract for sewer construction (bids opened Aug. 5) has been awarded to Samuel Monroe & Son, of Portsmouth, at \$1.55 per ft. for 30-in. brick sewer. 542 ft. 16.8 cts. for excavation; total, \$3,858.

Belleville, Ill.—The City Council has passed an ordinance for the construction of a brick sewer, 30-in. and 36-in. Cost about \$15,000. Louis Graner, City Engr.

Danville, Ill.—City Engr. W. H. Martin writes that bids are wanted Aug. 21 for 3,000 ft. of 8-in. pipe sewer.

South Bend, Ind.—See "Paving and Roadmaking."

Mobile, Ala.—Bids are wanted Aug. 28 for constructing storm sewers, as advertised in The Engineering Record.

Atlantic, Ia.—The City Clk. writes that the Iowa Engineering Co. has been engaged to prepare plans and specifications for a sewerage system which is to be started next year.

New Brighton, S. I., N. Y.—Bids are wanted Aug. 22 for the construction of a storm water sewer, with appurtenances, in Amos St.; the engineer's estimate calls for 1,035 ft. of 2-ft. 2-in.x3-ft. 3-in. brick sewer, 445 ft. 2-ft. 6-in.x3-ft. 9-in. and 100 ft. 3-ft. 6-in. lt diameter brick sewers; 12 manholes, etc. Bids are also wanted for constructing pipe sewers in Hamilton and Hatfield Aves. Geo. Cromwell, Pres. Boro. of Richmond.

Grinnell, Ia.—Engr. in Charge A. Marston, of Ames, Ia., writes that the contract for constructing septic tank of 250,000-gal. capacity has been awarded to O. P. Herrick, of Des Moines, Ia., for \$7,239. Other bidders were Des Moines Bridge & Iron Co., \$7,324; M. V. Kenned, Des Moines, \$7,949; Donnegan & Sullivan, Shenandoah, \$8,200.

Lakewood, O.—Bids are wanted Sept. 6 for laying the necessary sewer and water mains on Lake Ave. Bids will also be received by the Bd. of Hamlet Trus. in Sept. for laying necessary sewers on Clifton Boulevard. Plans may be obtained at the office of The Wm. H. Evers Engineering Co., Williamson Bldg., Cleveland. John French, Hamlet Clk.

Camden, N. J.—Local press reports state that the Street Com. of the City Council will receive bids Aug. 19 for the construction of several sewers.

Bridgeport, Conn.—Bids are wanted Aug. 20 for the construction of about 1,200 ft. of 40-in. brick sewer, as advertised in The Engineering Record.

Montreal, Que.—Bids are wanted Aug. 21 for constructing sewers in portions of Belanger and Cowan Sts. John R. Barlow, City Surveyor.

Ridley Park, Pa.—Bids are wanted Oct. 10 for a complete sewage disposal and purification plant, as advertised in The Engineering Record.

Blue Ridge, Ga.—City Clk. J. H. Davis writes that the estimated cost of proposed water works and sewerage system is \$15,000.

South Bend, Ind.—The Bd. of Pub. Wks. has passed resolutions for the construction of pipe sewers on East La Salle St. and a portion of Franklin St.

Port Huron, Mich.—Press reports state that the Council has under consideration the issue of \$60,000 sewer bonds.

Sault Ste. Marie, Mich.—See "Water."

Devils Lake, N. D.—The City Council is reported to have ordered the construction of a sewer system.

Revillo, S. D.—Surveys are said to have been completed for a complete system of sewerage.

Boston, Mass.—The time for receiving bids for furnishing and installing at the Calf Pasture, Dorchester, 6 boilers, is Aug. 25. Address Supt. of Streets.

Athol, Mass.—Bids are wanted by the Sewer Comrs. until Sept. 3 for constructing about 5 miles of sewers in this town, as advertised in The Engineering Record. Herbert L. Hapgood, Chmn.

Ogdensburg, N. Y.—The Common Council has voted in favor of constructing Barre St. sewer.

Boise, Idaho.—City Engr. Chas. H. Irvin writes that 2 lines of 6-in. pipe sewers, each 1,095 ft. in length, are to be constructed.

Oakland, Cal.—The Bd. of Superv. has directed the County Surveyor to prepare plans for macadamizing and constructing a sewer on San Leandro Road. Estimated cost, \$17,000.

St. Paul, Minn.—See "Paving and Roadmaking."

Torrington, Conn.—The contract for constructing sewers in numerous streets (bids opened Aug. 12) has been awarded to Ambrose Robbiati, 124 N. Elm St., Torrington, for \$10,392.

Peekskill, N. Y.—Sewer bonds to the amount of \$51,285 are reported to have been sold.

Pawtucket, R. I.—The Common Council has appropriated \$6,500 for the construction of new filter beds at South Woodlawn.

Durango, Colo.—H. T. Henderson has placed the estimated cost of a sewerage system at \$70,000.

Williamsport, Pa.—The Councils have awarded the contract for Building the Locust St. sewer conduit of brick, to Jos. Hendler Const. Co., of Wilkesbarre, for \$139,933.

Bradley Beach, N. J.—T. Frank Appleby, of Asbury Park, and others, have asked the Common Council for a franchise for the construction of a sewer system.

Guthrie, Okla. Ter.—The City Council has passed ordinances for 2 main sewers and for lateral sewers.

Aberdeen, Wash.—See "Water."

Swampscott, Mass.—The contract for Section 3 of the sewer system has been awarded to C. H. Eglee & Co., of Boston, for \$64,000.

Oak Cliff, Tex.—The Citizens' Sewerage Co., of Oak Cliff, has been incorporated, with a capital of \$6,000, to maintain a system of sewers. Incorporators: E. G. Patton, W. M. Ward and others.

Denver, Colo.—An ordinance has been passed authorizing the construction of sanitary sewers in South Side Sanitary Sewer Dist. No. 3, at a cost of \$16,800.

Westfield, Mass.—Town Engr. Oren E. Parks writes that the following bids were opened Aug. 6 for sewer construction. Trench to average 9.7 ft. in depth: A, Maloney & Peterson, Springfield, Mass., \$31,797 (awarded); B, Lynch Bros. Brick Co., Holyoke, \$35,610; C, R. D. Maynard, Springfield, \$37,763; D, Bruno, Salomone & Petitti, Boston, \$38,600; E, Seymour & Newell, Springfield, \$38,626; F, Long & Little, Leominster, \$39,087; G, D. H. Parsons & Co., Westfield, \$43,193; H, Brosman Bros., New York City, \$45,618. For detail bids see accompanying table:

Bidders.	Earth excav. 54-in. circular sewer, 4,610 ft.	36-in. circular sewer, 98 lin. ft.	Siphon, lump sum.	8-in. pipe sewer, 670 ft.	Br. masonry, 1,890 cu. yds.	Concrete mas., 725 cu. yds.	Spruce lumber, 15,000 ft. B. M.	Rock excav., 160 cu. yds.
A..	\$1.50	\$1.50	\$100	\$.50	\$11.00	\$4.00	\$10.00	\$3.00
B..	2.30	2.00	250	.30	9.50	7.50	35.00	3.00
C..	1.66	1.00	100	.25	12.90	5.95	40.00	3.00
D..	2.15	3.00	125	.50	12.00	6.00	25.00	3.50
E..	1.75	1.00	125	.30	12.50	7.00	50.00	4.50
F..	1.45	1.00	175	.50	13.95	5.70	35.00	5.00
G..	1.25	1.00	200	.40	15.50	9.00	30.00	4.00
H..	2.15	.30	100	.25	16.00	6.25	18.00	2.50

Brick masonry in Portland cement mortar, 1:2½; concrete masonry in Portland cement mortar, 1:3:6.

McKeesport, Pa.—The Sewer Com. has recommended the construction of a 7-ft. brick or concrete sewer on 5th Ave., an 8-ft. brick or concrete sewer from Cherry Alley to Crooked Run, and an 8x13-ft. sewer, brick or concrete, on Crooked Run, from Cherry Alley to Monongahela River. Estimated cost, \$100,000.

Sharon, Pa.—City Engr. Nicholls estimates the cost of a 54-in. circular brick storm sewer on Railroad St. at \$9,634.

Beloit, Wis.—City Engr. Robt. Caldwell writes that the contract for constructing about 9,000 ft. of sewers has been awarded to G. Mafaoli, of Rockford, Ill., at 60 cts., 65 cts. and 80 cts., respectively, for 8, 10 and 12-in. pipe; \$40 for manholes, \$15 for lamp holes, \$65 for flush tanks and 30 cts. for Ys; total, \$7,702. Other bids received were as follows: Harding, Nelson & Johnson, Racine, Wis., \$8,548.82; J. A. Heineman, Chicago, Ill., \$9,204.67; C. Johnson, Oshkosh, Wis., \$8,151.13; Reichert Const. Co., Racine, Wis., \$8,669.23. Trench to average 8 ft. in depth.

BRIDGES.

Sydney, N. S. W.—It is stated that the authorities have decided to award the contract for constructing the bridge across the Harbor to the E. & C. Bridge Co., of London & New York. Press reports state that it is the intention of the Bridge Co. to invite bids for the steel superstructure from English, French, German and American steel companies.

Cleveland, O.—See "Electric Railways."

Erie, Pa.—The Select Council has adopted a report submitted by the Railroad Co., in which the Com. recommends that the P. & E. R. R. Co. be asked to contribute \$25,000 toward the construction of a bridge at East Ave. The total cost of the bridge will probably be \$55,000.

Kansas City, Mo.—R. J. Ingraham, City Counselor, has notified the officials of the Metropolitan St. Ry., the Chicago & Alton and the Missouri Pacific R. R., that he desires to confer with them regarding the construction of a viaduct for street cars, wagons and pedestrians, at Lydia Ave.

Lawton, Okla. Ter.—Gov. Ferguson has received permission from the Interior Dept. to construct a bridge across Cache Creek in this county, at a cost of \$3,470.

Steelton, Pa.—It is stated that the Pennsylvania Steel Co. will construct a bridge at Dauphin St.

Victoria, B. C.—Local press reports state that the Bd. of Aldermen has decided to ask for bids for the building of the Point Ellice bridge.

Aberdeen, Wash.—The question of issuing bonds for the construction of a bridge across Chehalis River is reported to have carried at the recent election.

Marinette, Wis.—A resolution has been adopted by the Bd. of Co. Supervisors authorizing the Road Com. to solicit plans and specifications for a bridge to be built across Menominee River, between this Co. and Dickinson Co., Mich.

Dayton, O.—Local press reports state that a bridge will be built at 3d St. in the spring.

Birmingham, Ala.—It is stated that the railroad companies entering this city are agitating the building of a bridge at Gloss Furnace.

North Yakima, Wash.—The building of a bridge across Yakima River, 2 miles north of this city, is said to be contemplated.

Vicksburg, Miss.—Bids for constructing the Glass Bayou bridge, the A and V viaduct and the Stouts Bayou viaduct, are stated to have been received, respectively, as follows: Wm. T. Young, \$20,920, \$5,740 and \$28,290; Penn Bridge Co., Beaver Falls, Pa., \$17,500, \$6,000 and \$23,500; Geo. H. Crafts, \$19,161, \$5,912 and \$23,391; King Bridge Co., Cleveland, O., \$21,723, \$6,648 and \$27,278.

Boston, Mass.—The contract for building the abutments and approaches for Wellington Bridge, Middlesex Fells Parkway, in Somerville and Medford, is reported to have been awarded to Lawler Bros., for \$42,780.

Peru, Ind.—The Co. Comrs. have requested the Co. Council to make an appropriation for the building of a girder bridge across Wabash River at Broadway. A bridge 80 ft. wide, and to cost \$86,000, is contemplated; ⅓ of the cost to be borne by the Union Traction Co.

Walsenburg, Colo.—It is stated that 7 bridges along the Rio Grande R. R. have been washed away by the freshets.

Terre Haute, Ind.—The Co. Comrs. have instructed Engr. Bacon to investigate and report on the condition of the wagon bridge across Wabash River, which has been reported to be in an unsafe condition.

Whitehouse, Va.—The Chesapeake & Ohio R. R. Co., through F. I. Cabell, has, according to press reports, asked the Secy. of War for permission to construct a bridge across Levisay fork of the Big Sandy River, about 6¼ miles above Whitehouse. J. M. Staten, Gen. Inspector of Bridges, Richmond, Va.

Niles, O.—Local press reports state that the Co. Comrs. are to build a bridge at Ribbons Ave., at a cost of \$10,000.

Benton Harbor, Mich.—Plans have been adopted, and it is stated that bids will soon be asked for the building of a swing bridge across Paw Paw River.

Muskegon, Mich.—It is stated that the Co. Road Comrs. are planning to build 2 iron and steel bridges on Holton Road.

Cheneyville, Ill.—The Bridge Com. of the Bd. of Superv. has decided to report in favor of building a steel bridge, a short distance northeast of Cheneyville.

Newville, Pa.—The Pittsburg Bridge Co. is stated to have secured the contract to construct a bridge in this city, for \$9,835.

Reading, Pa.—The Court has appointed M. M. Dreibelbis, Lewis F. Kramer and Israel Bertolette as viewers, to look into the matter of having the County build a bridge across the Schuylkill River at 6th St.

Denver, Colo.—It is stated that the Denver & Rio Grande Ry. Co. intends to rebuild its double track bridge across Cherry Creek, at a probable cost of $15,000.

Syracuse, N. Y.—The construction of a wooden or steel viaduct at 24th St. (estimated to cost respectively between $20,000 and $30,000 and between $70,000 and $80,000), is said to be contemplated. The Mayor is reported to be in favor of a wooden structure.

Claremont, N. H.—The building of an iron bridge between this city and Weathersfield (Vt.), is under consideration; estimated to cost $30,000.

St. Paul, Minn.—The Legal Dept. has been instructed to compel the Northern Pacific R. R. Co. to construct a steel bridge across its right of way at Jessamine St. and to repave the bridge at Rice St.

Piqua, O.—A petition is being circulated asking for the construction of a bridge at Grant St.

Cincinnati, O.—The Bd. of Control has concurred in the resolution of the Co. Comrs. to reconstruct Lost Bridge, across Big Miami River at Elizabethtown, at a cost of $196,000.

Orbisonia, Pa.—The York Bridge Co., York, Pa., is reported to have secured the contract to construct the iron work on the bridge across Raystown Branch of the Juniata River, for $8,700. The bridge will consist of 2 spans, 160 ft. and 108 ft. long.

Gardiner, Me.—Contracts will soon be let for a new draw span for the Gardiner and Randolph bridge, span 106 ft. in length, 24 ft. wide. A. C. Clark, Chmn. of Selectmen, Randolph.

Waterville, Me.—A suspension foot bridge of 400 ft. span will be built immediately from Waterville to Winslow, across Kennebec River, by Harvey O. Eaton and Hon. W. T. Haines, of Augusta.

Ann Arbor, Mich.—Edwin W. Groves, City Engr., writes that bids will be received until Aug. 25 for constructing 4 concrete culverts, 1 66-ft. 6-in. long, 2 66-ft. long, and 1 69-ft. long.

Chicago, Ill.—Bids are wanted Aug. 22 for furnishing material and constructing the superstructure of the W. Division St. bridge. F. W. Blocki, Comr. of Pub. Wks.

San Jose, Cal.—Local press reports state that bids will be received by the Co. Comrs. until Sept. 2 for constructing 3 concrete bridges, 1 concrete and stone bridge and 1 rubble stone and concrete bridge.

Mansfield, O.—Bids are wanted Aug. 23 for constructing a steel bridge with plank floor across Toby's Run. D. S. Koontz, City Clk.

Ogden, Utah.—The Mayor has recommended to the Council the building of a viaduct at 24th St.

Pleasanton, Cal.—Cotton Bros. & Co. are stated to have secured the contract to construct a steel and concrete bridge across Arroyo Del Valle near Pleasanton, for $10,590.

Greenlane, Pa.—The Co. Comrs. have decided to construct a bridge across Perkiomen Creek, near Greenlane.

Baltimore, Md.—See "Railroads."

Tunkhannock, Pa.—State Engr. Gulick, of Phoenixville, is reported to be taking measurements for a bridge which is to be built in this city by the State.

Pasadena, Cal.—City Engr. T. D. Allin is said to be making surveys for the proposed boulevard bridge.

Columbus, O.—It is stated that the Co. Comrs. will soon ask bids for constructing 2 viaducts at Cleveland Ave. Probable cost, $75,000.

Omaha, Neb.—The citizens of the 6th and 9th Wards have petitoned the Council for a bridge at Seward St.

St. Louis, Mo.—C. D. Mitchell is reported to have received the contract to construct a coal shed and bridge at Bissell's Point, for $21,700.

Portland, Ore.—Press reports state that the officials of the Northern Pacific R. R. intend bridging the Willamette River at Portland; also the Columbia River at Vancouver, Wash.

Appleton, Wis.—It is stated that bids are about to be asked for a stone and concrete bridge to be built at John St. The total length of the structure, between abutments, will be 608 ft. Probable cost, $40,000.

Syracuse, N. Y.—See "Miscellaneous."

Luray, Va.—Bids will be received by the Town Council until Aug. 25 for constructing a steel bridge across Hawksbill Creek. T. R. Campbell, Mayor.

Chicago, Ill.—Bids are wanted Aug. 23 for repairing bridge at So. Ashland Ave. F. W. Blocki, Comr. of Pub. Wks.

PAVING AND ROADMAKING.

Atlantic City, N. J.—It is stated that plans have been prepared by the Com. on Highways of the City Council for the construction of a boulevard 60 ft. wide along Main Ave., from Oriental to Atlantic Aves.

The Council is considering propositions from the Pa. R. R. Co. relative to the paving of Atlantic Ave. Probable cost of said improvement $250,000.

Des Moines, Ia.—The City Council on Aug. 5 voted to pave E. 12th, 5th and Maple Sts., with asphalt.

Boise, Idaho.—City Engr. Chas. H. Irvin writes that it is proposed to pave a portion of 8th St., 8,333 yds., probably with brick.

Clarion, Pa.—Jas. B. Caldwell, of Brookville, is said to be preparing maps and drawings for the proposed improvement of Main St.; specifications call for 7,000 cu. yds. of grading, 17,000 sq. yds. of brick paving and 6,400 lin. ft. of curbing.

Portsmouth, O.—City Engr. B. C. Bratt writes that the contract for paving E. 5th St. with Portsmouth block, sand filler, combined cement curb and gutter, has been awarded to Kelley Bros., Portsmouth, at 89 cts. for paving and 50 cts. for curb and gutter; total, $10,816.

Cleveland, O.—Bids are wanted Aug. 20 for supplying and laying cement sidewalk, as required in this city during the period of 1 year; also for stone flagging for 1 year. Chas. P. Salen, Dir. of Pub. Wks.

Ft. Dodge, Ia.—Local press reports state that 8th St. is to be paved with asphalt.

Moline, Ill.—Press reports state that the Council proposes to lay 9 blocks of brick and 39 blocks of asphalt paving.

Paoli, Ind.—Bids are wanted Sept. 1 for the construction of certain gravel or macadam roads in Orange Co. John H. Weeks, Chmn. Bd. of Co. Comrs.

New York, N. Y.—Bids are wanted by the Comr. of the Dept. of Correction, Thos. W. Hynes, until Aug. 28 for furnishing all labor and materials required for a sidewalk at the city prison tombs. Amount of security required, $30,000.

Jersey City, N. J.—Bids are wanted Aug. 19 for improving Pierce Ave., the estimates call for 2,215 sq. yds. of Belgian paving, 1,170 ft. of curbstone, 3,050 sq. ft. of flagging, etc. Geo. T. Bouton, Clk. Bd. of Street & Water Comrs.

Chariton, Ia.—Press reports state that contracts will be let Sept. 8 for 7 blocks of brick paving.

Rome, N. Y.—The contract for paving W. Embargo St., 9,504 sq. yds. asphalt, with Medina curb, has been awarded to the Warner-Quinlan Asphalt Paving Co., Syracuse, for $20,297.

Streator, Ill.—Contracts will soon be let for about 1 mile of brick pavement.

Terre Haute, Ind.—City Engr. Ralph H. Sparks writes that bids will be received as follows: Improving 9th St. until Aug. 22; for alley pavement until Aug. 27; improving 4th St. until Sept. 1; improving Walnut St. until Sept. 3.

Chanute, Kan.—Bids are wanted Aug. 18 (extension of date) for paving with vitrified brick on Main St., as advertised in The Engineering Record.

South Bend, Ind.—Bids are wanted Sept. 2 for 26,572 sq. yds. of brick paving; also for about 1½ miles of pipe sewers, as advertised in The Engineering Record.

Mobile, Ala.—Bids are wanted Aug. 28 for approximately 19,000 sq. yds. of brick paving and 37,000 sq. yds. of asphalt paving, as advertised in The Engineering Record. Paving bonds to the amount of $200,000 have been sold by the Council.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that the contract for repairing asphalt pavements on numerous streets (bids opened Aug. 2) has been awarded to the Barber Asphalt Paving Co., Nelson Bldg., at $1.50 per sq. yd.

New York, N. Y.—Bids are wanted Aug. 20 for grading Grand Boulevard and Concourse from E. 161st St. to Mosholu Parkway, and constructing temporary roadways, sidewalks and paths; the engineer's estimates call for 298,000 cu. yds. of earth excavation, 402,000 cu. yds. of rock excavation, 603,000 cu. yds. of filling, 14,600 cu. yds. of selected filling, 12,000 cu. yds. of dry rubble masonry in retaining walls, 14,100 cu. yds. of random range ashlar-faced masonry in retaining walls, 26,500 lin. ft. foundation piles, 39,500 lin. ft. of new curbstone, 308,800 sq. ft. new flagging, 14,000 sq. ft. old flagging, 24,100 sq. ft. bridge stone, 128,000 sq. yds. macadam in roadways, 42,000 sq. yds. macadam in bicycle paths, 33,300 sq. yds. paved gutters, etc. Bids will also be received at the same time for regulating and grading, setting curbstone, flagging sidewalks, laying crosswalks, building approaches and placing E. 179th St., from 3d Ave. to Bronx River; the engineer's estimate calls for 11,500 cu. yds. of rock excavation, 10,200 lin. ft. new curbstone, 39,700 sq. ft. of flagging, etc. Louis F. Haffen, Pres. Boro. of Bronx.

Washington, D. C.—The contract for laying cement sidewalks, about 50,000 sq. yds. (bids opened Aug. 8) has been awarded to F. M. Kemp & Sons, of Middletown, O., at $1.04 and $1.11 per sq. yd.

Bellevue, Pa.—Bids will be received by Boro. Secy. Jas. Simeral until Aug. 19 for grading, paving and curbing portions of Kendell St., Bayne, Dawson, Mead and Washington Aves. John McGrew, Boro. Engr., 12 N. Diamond St., Allegheny, Pa.

Lexington, Mo.—The Council is said to be investigating the subject of brick paving.

St. Paul, Minn.—The Assembly Com. on Streets has approved the final order for macadamizing Concord St. on the west side; a sewer is also to be laid, at an estimated cost of $7,400, on Concord St.

The Bd. of Pub. Wks. has decided to pave Ramsey St. from 7th to Pleasant Ave. with asphalt.

Indianapolis, Ind.—Local press reports state that Mayor Bookwalter will have the Park Bd. prepare plans for Pleasant Run Boulevard. Estimated cost of said improvement, $100,000.

The Bd. of Wks. has adopted resolutions for asphalt roadway with brick gutters in two sections of 13th St.; also for resurfacing a portion of Mass. Ave. with asphalt.

St. Clair, Mich.—Bonds to the amount of $35,000 for paving Front St. were voted at the recent special election.

Steubenville, O.—See "Electric Railways."

Milwaukee, Wis.—City Engr. O. J. Poetsch writes that the contract for repaving 16th St. viaduct (17,400 yds.) with creosoted pine blocks has been awarded to Jas. O'Donnell, of Milwaukee, at $2.43 per yd.

The contract for paving a portion of 2d Ave. with asphalt is stated to have been awarded to the Western Paving & Supply Co. at $2.29 per sq. yd.; total, $21,000.

Atchison, Kan.—Thos. Beattie, of Atchison, is reported to have received a contract amounting to $96,311 for street paving and culverts.

Rome, N. Y.—The contract for paving W. Embargo St. with sheet asphalt is stated to have been awarded to the Warner-Quinlan Asphalt Paving Co., of Syracuse, for $20,297.

Winamac, Ind.—Daniel H. Fatout, of Indianapolis, is reported to have received the contract for 20 miles of gravel roads to be built in Monroe Township at $2,000 per mile.

San Francisco, Cal.—The estimated cost of improving 3d St. throughout its entire length, building new gutters and paving with basalt block, is placed at $90,000.

Montreal, Que.—The Road Com. has asked the Council for $22,500 for new macadam roads and permanent sidewalks.

Newark, N. J.—The Street Com. of the Bd. of Wks. has decided to ask the Council for $10,000 for repairing Sussex Ave.

Chicago, Ill.—Bids will be received by the Bd. of Local Improv. until Aug. 19 for paving with repressed vitrified brick, asphalt, crushed granite and granite block, on portions of numerous streets. Andrew M. Lynch, Pres.

Toledo, O.—Bids are wanted Sept. 8 for paving a portion of Bancroft St. with various kinds of block on a 6-in. concrete foundation, or with asphalt block on present sand foundation. Bids will also be received at the same time for paving a portion of Curtis St. with various kinds of block on a 6-in. concrete foundation, or an 8-in. sand foundation, or with asphalt block on a 6-in. gravel or broken stone foundation. Chas. H. Nauts, City Clk.

Decatur, Ill.—An ordinance has been passed providing for the paving of W. Main St. at an estimated cost of $22,300.

South Bend, Ind.—The Bd. of Pub. Wks. has passed resolutions authorizing the paving with brick of portions of Monroe and Bridge Sts.

Jersey City, N. J.—Local press reports state that plans for a boulevard along the New Jersey bank of the Hudson River north from Fort Lee have been completed by the Palisades Comn.

Duquesne, Pa.—Local press reports state that John W. Spearing, of Duquesne, received brick paving contracts as follows: N. 1st St., at $6,745; 3d St., for $7,966; 4th St., for $9,000; and S. 5th St., for $11,257. It is stated that a total of over 1,020,000 bricks will be required for this work.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Aug. 25 for improving a portion of Enright Ave. by grading, curbing and paving the roadway with brick and constructing the necessary culverts and drains. Geo. F. Holmes, Clk.

The lowest bid received for paving with granite on Eggleston Ave. is said to have been from F. H. Kirchner & Co., at $114,053.

The Bd. of Pub. Service has instructed the City Engr. to prepare estimates and specifications for asphalt paving on Bremen St. from 12th St. to Findlay.

Hoboken, N. J.—It is stated that bids will be received until Aug. 27 for regulating, grading and repaving with Belgian blocks on Jackson and Adams Sts. John Haggerty, City Clk.

Charleston, W. Va.—It is stated that bids are wanted Aug. 26 for $70,000 street improvement bonds.

Williamsport, Pa.—Bids will be received by the Highway & Sewer Com. of the Councils until Sept. 5 for paving with brick, asphalt or wooden blocks on a concrete foundation (in all about 1,970 sq. yds.) on Park and W. 3d Sts.; also for laying a wearing surface of vitrified brick on the old macadam foundation on portions of several streets, in all about 2,875 sq. yds. F. A. Snyder, City Engr.

Inlet, N. Y.—Bids will be received by the Bd. of Highway Comrs. until Aug. 26 for building a road from Eagle Bay to Inlet. F. N. Kirch, Chmn.

Morgantown, W. Va.—It is stated that bids are wanted Aug. 20 for about 3,500 sq. yds. of paving. M. T. Shisler, Recorder.

North Baltimore, O.—It is stated that bids are wanted Sept. 1 for completing South Main St. improvement by paving with brick. Jay Radebaugh, Village Clk.

Arcola, Ill.—It is stated that bids are wanted until Sept. 25 for 7,290 sq. yds. of brick pavement on a concrete foundation. Thos. Monahan, Mayor.

Sault Ste. Marie, Mich.—See "Water."

Norfolk, Va.—This city proposes to issue $15,000 bonds for street paving purposes.

Logan, O.—At a recent special election it was voted to issue bonds for street paving purposes.

Mechanicville, N. Y.—The contract for paving Main and Railroad Sts. with vitrified block is reported to have been awarded to Mooney & Kellam, of Troy, the lowest bidders, as follows: Pavement, per sq. yd., $1.84; 6x12-in. granite curbing and circulars, per lin. ft., 73 cts.; 6x12-in. granite header curbing, per ft., 50 cts.; 5x16-in. bluestone curbing and circulars, 85 cts. per ft.; 5x16-in. bluestone header curbing, per ft., 62 cts.; extra concrete under railroad strip, per yd., $5.50; extra excavating under railroad strip, per yd., 55 cts.

East Grand Forks, Minn.—Recorder Henry Harm writes that the following bids were opened Aug. 5 for about 33 blocks of paving: *a*, sandstone paving; *b*, granite macadam; *c*, slate macadam; *d*, granite curbing; *e*, combintion curb and gutter; *f*, sandstone curbing; *g*, pine curbing: Chas. D. Ray, Chicago, Ill., *a* $2.53, *b* $1.48, *d* $1, *e* 83 cts., *f* 78 cts., *g* 35 cts.; P. H. Thornton, St. Paul, *a* $2.46, *b* $1.46, *c* $1.39 (awarded), *e* 75 cts., *f* 72 cts., *g* 23 cts.; Fielding & Shepley, St. Paul, *b* $1.43, *c* $1.41, *e* 80 cts., *f* 75 cts., *g* 25 cts.; P. McDonald, Duluth, *a* $2.35, *b* $1.45 ($1.25 for cedar block paving), *d* $1, *e* $1, *f* 68 cts., *g* 34 cts.

Corry, Pa.—City Engr. Nevin R. Dickson writes that the contract for 16,000 sq. yds. of brick paving has been awarded to the Park Paving Co., of Rochester, Pa., at $1.88 for paving, $30 for catch basins, total $30,209. Other bids received were as follows: Chas. H. Bartow, Columbus, O., bid $1.95 for Mack wire cut brick, $1.96 for Mack repressed block and $2.01 for Mack repressed brick; totals, $31,344, $31,504 and $32,304, respectively. Rosser & Maloney, Bellaire, O., bid $1.95 for Mack block and $2.05 for Mack repressed brick; totals, $31,423 and $33,023. Mahoney Bros. & Gardner, Jamestown, N. Y., bids $1.94 for Jamestown wire cut brick, $2 for Jamestown block, $2.03 for Mack wire cut, $2.04 for Mack block and $2.09 for Mack repressed; totals, $31,255 to $33,440.

Dayton, O.—Bids are wanted Sept. 5 for paving with brick or asphalt and furnishing and setting curbs on 5th St. Estimated quantities, 7,040 sq. yds. of paving, 2,900 lin. ft. of straight curb, etc. J. E. Gimperling, Pres. Bd. City Affairs.

New Brighton, S. I., N. Y.—The following bids for granite block paving were opened Aug. 8 by Geo. Cromwell, Richmond Boro. Pres., only the largest items being stated: A, John E. Donovan; B, Michael Fitzgerald; C, James P. Graham; D, Joseph Johnson; E, Cunningham & Kearns:

Jersey St., from Richmond Terrace to 5th St.

Bidders.	Granite block, 4,600 sq. yds.	Concrete, 850 cu. yds.	New bridge-stone, 600 sq. ft.	New curb, 2,750 ft.	New coping, 20 ft.	Brickwork, 1 cu. yd.	Total.
A..	$2.85	$5.15	$.55	$.78	$.60	$11.00	$19,985
B..	2.67	4.00	.60	.70	.25	7.00	17,979
C..	2.53	4.60	.60	.75	.50	10.00	17,990
D..	2.70	4.75	.60	.85	.50	11.00	19,176
E..	2.70	4.00	.50	.79	.01	.01	18,293

Richmond Terrace, from York Ave. to Westervelt Ave.

Bidders.	Granite block, 2,650 sq. yds.	Concrete, 500 cu. yds.	New bridge-stone, 1,150 sq. ft.	New curb, 1,450 ft.	Flagging, 50 ft.	1 Receiving basin.	Total.
A..	$2.70	$5.00	$.55	$.78	$1.00	$140	$11,664
B..	2.77	4.00	.70	.65	.40	150	11,295
C..	2.53	4.60	.50	.75	.30	115	10,862
D..	2.70	4.75	.60	.85	.30	150	11,684
E..	2.70	4.00	.60	.79	.30	240	11,290

Award recommended to lowest bidder in each case.

New Brighton, S. I., N. Y.—The following bids for asphalt and granite block paving were opened Aug. 8 by Geo. Cromwell, Pres. Richmond Boro., only the largest items and the totals being given: A, John E. Donovan; B, Uvalde Asph. Pavg. Co.; C, Barber Asph. Pavg. Co:

Richmond Road, from Vanderbilt Ave. to Summit South of Clove Ave.

Bidders.	Asph., 6,700 sq. yds.	Granite block, 1,500 sq. yds.	Concrete, 1,510 cu. yds.	New curb, 3,600 ft.	1 Receiving basin.	Total.
A.......	$1.56	$3.10	$5.65	$.80	$140	$26,847
B.......	1.60	2.95	5.00	.90	160	26,373
C.......	2.19	3.18	5.25	1.00	320	32,239

Richmond Terrace, from S. I. R. T. R. R. Co.'s Crossing to Ferry St.; and Richmond Ave.

Bidders.	Asph., 5,400 sq. yds.	Concrete, 1,150 cu. yds.	New curb, 2,450 ft.	3 Receiving basins.	Total.
A..........	$1.56	$5.25	$.75	$140	$16,801
B..........	1.45	4.75	.80	150	15,809
C..........	2.19	5.25	1.00	320	21,650

Award recommended to lowest bidder in each case.

New York, N. Y.—The Barber Asph. Pavg. Co. has been awarded 4 contracts for asphalt paving, according to bids opened by Louis F. Haffen, Bronx Boro. Pres., on Aug. 4, as follows: A, Continental Asph. Pavg. Co.; B, Barber Asph. Pavg. Co.; C, Century Constn. Co.; D, Asph. Constn. Co.; E, Sicilian Asph. Pavg. Co.:

Forest Ave., from Westchester Ave. to Home St.

Bidders.	Asph., 11,540 sq. yds.	Relay, 11,650 sq. yds.	Concrete, 550 cu. yds.	New curb, 4,000 ft.	Old curb, 4,100 ft.	Total.
A....	$1.30	$.32	$5.25	$.75	$.25	$25,642
B....	1.02	.24	4.73	.79	.18	21,066
C....	1.30	.33	5.25	.79	.30	26,124
D....	1.30	.40	6.00	.80	.30	27,392
E....	1.65	.40	6.50	.95	.40	32,716

Park Ave., from E. 165th St. to E. 177th St.

Bidders.	Asph., 30,125 sq. yds.	Relay, 30,125 sq. yds.	Concrete, 900 cu. yds.	New curb, 13,550 ft	Old curb, 1,600 ft.	Total.
A....	$1.30	$.30	$5.25	$.75	$.25	$63,487
B....	1.02	.24	4.73	.79	.18	53,207
C....	1.30	.33	5.25	.79	.30	65,013
D....	1.22	.40	6.00	.80	.30	65,522

Intersection of Washington Ave. and 161st St.

Bidders.	Asph., 3,700 sq. yds.	Concrete, 550 cu. yds.	New curb, 800 ft.	Total.
B.............	$1.28	$4.38	$.79	$7,777
C.............	1.40	5.25	.90	8,787
D.............	1.90	6.00	.90	11,050

Washington Ave., from 3d and 159th St. to Pelham.

Bidders.	Asph., 65,300 sq. yds.	Concrete, 11,250 cu. yds.	Old curb, 28,800 ft.	Total.
A...........	$1.30	$5.25	$.25	$151,152
B...........	1.28	4.38	.18	138,043
C...........	1.27	5.15	.35	150,948
D...........	1.90	6.00	.30	200,210

POWER PLANTS, GAS AND ELECTRICITY.

New York, N. Y.—The Mayor has approved the issue of $200,000 bonds for the construction of a new heating and lighting plant for the American Museum of Natural History.

Jackson, Miss.—F. J. Butler, of Greenville, is stated to have secured the contract for constructing an electric power plant at the new Capitol, for $36,020.

Ladysmith, Wis.—The Council is stated to have granted the Ladysmith Light & Power Co. a 10-year electric light franchise. Work on the plant will begin at once.

Aberdeen, S. D.—Thos. Baker, Jr., and others, of Fargo, N. D., are reported to have petitioned for a franchise for an electric light and power plant.

Edwardsville, Ill.—The J. R. Bennet Electric Co., which is reported to have recently received a franchise for lighting this city, has purchased a site in the East End, near the Henrietta coal mine, where it is said its power plant will be located.

Boulder, Colo.—The City Council is stated to have awarded to the Boulder Electric Light & Power Co., whose contract for lighting the city does not expire until next May, a contract for 10 years from May 1, 1903, for lighting the city at the rate of $100 a year per arc light. It is stated that the company will expend about $40,000 in improvements.

Mercer, Pa.—L. W. Orr, Jas. D. Emery, and others, have asked for a franchise to construct an electric light plant.

Lancaster, Pa.—The Council has granted John L. Dunn & Co., of Wilkesbarre, to be known as the Lancaster Steam Htg. Co., a franchise to lay and maintain a system of pipes in Lancaster to supply private consumers with steam.

Knoxville, Tenn.—The Knoxville Water Power Co., which is reported to have been recently incorporated to dam the Little Tennessee River 30 miles above Knoxville, and generate power to supply electricity to the entire East Tennessee, has been organized, with Chas. H. Treat, Pres., and H. O. Reed, Secy., both of N. Y. City, N. Y.

Tiffin, O.—The Logan Natural Gas Co. is stated to have secured franchises in Tiffin and Carey.

Minneapolis, Minn.—It is stated that about $100,000 will be expended by the Minneapolis Electric Co. in improvements on the building at 15 8th St. S. Two stories will be added and storage batteries to increase the H.-P. to 4,000 will be put in.

Ft. Wayne, Ind.—The Ft. Wayne Electric Light & Power Co. has been incorporated, with a capital of $500,000, by Edw. R. Coffin, Wm. P. Bonbright and others. It is the intention of the company to supply electrical current, steam, hot water and gas to consumers in and near Ft. Wayne.

Anoka, Minn.—The City Council is stated to have granted J. W. Steed a franchise for an incandescent system.

Memphis, Tenn.—The Citizens' Gas & Electric Light Co. has been incorporated, with a capital of $100,000, by Dr. J. H. Stolper, Percy H. Patton, and others, for the establishment and operation of works for the manufacture, distribution and sale of gas and electric current for light, heat and power.

Baird, Cal.—The San Francisco Construction Co., San Francisco, and Geo. W. Elder, 455 Valencia St., San Francisco, are stated to have secured the contract for constructing a dam across McCloud River about 20 miles from Baird, for the McCloud River Electric Power Co.; probable cost, $500,000.

Sea Cliff, L. I., N. Y.—The Bd. of Trus. is stated to have granted a franchise for lighting Sea Cliff to the Roslyn Electric Light & Power Co.

Storm Lake, Ia.—A. W. Unger is stated to have petitioned the Council for a franchise for a gas plant.

Dansville, N. Y.—The Mill Creek Electric Light & Power Co. has been incorporated by F. A. Owens, W. J. Beecher, and others. It is stated that it is proposed to utilize the water of Big Mill Creek between Perkinsville and Dansville and erect and equip a plant to furnish Danville with electricity.

Orillia, Ont.—See "Water."

New Orleans, La.—Local press reports state that the City Council on Aug. 5 accepted the bid of Herbert A. Ballard, of Cincinnati, O., for the construction of the municipal electric light plant, for $1,369,000.

Tacoma, Wash.—City Engr. Norton L. Taylor writes that the following bids were opened July 30 for lighting the city for the next 5 years: *a*, price per Kw. hour for alternating current; *b*, price per Kw. hour for direct current: Tacoma Ry. & Power Co., Tacoma, *a* .895 cts., *b* .97 cts.; Tacoma Cataract Co., Tacoma, *a* .84 cts., *b* .94 cts. (awarded). Estimated consumption for year ending Aug., 1903, 3,200,000 Kw.

Campbellsville, Ky.—See "Water."

Fayetteville, N. C.—Bids are desired by this city on an electric light plant of 50 arc lights and 3,000 incandescent lights. N. B. Alexander, Chmn. Light Com.

Alton, Ill.—The Alton Electric Ry. Co. will extend its gas mains several miles. J. F. Porter, Pres.

Warrenton, Pa.—The Virginia Electrical Construction Co. is stated to have secured the contract for the installation of a $28,000 electric plant at Warrenton, Va., for the Warrenton Electric Co.

Charlotte, Mich.—The Council is reported to be investigating the advisability of installing an electric light plant in connection with the water works.

Pennsgrove, N. J.—See "Water."

Lancaster, N. Y.—The Lancaster-Depew Natural Gas Co. has been incorporated, with a capital of $100,000, to manufacture and produce gas for lighting purposes in Cheektowaga, Lancaster and Amherst. Directors: J. W. Stearns, of Akron; Frank D. Smith, of Springville, Lawrence P. Meyer, of Bowmansville, and others.

Georgetown, Del.—See "Water."

Emporia, Kan.—Contracts for machinery for the electric light plant are stated to have been awarded as follows: machinery, to the General Electric Co., Schenectady, N. Y., $12,240; boiler, to Fairbanks, Morse & Co., St. Paul, Minn., $2,475, and heater to the E. G. T. Colles Co., for $805.

Spokane, Wash.—The Stockholders of the Washington Water Power Co. are stated to have ratified an increase in the capital from $2,000,000 to $2,600,000. The increase is for improvements here and extending the power line into the Coeur d'Alenes. It is estimated that the total cost, including the line into Idaho, will be $475,000. T. B. Fisken, Supt., Spokane.

Charles City, Ia.—The citizens are stated to have voted Aug. 8 to grant a franchise to the Charles City Electric Light & Htg. Co.

Norfolk, Va.—A charter has been granted to the People's Light & Power Co. to acquire real estate, to construct and operate suitable works and machinery for the manufacture and sale of electricity for power and illumination; capital, $50,000. John G. Tilton, Pres.; A. Brooke Taylor, Secy.

Stuttgart, Ark.—See "Water."

Blue Ridge, Ga.—City Clk. J. H. Davis writes that this city proposes to construct an electric light plant at a cost of $15,000.

ELECTRIC RAILWAYS.

Stockton, Cal.—H. H. Griffith, Local Supt. of the Alameda & San Joaquin R. R. Co., is stated to have petitioned the Bd. of Superv. for a franchise over several county roads running into Stockton.

Cleveland, O.—A press report states that the Northern Ohio Traction Co. is planning to expend about $250,000 for improvements to its system. Part of the road will be double tracked and new bridges will be constructed over the gorge of Cuyahoga Falls.

Santa Maria, Cal.—W. W. Barnes and J. T. Coffman, of Souoma, are stated to have petitioned the Bd. of Superv. for a franchise for an electric railway in Santa Maria.

Lansing, Mich.—It is stated that the management of the Michigan Suburban R. R. has decided to equip its line between this city and St. Johns with electricity.

Elwood, Ind.—The Lake Erie & Western R. R. Co. is stated to have decided to construct an electric railway from Elwood to Indianapolis and Noblesville. E. A. Handy, Ch. Engr., Cleveland, O.

New York, N. Y.—The Bd. of Aldermen has granted the Union Ry. Co., of N. Y. City, a franchise to extend its line on several streets and over Central or Macomb's Dam Bridge.

Richmond, S. I., N. Y.—The Richmond St. Ry. Co., of Richmond, has been incorporated, with a capital of $190,000, to operate the electric railway formerly controlled by the Staten Island Electric Ry. Co. Jas. F. Leavy, of Brooklyn, and John B. Summerfield, of Queens Boro., are among the directors.

Sioux City, Ia.—W. M. Jones, of Lafayette, Ind., is reported interested in the construction of an electric railway between Sioux City and Omaha, Neb.

Emaus, Pa.—The Perkiomen Traction Co. is reported to be securing a right of way for its proposed line of 30 miles from Emaus to Collegeville. Hugh E. Crilly, of Allentown, and Frank Reeder, of Easton, are among the directors.

Picton, Ont.—M. R. Allison, and others, of Picton, are stated to have secured a franchise for the construction of a street railway.

Sharon, Pa.—The Council is stated to have granted the East End St. Ry. Co., of Sharon, a right of way over certain streets.

Onawa, Ia.—T. P. Hord and F. Y. Keatun, of Davenport, are reported interested in the construction of an electric railway from Onawa to Sioux City.

Morristown, Ind.—Chas. L. Henry, representing the Rushville & Indianapolis Ry. Co., is stated to have secured a franchise.

Augusta, Me.—Articles of association have been approved by the State R. R. Comn. for 90 miles of electric railway by the Me. & N. H. Ry. Directors; Geo. B. James, of Boston; A. Crosby Kennett, Conway, N. H.; Edw. E. Hastings, Fryeburg, Me., and others. Capital, $400,000. Percy Richardson, of Portland, is making surveys.

Sherman, Tex.—Geo. Murphy, N. B. Birge and others have petitioned the Council for a franchise.

Mt. Vernon, O.—Dr. J. F. Shrontz is reported interested in the construction of an electric railway between Mt. Vernon and Newark, by way of Gambier and Martinsburg.

Los Angeles, Cal.—Bids are wanted by the City Clk. until Sept. 8 for electric street railway franchise, commencing at point on Pasadena Ave. and Marmion Way, thence along Ave. 63 to its intersection with Elgin St.

Phelps, N. Y.—The Town Trus. are stated to have granted a franchise to the Rochester & Eastern Rapid Transit Co. A. L. Parker, Mgr., Rochester.

Salamanca, N. Y.—The Salamanca & Little Valley Traction Co. is stated to have petitioned for a franchise to build a trolley line from the S. & B. Junction of the Buffalo, Rochester & Pittsburg R. R., through Salamanca and on to Little Valley, a distance of about 14 miles.

Eaton, O.—It is stated that the extension of the line of the Dayton & Western Traction Co., from Eaton, O., to Richmond, Ind., will be built before the end of the coming winter. V. Winters, Mgr., Dayton.

Bluefield, W. Va.—The City Council is stated to have granted V. V. Carter a franchise for an electric railway.

Ephrata, Pa.—The Farmers Mutual Electric Ry. Co. is stated to have been organized to construct an electric railway from Ephrata to Lincoln. Thos. A. Willson is reported interested.

Pittsburg, Pa.—Contracts are stated to have been awarded by the Pittsburg, McKeesport & Connellsville Ry. Co. to Jas. Stewart & Co., Second Natl. Bank Bldg., for the erection of 3 car barns, a machine shop and warehouse and about 6 sub-power stations to be located at various points along the line; total cost of buildings will be about $150,000 and work on their construction will be started at once.

North Adams, Mass.—The State R. R. Comrs. are stated to have granted the Hoosac Valley St. Ry. Co. permission to increase its capital from $100,000 to $400,000, to be used for improving and extending the line. W. T. Nary, Mgr., North Adams.

Watsonville, Cal.—W. J. Rogers is stated to have petitioned the Superv. for a franchise for an electric railway from Watsonville to Camp Goodall.

Steubenville, O.—The Steubenville, Mingo & Ohio Traction Co. is stated to have secured a franchise to build a direct line between Steubenville and Mingo, O., along the pike road, a distance of 3 miles. Before the road is constructed, it is reported, the company must expend $200,000 on a masonry road to support its roadbed.

Kansas City, Mo.—The Kansas City, Forest Hill & Swope Park Ry. Co. is stated to have petitioned the Co. Comrs. for a franchise over the county roads.

Marysville, Pa.—Ordinances are stated to have been introduced in the Boro. Councils of Marysville and Duncannon granting franchises to the Perry County St. Ry. Co. The company is reported to have secured a charter for an electric line to connect these two places.

Elkton, Md.—The City Council is stated to have granted the Kent-Cecil Light, Power & Ry. Co. a franchise to build and operate a trolley line in Elkton. E. A. Tennis, of Philadelphia, Pa., and H. M. McCullough, of Elkton, are among the incorporators.

Chestertown, Md.—The Co. Comrs. are stated to have granted the Baltimore & Chestertown Ry. Co. a franchise to construct an electric railway from Chestertown to Tolchester and Rock Hall.

Montreal, Que.—It is stated that the Montreal St. Ry. Co. will extend the eastern portion of the Notre Dame St. line to Loague Pointe, a distance of about 3 miles. F. L. Wanklyn, Gen. Mgr., Montreal.

Lexington, S. C.—A charter is stated to have been granted to the Lexington & Columbia Electric St. Ry. Co., which proposes to own and operate an electric street railway line between Columbia and Lexington, a distance of about 12 miles. Alfred J. Fox, Pres.; J. E. Kaufman, Secy.

Geneva, N. Y.—The Rochester & Eastern Rapid Ry. Co. is stated to have secured a franchise through the town. A. L. Parker, Mgr., Rochester.

Lewisberry, Pa.—The Lewisberry & Harrisburg Traction Co. is stated to have secured a right of way from Lewisberry to New Cumberland, a distance of 7 miles.

Washington, N. J.—The Council is stated to have granted a franchise to the Easton & Washington Traction Co.

Ft. Wayne, Ind.—The Ft. Wayne, Van Wert & Lima Traction Co. has been incorporated, with a capital of $2,000,000. Henry C. Paul, of Ft. Wayne; Jas. Murdock, of Lafayette, and D. J. Cable, of Lima, are among the incorporators. Mr. Cable is stated to have secured a private right of way between the cities named, with a franchise to Bryan and Hicksville, O.

New Rochelle, N. Y.—The City Council is stated to have granted a franchise to the Westchester Electric Ry. Co. to extend its line on Webster and Mayflower Aves.

Michigan City, Ind.—The Chicago & South Shore Ry. Co. is stated to have petitioned the Council for a franchise.

Oneida, N. Y.—The Oneida Ry. Co. is stated to have filed with the Secy. of State a certificate authorizing the extension of its line from Oneida to Sullivan, through Lenox and Canastota, a distance of 8 miles. G. Leggett, Supt., Oneida.

Lafayette, La.—The City Council is stated to have granted the McIlhenny Electric Ry. Co. right of way through several streets.

Killingly, Conn.—The State R. R. Comrs. are stated to have approved the construction plans of the Danielson & Norwich St. Ry. Co. for an extension of its line from Killingly, through Falls Brook to Central Village.

Galesburg, Ill.—The Council is stated to have granted a franchise to the Galesburg & Oneida Electric St. Ry. Co.

Texarkana, Tex.—The Texarkana Traction Co. is stated to have been organized, with a capital of $100,000, by E. J. Spence and T. W. Crouch, of St. Louis, Mo., and J. S. Tritle and R. W. Rodgers, of Texarkana, to construct, equip and operate a street railway in Texarkana, Tex., and vicinity.

Ft. Worth, Tex.—The Citizens' Electric Ry. Co. is about to petition the Council for a franchise. Col. J. T. Voss is reported interested.

Cincinnati, O.—The Cincinnati, Milford & Eastern Traction Co., of Cincinnati, has been incorporated, with a capital of $10,000, by Sumner B. Day, Geo. H. Chamberlain and others, to construct an electric railway from the end of the line of the Cincinnati Traction Co. in Eastern Ave., through Terrace Park to Milford.

RAILROADS.

Los Angeles, Cal.—The Ludlow & Southern R. R. Co. is reported incorporated, with a capital of $25,000. Chas. Wier and Walter Rose, of Los Angeles, are among the directors.

Tacoma, Wash.—A press report states that the Great Northern Ry. (J. J. Hill, Pres. St. Paul, Minn.) and the Northern Pacific Railway (W. L. Darling, Chief Engineer, St. Paul, Minn.) will expend about $3,000,000 in improvements, including double tracks from Tacoma to Seattle and Everett, a total distance of 70 miles, and new stations at Tacoma and Seattle.

Knoxville, Tenn.—The contract for the construction of the Knoxville, La Follette & Jellico R. R., the Louisville & Nashville extension into Louisville from La Follette to Beaver Ridge, near Knoxville, 28 miles, is reported to have been awarded to Mason & Hoge, of Lexington, Ky., and St. Louis, Mo., and Walton & Co., of Roanoke, Va. It involves about $1,000,000.

Charleston, W. Va.—The Elk River, Falling Rock & Gauley Ry. Co. is reported incorporated here to construct a railroad from the mouth of Falling Rock Creek, in Kanawha County, to the mouth of Twenty-Mile Creek, in Nicholas County, W. Va. Headquarters to be at Charleston.

Georgetown, La.—The Little River Valley Ry. Co. is reported organized with a capital of $500,000, to construct a standard gauge railroad from Georgetown in a northerly direction, through the parishes of Grant, Winn and Catahoula.

Los Angeles, Cal.—A press report states that the Santa Fe R. R. Co. will rebuild about 176 miles of track in California, Arizona and New Mexico. A. G. Wells, Gen. Mgr., Los Angeles.

Sioux Falls, S. D.—The Sioux Falls & Manitoba Ry. Co. has been incorporated, with a capital of $2,600,000, to construct a railroad from Sioux Falls to Madison, a distance of 50 miles. Directors: B. F. Sherman and J. F. Sherman, of Sioux Falls; J. E. Colton, of Colton, and others.

The Dalles, Ore.—A company is stated to have been formed here, with a capital of $500,000, to construct a railroad between The Dalles and Biggs. Walter H. Moore of Moro, and Jos. T. Peters, of The Dalles, are among the incorporators.

Des Moines, Ia.—The Continental Ry. Co., of Des Moines, has been incorporated, with a capital of $100,000, to construct a railway north and south through Iowa; also from the north line of Minnesota, near the Lake of the Woods, to Kansas City. W. T. Smith, Pres., and G. W. Filloon, Secy., both of Des Moines.

Towanda, Pa.—The Dirs. of the Susquehanna & New York R. R. Co. are stated to have voted to issue $2,000,000 bonds to build an extension from Towanda to Binghamton, N. Y.

Pittsburg, Pa.—See "Business Buildings."

New Alexandria, O.—Douglass Bros. of New Alexandria, will let about 1 mile of their Wabash contract, of which 125,000 cu. yds. is fine steam shovel work, and 60,000 cu. yds. scraper and small car work.

Baltimore, Md.—The Western Maryland R. R. Co. is stated to have purchased 125 acres of land in South Baltimore for terminal purposes, and it is said work will be begun immediately on improving the property for railroad purposes. The site is located west of Fort McHenry, on the Middle branch of the Patapsco. The Patapsco will probably be bridged. J. M. Hood, Gen. Mgr., Baltimore.

PUBLIC BUILDINGS.

Yorkton, N. W. Ter.—Bids are wanted Aug. 23 for erecting a court house at Yorkton. Fred Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont.

Akron, O.—Local press reports state that bids will be received by the Library Bd. until Aug. 21 for erecting a library.

New York, N. Y.—Bids will be received until Aug. 19 by Homer Folks, Comr. of Pub. Charities, for furnishing material and installing a heating apparatus in the City Hospital, Blackwell's Island. Bids will also be received at the same time for furnishing and erecting new and making alterations to old fire escapes on various buildings at Randall's Island.

Akron, O.—The St. Paul's Episcopal Society is reported to be preparing to erect a $40,000 church and rectory.

Pueblo, Colo.—It is stated that a new edifice will be erected by the Peoples Church at a cost of $40,000. Rev. A. A. Hoskin, Pastor.

New York, N. Y.—The contract for erecting the new house for Engine Co. No. 62, at White Plains Road and Julianna St. is stated to have been awarded to Laurence J. Rice, 396 Bway., for $34,735.

Elizabeth, N. J.—The John R. Parker Co., 253 Bway., New York, N. Y., is stated to have secured the contract for erecting the Union Co. Court House for $488,778.

St. Paul, Minn.—The Bd. of State Capitol Com. are stated to have postponed opening bids for interior stone and marble work for the Minnesota capitol until Dec. 2.

New York, N. Y.—The Mayor has approved the ordinance providing for the issue of $39,000 bonds for the construction of a dormitory in the Medical College Bldg. for the employees of Bellevue and Allied Hospitals.

Brooklyn, N. Y.—The Mayor has approved an ordinance providing for the issue of $150,000 bonds for the completion of an addition to the Brooklyn Institute of Arts and Sciences.

Annapolis, Md.—The contract for wrecking the present annex to the State House and erecting the new annex is stated to have been awarded to Henry Smith & Sons, 116 Regester St., Baltimore, for about $431,672.

Washington, D. C.—The committee supervising the erection of a church for the congregation of the Foundry M. E. Church is reported to have invited a number of architects to submit sketch plans for the proposed structure; $145,000 is available for the church, parsonage and site.

Newark, N. J.—E. M. Waldron & Co., of Newark, are stated to have secured the contract for completing the $1,000,000 R. C. Cathedral of the Sacred Heart, now in course of erection at 5th and Clifton Aves.

Marquette, Mich.—The contract for erecting the Marquette Co. Court House is stated to have been awarded to the Northern Construction Co., of Milwaukee, for $118,563.

Hoffman Island, N. Y.—Bids are wanted Aug. 28 for piping and repairs to steam plant, pipe covering, setting 2 new boilers and piping and heating in cabin passenger quarters at the Upper Quarantine Station. Fred. H. Schroeder, Pres. Bd. of Quarantine Comrs., 115 Bway., New York City.

Cleveland, O.—Bids are wanted Sept. 6 for erecting an Acute Hospital building on site designated at Cleveland State Hospital. Frank L. Packard, Archt., Columbus, O. A. B. Howard, M. D., Secy. Bd. of Trus.

Sheboygan, Wis.—Bids are wanted Sept. 10 for the erection of a public library. Francis Williams, Secy. Library Bd. Approximate cost of building, $35,000.

Chattanooga, Tenn.—The Walnut St. Hebrew Society is stated to have decided to erect a $25,000 synagogue.

Bottineau, N. D.—Bids are wanted Aug. 22 by the Bd. of Co. Comrs. for jail cells. N. P. Nordin, Co. Aud.

New York, N. Y.—Bids are wanted Aug. 26 for erecting a building at Beekman and William Sts. Thos. Sturgis, Comr. of Fire Dept.

Monson, Mass.—Bids are wanted Aug. 29 at the office of Kendall, Taylor & Stevens, Archts., 93 Federal St., Boston, by the Trus. of the Mass. Hospital for Epileptics (railroad station Palmer, Mass.), for constructing (exclusive of heating, plumbing and lighting) buildings for Nurses' Home, and electric plant for said hospital at Monson. Wm. N. Bullard, Chmn. Bd. of Trus.

Scotch Ridge, O.—Bids are wanted Aug. 30 for building a church. R. S. Davidson, Secy. Trus. of the U. P. Church.

Ada, Minn.—Press reports state that the time for receiving bids for erecting the Co. Court House, both including and not including the heating and plumbing, has been extended from Aug. 8 to Aug. 25. Louis Pfund, Chmn. Co. Comrs.

Cincinnati, O.—Bids will be received by the Bd. of Trus. of the Pub. Library of the School Dist. until Sept. 9 for $180,000 library bonds. Drausin Wulsin, Pres.

Pleasant Plains, Ia.—Bids will be received by B. Jacobsmeier, Washington, Ia., until Aug. 19, for erecting a R. C. church in this city.

Laconia, N. H.—The contract for the State Home for Feeble Minded Children has been awarded to J. H. Mendell & Co., Manchester, N. H. McFarland, Colby & McFarland, of Boston, Mass., Architects.

Pittsburg, Pa.—A press report states that the American Steel & Wire Co. will erect a hospital on the grounds of each of its 22 plants; the buildings and equipment will cost about $300,000.

Columbus, O.—The plans of Albert R. Ross, 156 5th Ave., New York, N. Y., are stated to have been accepted for the Columbus public library.

Great Falls, Mont.—Stoddard & Smith, of Butte, are stated to have secured the contract for erecting the Carnegie Library, for $24,893.

New York, N. Y.—The Municipal Art Comn. is stated to have approved the plans of Consulting Archt. Aiken, for alterations to the City Hall to cost $25,000, and for 3 public baths, 2 in the Boro. of Manhattan and 1 in the Boro. of Brooklyn.

Brattleboro, Vt.—It is stated that plans have about been completed for the Thomas Thompson Hospital, to cost about $50,000.

New York, N. Y.—Bids will be received by Thos. Sturgis, Fire Comr., until Aug. 28 for furnishing material and erecting an engine house on Sedgwick Ave. and 178th St., Boro of Bronx.

Manchester, Ia.—It is stated that bids are wanted Aug. 20 for erecting a library. H. W. Tuttle, Manchester, may be addressed. Hallett & Rawson, Archts., Des Moines.

Buffalo, N. Y.—The lowest bid opened Aug. 12 for erecting the 65th Regt. Armory is reported to have been submitted by Moiser & Summers, of Buffalo, for $610,000.

Hobart, Okla. Ter.—J. W. Stokes is stated to have secured the contract for erecting the Kiowa County Court House, for $30,000.

Miami, Fla.—Bids will be received by E. C. Dearborn, Clk. of Circuit Court, until Oct. 7 for erecting a court house. Wilson & Edwards, Archts., Columbia, S. C.

Muskegon Heights, Mich.—Bids are wanted Aug. 27 for erecting a city hall. D. W. Valentine, Chmn. Village Council.

Worthington, Minn.—Bids are wanted Aug. 20 for erecting the M. E. Church. John Scott, Chmn. Bldg. Com.

BUSINESS BUILDINGS.

Columbus, Ga.—Bids are wanted Sept. 3 for the construction of a Y. M. C. A. building at Columbus, in accordance with plans and specifications on file in the office of T. W. Smith and T. F. Lockwood, of Columbus. L. H. Chappell, Chmn. Bd. of Trus.

Rutland, Vt.—The Rutland R. R. is preparing to commence work on the new station. Address W. Seward Webb, Shelburne, Vt.

Ishpeming, Mich.—Charleton, Gilbert & Demar, Marquette, are the architects for a $15,000 office building for the Lake Superior Iron Co.

Denver, Colo.—The University Club is about to build an $18,000 brick and stone club building at 17th and Grand Sts.

Kansas City, Mo.—It is stated that the Western Methodist Book Co. will erect a 7-story building on Baltimore Ave. and 10th St., to cost about $200,000.

A $12,000 addition is to be built to the store of M. B. Campbell at 1422 and 1424 St. Louis Ave.

Jacksonville, Fla.—J. H. W. Hawkins is stated to be preparing plans for a 4-story brick and stone business block to be erected on Bay and Laura Sts., to be occupied by the Fetting Furniture Co.

Minneapolis, Minn.—F. B. and L. L. Long, 605 Kasota Bldg., are stated to have prepared plans for erecting a $35,000 office building for the Minneapolis Gas Light Co. on 7th and Nicollet Sts.

Buffalo, N. Y.—Bethune, Bethune & Fuchs, 47 W. Chippewa St., are stated to have prepared plans for a 7-story brick and steel hotel which Walter B. Duffy, of Rochester, will erect on Washington and Clinton Sts., to cost about $700,000.

Jersey City, N. J.—A 6-story warehouse owned by the National Storage Co., on Black Tom Island, is reported to have been destroyed by fire Aug. 9.

Paducah, Ky.—The Paducah Masons and Odd Fellows are stated to have decided to erect a fraternity building on 5th St. and Bway., to cost about $50,000.

Altoona, Pa.—The Opera House Block is stated to have been destroyed by fire Aug. 10.

Fond du Lac, Wis.—The Elks Assoc. is stated to have decided to erect a club house, to cost about $30,000. W. C. Reinit, Chmn. Bldg. Com.

Paterson, N. J.—John W. Ferguson, of Paterson, is stated to have secured the contract for erecting a building to be occupied jointly by the Paterson Natl. Bank and the Paterson Safe Deposit & Trust Co., to cost about $325,000.

Annapolis, Md.—O. C. Gottschall is stated to have prepared plans for an opera house, to cost about $15,000.

Pittsburg, Pa.—The Pennsylvania R. R. Co. is reported to be surveying land for a new station in the East End, Pittsburg, to replace the East Liberty Station. Many changes are to be made in the grade, and some curves are to be straightened. Robt. T. Patterson, Gen. Supt. Terminals, Pittsburg.

San Francisco, Cal.—Albert Pissis, 307 Sansome St., is stated to have prepared plans for a 5-story building to be erected on Mission and 3d Sts. for the Wilcox Realty Co., to cost about $125,000.

Thos. Walsh is stated to have prepared plans for a 7-story building for the Italian American Bank, to be erected on Montgomery and Sacramento Sts., to cost about $225,000.

Denton, Md.—Bids are wanted Aug. 26 for erecting a brick building for the Denton National Bank. T. C. West, Cashier.

Richmond, Va.—W. A. Chesterman, of Richmond, has secured the contract for erecting a $25,000 addition to the Westmoreland Club House.

F. Sitterding has secured the contract for erecting the Horse Show Bldg. for $30,000.

Rochester, N. Y.—It is stated that Vreedenberg & Co., lithographers, propose erecting a 6-story building on South Ave. and Capron St., to cost $40,000.

St. Louis, Mo.—Permits are stated to have been issued to the Forest City Bldg. Co. for the erection of a 7-story hotel on Washington Ave. and King's Highway, to cost about $300,000, and to the Missouri Furniture Co. for an addition to a factory to cost about $30,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

327 to 331 E 11th St, br stores & tenemts; c, $45,000; o, Lapin & Baum; a, Bernstein & Bernstein.

36 to 42 Bway, br, stone & terra cotta office bldg; c, $2,250,000; o, The Forty-Two Bway Co, Wm P Jeffery, Pres; a, Henry Ives Cobb.

353 & 355 W 17th St, br club house; c, $50,000; o, Theo B Starr; a, John H Duncan.

32d St & 5th Ave, br hotel; c, $550,000 o, The Old Colony Co; a, Harry B. Mulliken.

225 & 227 W 35th St, br lodging house; c, $40,000; o, Children's Aid Society; a, Vaux & Emery.

55 & 57 W 44th St, br club house; c, $160,000; o, City Club Realty Co; a, Lord & Hewlett.

3d Ave & 161st St, br stores & tenemt; c, $25,000; o, Rosalio Coniglio; a, Bronx Architectural Co.

Franklin & Leonard Sts, improvements; c, $22,500; o, August C Bechstein: a, Franklin Baylies.

Brooklyn, N. Y.

51st St & 4th Ave, br telephone exchange; c, $30,000; o, N Y & N J Telephone Co; a, W B Claflin.

Flatbush & Lafayette Aves, add 9 stories to br warehouse; c, $45,000; o, L L Firuski; a, J. G. Glover.

Washington & Johnson Sts, br extension; c, $215,000; o, Brooklyn Daily Eagle; a, G L Morse.

DWELLINGS.

Wilmington, Del.—N. H. Cloud, 228 Shipley St., is the architect for 8 dwellings to be built at 5th and Broome Sts. for Jas. B. Oberly. Cost, $25,000.

Denver, Colo.—D. C. Dodge is about to build a 2-story brick and stone flat on 12th Ave. and E. 15th St. Cost, $21,000. Architect, A. J. Norton.

Chas. Quayle, of Denver, is the architect for a 3-story brick and stone flat to be built by a Syndicate Co. at 1305 Grand St. Cost, $35,000.

St. Louis, Mo.—Permits have been issued for the erection of a dwelling at 5045 Lindell Boule. for Mrs. M. J. Green, to cost about $110,000, and for a residence for Mrs. Emma C. Copelin at 5154 Westmoreland Pl., to cost about $50,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

323 & 325 Bleecker St, br tenemt; c, $42,000; o, Jacob Cohen; a, Geo F Pelham.

334 & 336 E 13th St, br tenemt; c, $50,000; o, Chas I Weinstein; a, Geo F Pelham.

Ave A & 68th St, br apartment; c, $70,000; o, Central Brewing Co; a, Wm Mortensen.

Jumel Pl & Edgecombe road, br tenemt; c, $35,000; o, Frederika Radler; a, Henri Fouchaux.

Madison Ave & 72d St, improv to br dwellg; c, $30,000; o, Louis C Tiffany; a, Andrew J Robinson Co.

SCHOOLS.

Bridgeton, N. J.—Bonds to the amount of $25,000 are stated to have been sold for erecting a school in the 2d Ward.

Connersville, Ind.—The School Bd. is stated to have purchased a site on Houston Sq. for the erection of a $30,000 school.

Grand Rapids, Minn.—The plans of F. D. Orff, of Minneapolis, are stated to have been accepted for a high school.

Burlington, Vt.—R. B. Willcox, 135 College St., is stated to be preparing plans for an 8-room school to be erected on Archibald St. and Intervale Ave., to cost $25,000.

Columbus, O.—The Trus. of the State Univ. are stated to have approved plans for the Engineers Building, to cost about $80,000.

Wilkinsburg, Pa.—Bids are wanted Aug. 23 for constructing a 14-room school for the 1st Ward. H. M. Henning, Secy. School Bd.

Philadelphia, Pa.—Local press reports state that Architect Cook will receive bids Sept. 2 for a 12-division addition to the Pastorius School in Germantown, and for a 15-division school at D and Clearfield Sts.

Mobile, Ala.—The plans of Architect Smith, of Montgomery, are stated to have been accepted for a $35,000 school. It will probably not be erected until after Jan. 1.

New Britain, Conn.—Bradley & Chapman, of Hartford, are stated to have secured the contract for remodelling the heating and ventilating apparatus of the high school, for $4,000.

Ruthven, Ia.—Bids are wanted Sept. 3 at the store of Ed. F. Ahrens, Ruthven, for the erection of a school in the east half of Dist. No. 4, Highland Township. A. J. Ennis, Secy.

Manzanola, Colo.—Bids are wanted by the School Bd. of Dist. No. 3 at the office of Beaty Bros., Manzanola, until Sept. 1 for building an addition to the school in said Dist. R. O. McClain, Secy.

Des Moines, Ia.—Louis H. Schneider, of Boston, has asked the City Council for a franchise giving his company exclusive right for a period of years to the garbage of this city, with a view to establishing a crematory in Des Moines, at a cost of $50,000 to $100,000.

GOVERNMENT WORK.

Annapolis, Md.—Bids are wanted Sept. 3 for dredging at the U. S. Naval Academy, Annapolis. H. C. Taylor, Ch. of Bureau of Navigation, Navy Dept., Washington, D. C.

Brooklyn, N. Y.—Bids will be received at the Navy Dept. until Sept. 10 for furnishing steel for use in building the battleship "Connecticut" at the Navy Yard, Brooklyn. Chas. H. Darling, Acting Secy. of the Navy.

New Orleans, La.—The following bids were opened July 28 by Maj. Geo. McC. Derby, Corps of Engrs., U. S. A., for levee work:

Bidders and Addresses.	Rossland Levee, 86,600 cu. yds.	Excelsior Levee, 86,600 cu. yds.	Wildwood Levee, 77,200 cu. yds.	Wildwood Levee, Line A, 95,000 cu. yds.	Home Place Levee, 76,700 cu. yds.	Home Place Levee, Line A, 95,000 cu. yds.	Ashland Levee, 58,200 cu. yds.	Ashland Levee, Line A, 74,000 cu. yds.	Ashland Levee, Line B, 67,000 cu. yds.
	cts.	cts.	cts.	cts.	cts.	cst.	cts.	cts.	cts.
Bat O'Brien, Darrow, La.	13.98	14.42	14.72	16.98	14.98	16.98	13.73	16.99	13.99
Helgason Bros., Vicksburg, Miss.	14.95	14.95	15.95	.....	14.95	.....	14.95	.....	14.95
J. R. Bobbitt, Cofield, La.	13.9	14⅓	14.4	.....	14⅓	.....	[illegible]	.....	[illegible]
Thompson & Powell, Waggaman, La.	15½	15½	14⅝	15	15½	15½	14½	14⅝	15.00
Donovan & Daley, Bougere, La.	12.7	13⅞	14⅞	15½	13.4	14.4	12.7	13.7	12.7
M. L. Linnan, Lauderdale, La.	14.74	14.74	14.99	16.00	16.24	16.24	14.97	14.97	14.97

Bids were also received on *a*, Cane Brake Levee, about 69,700 cu. yds.; *b*, Shamrock Levee, about 69,000 cu. yds.; and *c*, Vancluse Levee, about 68,200 cu. yds.: Helgason Bros., *a* 19.90 cts., *b* 36 cts., *c* 17.46 cts.; J. R. Bobbitt, *a* 21 cts., *c* 19 cts.; Jas. R. Marlow, Union, La., *c* 15.49 cts. (awarded).

Chicago, Ill.—Bids are wanted Aug. 22 for the following work in Cottage of Parental School, N. St. Louis Ave.: masonry, cut stone, terra cotta, sheet metal and the roofing, structural iron, fireproofing, steam heating, ventilating, plumbing, etc. W. B. Mundie, Archt. of the Bd.

Fond du Lac, Wis.—Bids are wanted Aug. 19 for installing a heating system in Lincoln School. E. A. Bartlett, City Clk.

Dowagiac, Mich.—The contract for erecting the high school is stated to have been awarded to G. Nordella, of Grand Rapids, for $26,540.

New York, N. Y.—The Children's Aid Society has filed plans for the erection of a 4-story school, to be erected on 38th St. and 9th Ave., to cost $40,000. Architects, Clinton & Russell, 32 Nassau St.

Hoboken, N. J.—Contracts for erecting No. 8 school are stated to have been awarded as follows: Carpenter work, Robt. Rath, 259 6th St., $26,483; masonry, Farrell & Sons, $48,687, and plumbing, T. Hasley, $5,593.

Providence, R. I.—Press reports state that 4 new buildings will be erected at the Brown Univ. as follows; the John Carter Brown Library of America, to cost $150,000: a Y. M. C. A. building, the gift of John D. Rockefeller, Jr., to cost $75,000; a mechanical engineering building, to cost $100,000, and a dormitory 4 stories high 120x150 ft.

Harrisburg, Pa.—Henry Schuddemage, of Harrisburg, is stated to have secured the contract for erecting the Camp Curtin School, for $88,900.

South Norwalk Conn.—The plans of S. M. Holden, of Paterson, N. J., are stated to have been accepted for a school to cost about $33,000.

Oconto Falls, Wis.—Bids are wanted Aug. 20 for erecting a 2-story and basement brick High School. E. A. Edmonds, Chmn. Bldg. Com.

South Manchester, Conn.—Beatty & Wilcox, of Fall River, Mass., are stated to have secured the contract for erecting the high school which Cheney Bros. will present to the city; probable cost, $100,000.

La Salle, Ill.—It is stated that plans will be received by the Bd. of Educ. until Sept. 1 for a school. Address, Thos. N. Haskins.

Cumberland, Wis.—It is stated that bids are wanted Aug. 29 for erecting a high school. I. G. Babcock, Secy. Bd. Educ.

Harrison, O.—Bids will be received until Aug. 21 by the Village Bd. of Educ., Dist. No. 5, for installing a hot water or steam heating system in the public school. W. E. Taylor, Clk.

Pasadena, Cal.—The citizens are stated to have voted to issue $100,000 bonds for a high school.

Boston, Mass.—Bids are wanted by the City Schoolhouse Comrs. until Aug. 21 for erecting a Grammar School on Columbia Road, Dorchester. Bids will also be received, separately, at the same time, for electric work and fixtures; heating and ventilating; and installing a plumbing system and fixtures in said school. Bids are wanted Aug. 22 for mason, carpentry and other work in Sherwin School, Roxbury and for mason, carpentry and other work in connection with strengthening floors in Lyman School, East Boston. R. Clipston Sturgis, Chmn.

STREET CLEANING AND GARBAGE DISPOSAL.

Newark, N. J.—City Engr. Ernest Adam writes that the contract for garbage collection and disposal has been awarded to Benjamin Meyer. For bids received July 17 see The Engineering Rcord of July 26.

Atlanta, Ga.—Bids are wanted Sept. 10 for the collection of all garbage and nightsoil of the city for a period of 4 years, from Jan. 1, 1903; bids are also wanted for the cremation of all garbage and nightsoil for 5 years. Dr. E. H. Richardson, Secy. Bd. of Health; Dr. B. W. Bizzell, Chmn. Com. on Destruction of Garbage.

Brooklyn, N. Y.—Bids are wanted Aug. 25 for the collection and removal of garbage in this Boro. for 1 year. F. M. Gibson, Deputy and Acting Comr. of Street Cleaning, New York City.

Rankin, Pa.—The Rankin Council is said to have decided to co-operate with other towns of the Monongahela and Turtle Creek valleys in the erection of a garbage furnace. Braddock, North Braddock, Turtle Creek and East Pittsburg have consented to bear a share of the erection of the furnace.

Haughton, Mich.—The Council is considering the question of garbage disposal by cremation.

Sharon, Pa.—The South Sharon Garbage & Const. Co. has asked the Council for the privilege of caring for city garbage for the next 15 years.

Louisville, Ky.—Bids are wanted at the U. S. Engineer Office until Sept. 6 for office and warehouse buildings at Locks 2 and 3, Green River, Ky. Maj. E. H. Ruffner, Corps of Engrs., U. S. A.

Boston, Mass.—Bids are wanted Sept. 13 for dredging Merrimac River, Mass. Capt. Harry Taylor, Corps Engrs., U. S. A.

Wilmington, Del.—Bids are wanted Sept. 11 for dredging in Mispillion, Murderkill and Appoquinimink Rivers, Del. Col. Jared A. Smith, Corps Engrs., U. S. A.

MISCELLANEOUS.

Portland, Ore.—Bids are wanted Sept. 25 for all machinery for the sectional wooden dry dock for the port of Portland, embracing centrifugal pumps, piping and valves, electric motors and wiring, etc., for same. Jas. E. Blackwell, Consulting Engr., Dexter Horton Bldg., Seattle, Wash. E. T. C. Stevens, Clk. of Bd.

New York, N. Y.—Bids are wanted Aug. 28 by the Comr. of the Dept. of Correction, Thos. W. Hynes, for the erection of a stone wall to complete the enclosure of the entire block and prison buildings on Leonard, Elm and Franklin Sts. The amount of security required is $100,000.

Larry's River, N. S.—Bids are wanted Aug. 22 for constructing a breakwater at Larry's River. E. G. Millidge, Resident Engr., Antigonish, N. S. Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa.

Quebec Harbor, Que.—Bids are wanted Aug. 22 for the construction of crib work, concrete and pile work, in Quebec Harbor. Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont.; H. A. Gray, Res. Engr., Confederation Life Bldg., Toronto, Ont.

New York, N. Y.—The Mayor has approved the ordinance providing for the issue of $409,000 bonds for park work, to be divided as follows: Boro. of Manhattan and Richmond, $285,000; Boro. of Brooklyn and Queens, $100,000; Boro. of Bronx, $24,000.

Syracuse, N. Y.—Plans of City Engr. Frank J. Schnauber for proposed improvement of Onondaga Creek, in center of the city, provide for a bridge at W. Onondaga St. to cost $12,000, the remaining $28,000 of the amount appropriated to be expended mostly in excavating.

Buffalo, N. Y.—Press reports state that the Lackawanna Steel Co. is preparing plans for the construction of a breakwater, estimated to cost about $2,000,000.

New Iberia, La.—Surveys are said to have been completed under the supervision of Walter Kemper, for the proposed Bayou Carlin navigable canal, to be 14 miles in length and extend from this city to the gulf.

NEW INDUSTRIAL PLANTS.

The Raven Lake Portland Cement Co., 16 King St. W., Toronto, Ont., is considering the erection of a plant to have a daily capacity of 1,200 bbls., and expects to install a power plant of 2,000 H.-P. It is intended to use electric power generated by water.

The White Star Portland Cement Co., 15 Atwater St., Detroit, Mich., will erect a plant to have a daily capacity of 1,000 bbls. About 1,200 H.-P. will be required, half of which will be furnished by water, and the balance by engines. Electrical transmission of power will be installed.

The Standard Tin Plate Co., Canonsburg, Pa., is preparing to erect an 8 mill plant.

The Derby Cotton Mill, Shelton, Conn., is erecting a 3-story, 64x40-ft. addition.

The Pacific Shade Cloth Co., Oakland, Cal., is erecting a 50x200-ft. factory, which will be run by electric power.

The Faulk Bros. Co., E. Liverpool, O., is erecting a 3-story and basement, 40x100-ft. flour mill at Chester, W. Va., to have a daily capacity of 60 bbls.

The Henderson, Ky., Elevator Co. has let contracts to the Reliance Mfg. Co., Indianapolis, Ind., for the erection of a 40x60-ft. elevator, with a capacity of 45,000 bu., and a 48x160-ft. warehouse. The power plant will be 80 H.-P.

BUSINESS NOTES.

The Capewell Horse Nail Co., Hartford, Conn., has let a contract to The Berlin Construction Co., Berlin, Conn., for a 3-story, 350x100-ft. factory to replace that recently burned. The building will be of brick and steel, with concrete floors and roof.

T. A. Budd, 610 Ellicott Square, Buffalo, N. Y., has been appointed sole agent for Western New York for the We-Fu-Go and Scaife water-softening and purifying systems, which are manufactured by Wm. B. Scaife & Sons Co., Pittsburg, Pa.

The contracts for the new plant of the Cleveland Pneumatic Tool Co. have been awarded to J. A. Reaugh & Son, of Cleveland, O., who expect to have it ready for operation within 90 days.

The S. Obermayer Co., Cincinnati, has contracted for a 3-story 60x80-ft. addition to its plant for making foundry supplies.

Improved gravity concrete mixers made by the Contractors' Plant Co., Boston, are employed on three dams now building in the South. Two are used at Portman Shoals by the Flynt Bldg. & Construction Co., two by the Catawba Power Co. and several by the Bibb Mfg. Co.

Westinghouse, Church, Kerr & Co. report receiving recently the following orders for Roney automatic stokers: Lackawanna Iron & Steel Co., Lebanon, Pa., two 93x20-in. grate automatic stokers; Narragansett Electric Light & Power Co., Providence, R. I., twelve 132x22-in. grate stokers to operate under B. & W. boilers and be driven by a Westinghouse induction motor and a Westinghouse standard engine; Indianapolis, Ind., Light & Power Co., twelve 54x20-in. and eight 84x24-in. grate stokers; Jones & Laughlins, Pittsburg, Pa., sixteen 120x24-in. and six 100x20-in. grate stokers; United Railways & Electric Co., Baltimore, Md., ten 132x22-in. grate stokers; Peacedale, R. I., Mfg. Co., several sizes, aggregating six complete stokers; Solvay Process Co., Detroit, Mich., six 120x20-in. grate stokers; U. S. Navy Yard, Portsmouth, N. H., two 100x20-in. grate stokers; Pittsburg, Pa., Railways Co. four 100x18-in. grate stokers for the Allegheny plant, and two 100x20-in. grate stokers for its Birmingham station.

The Philadelphia Pneumatic Tool Co. reports an unprecedented rush of business, and that its manufacturing capacity is taxed to the utmost. The increasing demand for the Keller rotary drills is a particularly noticeable feature. Four large steel companies have recently purchased Keller tools to the aggregate number of 237; a Western trunk line has recently contracted for at least 1,500 Keller tools within the next eight months, and a cable order for Keller tools was received last week from Bilbao, amounting to several thousand dollars.

On Aug. 15 a greater portion of the interior of the office of P. & F. Corbin, New Britain, Conn., was destroyed by fire. The Purchasing and Sales Department suffered the heaviest losses, many papers relating to orders being consumed, together with the entire collection of catalogues of the Purchasing Department of the American Hardware Corporation. Manufacturers are requested to send copies of their catalogues to the purchasing agent, A. N. Abbe, to replace those lost.

The John Davis Co., Chicago, is erecting a plant which will just about double its present output. It will have frontages of 445 ft. on 22d St., 169 on Halsted and 566 on Union St. It will be reached by spur tracks of the C. B. & Q. Ry. and also a slip from the Chicago River. The office and warehouse building will be 165x175 ft.; the blacksmith shop and brass foundry, 50x100 ft., and the pipe shop, machine shop and testing rooms, 150x250 ft. and 2 stories high. In addition there will be a foundry, pipe sheds, pattern shops and pattern storage rooms. All buildings are brick. The company expects to occupy the new quarters about Nov. 1, and all departments will be electrically operated.

The Stanley Instrument Co., Great Barrington, Mass., has let contracts for an extension of its main office building of about 40 ft. square on the ground floor and 40x80 ft. on the second floor and a 30x90 ft. power house and cleaning building. The power plant will be electrical and the present steam power plant will be rearranged and used as an auxiliary.

PRCPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Aug. 18. Blakely, Ga. ....July 26
Adv., Eng. Record, July 26 to Aug. 16.
Aug. 18. North Hempstead, N. Y. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Aug. 19. Westervil.e, O. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Aug. 20. Ithaca, N. Y. ....July 26
Aug. 21. Zelienople, Pa. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 21. Chimney, Cleveland, O. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 21. Dam, Cheyenne, Wyo. ....Aug. 2
Aug. 21. Manning, Ia. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 22. Dam, Grinnell, Ia. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 22. Ft. Barrancas, Fla. ....Aug. 2
Aug. 25. Dam, etc., Charleston, S. C. ....Aug. 16
Adv., Eng. Record, Aug. 9, 16.
Aug. 25. Joliet, Ill. ....Aug. 16
Aug. 28. New London, Wis. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 28. Danville, Ill. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 29. Redfield, S. D. ....Aug. 9
Sept. 1. Engine, Kansas City, Mo. ....Aug. 16
Sept. 1. Mendota, Ill. ....Aug. 16
Sept. 1. Dam, Ithaca, N. Y. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 2. Portsmouth, O. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 4. Farmington, Mo. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 5. Engine and boiler, Milwaukee, Wis. ...July 19
Sept. 6. Pipes, Washington, D. C. ....Aug. 9
Adv., Eng. Record, Aug. 9.
Sept. 6. Gates, valves, Washington, D. C. .....Aug. 2
Adv., Eng. Record, Aug. 2.
Sept. 8. Los Angeles, Cal. ....Aug. 16
Sept. 9. Houma, La. ....Aug. 9
Oct. 15. Chicago, Ill. ....Aug. 16
Dec 1. Pumps, Seguin, Tex. ....July 26
—— Franchise, Whitesboro, Tex. ....Aug. 16
—— Pumps, etc., Weatherford, Tex. ....Aug. 9
—— Elgin, Tex. ....Aug. 9

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 19. Camden, N. J. ....Aug. 16
Aug. 19. New York, N. Y. ....Aug. 16
Aug. 20. Bridgeport, Conn. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 20. Brooklyn, N. Y. ....Aug. 9
Aug. 21. Danville, Ill. ....Aug. 16
Aug. 21. Montreal, Que. ....Aug. 16
Aug. 21. Peoria, Ill. ....Aug. 9
Aug. 21. Berkley, Va. ....July 26
Adv., Eng. Record, July 26 to Aug. 9.
Aug. 22. New Brighton, S. I., N. Y. ....Aug. 16
Aug. 22. Monticello, Ind. ....Aug. 2
Aug. 23. Mansfield, O. ....Aug. 2
Aug. 25. Boilers, Boston, Mass. ....Aug. 16
Aug. 25. Wapakoneta, O. ....Aug. 16
Aug. 25. Tyrone, Pa. ....Aug. 9
Adv., Eng. Record, Aug. 9.
Aug. 28. Mobile, Ala ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug 29 Geneva, O. ....Aug. 2
Aug. 30. West Carthage, N. Y. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 30. Washington, D. C. ....Aug. 9
Adv., Eng. Record, Aug. 9
Sept. 2. South Bend, Ind. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 2. Plainfield, N. J. ....Aug. 9
Sept. 3. Athol, Mass. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 6. Lakewood, O. ....Aug. 16
Oct. 10. Ridley Park, Pa. ....Aug. 16
Adv., Eng. Record, Aug. 16.

BRIDGES.

Aug. 20. Perryville, Ark. ....Aug. 9
Aug. 22. Chicago, Ill. ....Aug. 16
Aug. 23. Mansfield, O. ....Aug. 16
Aug. 23. Chicago, Ill. ....Aug. 16
Aug. 25. Ann Arbor, Mich ....Aug. 16
Aug. 25. Luray, Va. ....Aug. 16
Aug. 29. Indianapolis, Ind. ....Aug. 9
Sept. 1. Armour, S. D. ....Aug. 9
Sept. 2. San Jose, Cal ....Aug. 16
Sept. 3. Parker, S. D. ....Aug. 9
Sept. 3. Substructure, Chicago, Ill. ....July 19
Adv., Eng. Record, July 19.
Sept. 3. Superstructure, Chicago, Ill. ....July 19
Adv., Eng. Record, July 19.
Sept. 5. Milwaukee, Wis. ....July 19
Sept. 9. Caldwell, Idaho ....July 12

PAVING AND ROADMAKING.

Aug. 18. Chanute, Kan. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 19. Chicago, Ill. ....Aug. 16
Aug. 19. Bellevue, Pa. ....Aug. 16
Aug. 19. Jersey City, N. J. ....Aug. 16
Aug. 20. Morgantown, W. Va. ....Aug. 16
Aug. 20. Cleveland, O. ....Aug. 16
Aug. 20. New York, N. Y. ....Aug. 16
Aug. 20. Williamsport, Pa. ....Aug. 9
Aug. 21. Oneida, N. Y. ....Aug. 9
Aug. 21. Cincinnati, O. ....Aug. 2
Aug. 22. Terre Haute, Ind. ....Aug. 16
Aug. 23. Mansfield, O. ....Aug. 2
Aug. 24. Centerville, Ind. ....July 19
Aug. 25. Arcola, Ill. ....Aug. 16
Aug. 25. Cincinnati, O. ....Aug. 16
Aug. 25. Lorain, O. ....Aug. 2
Aug. 25. Warren, O. ....Aug. 2
Aug. 25. Tyrone, Pa. ....Aug. 9
Adv., Eng. Record, Aug. 9.
Aug. 27. Hoboken, N. J. ....Aug. 16
Aug. 27. Terre Haute, Ind. ....Aug. 16
Aug. 28. Mobile, Ala. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 28. New York, N. Y. ....Aug. 16
Aug. 28. Des Moines, Ia. ....Aug. 9
Aug. 29. Memphis, Tenn. ....Aug. 9
Aug. 29. Dayton, O. ....Aug. 9
Aug. 29. Jeffersonville, Ind. ....Aug. 9
Aug. 29. Waukesha, Wis. ....Aug. 9
Aug. 29. Cincinnati, O. ....Aug. 9
Aug. 29. Memphis, Tenn. ....Aug. 9
Sept. 1. North Baltimore, Md. ....Aug. 16
Sept. 1. Paloi, Ind. ....Aug. 16
Sept. 1. Terre Haute, Ind. ....Aug. 16
Sept. 1. Niagara Falls, N. Y. ....Aug. 2
Sept. 2. South Bend, Ind. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 3. Terre Haute, Ind. ....Aug. 16
Sept. 3. Toledo, O. ....Aug. 9
Sept. 5. Dayton, O. ....Aug. 16
Sept. 5. Williamsport, Pa. ....Aug. 16
Sept. 8. Toledo, O. ....Aug. 16
Sept. 8. Charlton, Ia. ....Aug. 16

POWER, GAS AND ELECTRICITY.

Aug. 20. Dexter, Mich. ....Aug. 9
Aug. 21. Koala Zumpur, Malay ....July 19
Aug. 25. National Military Home, Kan. ....Aug. 9
Aug. 26. Washington, Ia. ....Aug. 9
Aug. 29. Detroit, Mich. ....July 26
Sept. 8. Amsterdam, Holland ....Aug. 2
—— Elgin, Tex. ....Aug. 9
—— Fayetteville, N. C. ....Aug. 16

GOVERNMENT WORK.

Aug. 20. Ft. Snelling, Minn ....Aug. 9
Aug. 20. Levee work, Memphis, Tenn. ....Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Aug. 20. New Brighton, Va. ....Aug. 2
Aug. 21. Pipestone, Minn. ....Aug. 2
Aug. 21. Newport, Vt. ....July 26
Adv., Eng. Record, July 26, Aug. 2.
Aug. 21. Dredging, Philadelphia, Pa. ....July 26
Adv., Eng. Record, July 26 to Aug. 16.
Aug. 22. Boiler plant, Cleveland, O. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Aug. 22. New York, N. Y. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Aug. 22. Boilers, Hampton, Va. ....Aug. 2
Aug. 22. Ft. Barrancas, Fla. ....Aug. 2
Aug. 22. Dredging plant, Buffalo, N. Y. ....July 26
Adv., Eng. Record, July 26 to Aug. 16.
Aug. 23. Fireproofing, Washington, D. C. ....Aug. 2
Aug. 23. Ft. Wright, Wash. ....Aug. 2
Aug. 23. Trestle and tank, Ft. Myer, Va. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 25. Cincinnati, O. ....Aug. 2
Aug. 25. Harbor work, Savannah, Ga. ....Aug. 2
Adv., Eng. Record, Aug. 2, 16.
Aug. 25. Ft. Des Moines, Ia. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 25. Post Office, Ellsworth, Me. ....Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Aug. 25. Ft. Riley, Kan. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 25. Bulkhead, Philadelphia, Pa. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 26. Supplies, Phoenix, Ariz. ....Aug. 9
Aug. 27. Metal lathing, etc., Washington, D. C. Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 27. Repair steamer, Pittsburg, Pa. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 28. Philadelphia, Pa. ....Aug. 2
Aug. 28. Harbor work, Cleveland, O. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 28. Breakwater, Cleveland, O. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 28. Vaults, Washington, D. C. ....Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Aug. 28. Ft. Strong, Mass. ....Aug. 2
Aug. 28. Dredging, Wheeling, W. Va. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Aug. 29. Light fixtures, St. Cloud, Minn. ....Aug. 9
Aug. 29. Light fixtures, Joliet, Ill. ....Aug. 9
Aug. 29. Light fixtures, Hot Springs, Ark. ....Aug. 9
Aug. 29. Light fixtures, Oskaloosa, Ia. ....Aug. 9
Aug. 29. Light fixtures, Abilene, Tex. ....Aug. 9
Aug. 30. Rock Island, Ill. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 2. Bldg., Johnson City, Tenn. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 2. Rapid City, S. D. ....Aug. 9
Sept. 2. New Orleans, La. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 3. Dredging, Annapolis, Md. ....Aug. 16
Sept. 3. Plumb'g lab'atory, Washington, D. C. Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 3. Wiring lab'atory, Washington, D. C. Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 3. Dredging, New York, N. Y. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 3. Dam, Charleston, S. C. ....Aug. 2
Adv., Eng. Record, Aug. 2 to 16.
Sept. 4. Post Office, Lockport, N. Y. ....Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 6. Louisville, Ky. ....Aug. 16
Sept. 6. Bremerton, Wash. ....Aug. 2
Sept. 8. New Orleans, La. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 9. Htg. P. O., Elmira, N. Y. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 10. Brooklyn, N. Y. ....Aug. 16
Sept. 10. Post Office, Anniston, Ala. ....Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 11. Wilmington, Del. ....Aug. 16
Sept. 11. Dredging Baltimore Harbor, Md. ...Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 11. Dredging Curtis Bay, Baltimore, Md. Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 11. Dredging, etc., New York, N. Y. ....Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 11. Wiring P. O., New Brunswick, N. J. ..Aug 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 11. Htg. P. O., New Brunswick, N. J. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 13. Boston, Mass. ....Aug. 16
Sept. 13. Dock, Norfolk, Va. ....July 26
Adv., Eng. Record, Aug. 2, 9.
Sept. 15. Htg. P. O., Abilene, Tex. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 16. Htg. P. O., Oakland, Cal. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 17. Wiring P. O., Abilene, Tex. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 18. Wiring P. O., Oakland, Cal. ....Aug. 9
Adv., Eng. Record, Aug. 9, 16.

BUILDINGS.

Aug. 19. Hospital bldg., New York, N. Y. ....Aug. 16
Aug. 19. Church, Pleasant Plains, Ia. ....Aug. 16
Aug. 19. School, Fond du Lac, Wis. ....Aug. 16
Aug. 20. School, Oconto Falls, Wis. ....Aug. 16
Aug. 20. Library, Manchester, Ia. ....Aug. 16
Aug. 20. Church, Worthington, Minn. ....Aug. 16
Aug. 20. Pub. bldg., Boston, Mass. ....Aug. 9
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Aug. 20. School, Orange, N. J. ....Aug. 2
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Aug. 21. School, Boston, Mass. ....Aug. 16
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Impermeable Masonry.

The increasing demand for masonry to be employed in resisting the pressure of water in structures where the duty to be performed is trying, has made prominent the desirability of obtaining, if possible, concrete or other masonry which shall be impermeable to water. Civil engineers of extended experience in masonry construction realize how little ordinary masonry can be relied upon as a water-tight material. This is not denying that considerable quantities of concrete and rubble masonry have been constructed in dams which are essentially impermeable to water, but of the total mass of masonry structures in engineering work it is doubtless safe to say that but a small part is actually water-tight. In many places this is a matter of no consequence, the principal end to be attained being the preservation of the masonry mass in proper form and with proper carrying capacity. In other cases many an engineer would have been saved much apprehension, not to say anxiety, if he could have felt confident that his masonry would successfully carry the pressure of water without material loss. All masonry composed of natural stone laid in mortar is more or less porous, and, however well made, it may be that sensible absorption of water will take place; but this is not leakage.

The pages of the "Transactions" of the American Society of Civil Engineers, as well as much other engineering literature, give evidence of the desirability of attaining, if possible, impermeable concrete or other masonry for many purposes. A number of investigations have been made by Mr. George W. Rafter, Messrs. Sooysmith & Company, and other investigators at one time or another, some of the results of which have been made public and others have not. Experimental work has also been done in this direction for the Metropolitan Water and Sewerage Board of Boston under the direction of Mr. F. P. Stearns, chief engineer. Finally, a number of tests, as to the impermeability of gravel concrete of different proportions, under pressures of water ranging from 20 to 80 pounds per square inch, have been made during the current year at the Thayer School of Civil Engineering, the results of which have been published as the thesis work of two of the graduate students, Messrs. McIntyre and True.

Throughout all these investigations, so far as they have been published, there has been a careful recognition of the necessity of sufficient mortar to fill the voids of the broken stone or gravel used in the concrete, but there seems to have been scarcely sufficient attention directed to one or two other essential qualities of the cement for the attainment of impermeability in the final mixture. Obviously, it is essential that there should be sufficient mortar to fill the voids of the gravel or broken stone, those voids depending largely upon the method of preparation or selection of the broken stone and the variation in size of the stones of which the gravel is composed. In the past it has been almost universal practice so to prescribe the broken stone as to exclude the smaller sizes and make the voids from 40 to 45 per cent. or possibly 50 per cent. of the volume. Under such circumstances, so small a volume of mortar as 30 per cent. of the total of broken stone would clearly fall far short of producing a water-tight mixture. Mr. Rafter was, therefore, judicious in specifying 40 to 45 per cent. of the volume of the aggregate for the mortar employed in his concrete. It may even be doubted whether 40 per cent. of mortar would always fill the voids of the broken stone, as the latter is usually prescribed. The voids of gravel, unless the smaller stones be excluded, will seldom exceed one-third of the volume, and hence 30 per cent. of mortar would usually fill the voids of such gravel.

As has already been intimated, however, it is not necessarily sufficient to employ a volume of mortar that is equal to the voids in the broken stone or gravel. The mortar is composed of certain portions of sand and cement, the voids of the sand itself sometimes exceeding 40 per cent. of its volume. It is just as essential to fill the sand voids as those of the broken stone or gravel. In order that voids of the sand shall be so filled as to produce impermeability, it is further requisite that the cement shall be ground fine so that the operation of setting, i. e., of crystallization, shall leave no voids of sufficient size to permit water to find its way through them. It is not to be supposed that the operation of crystallization which takes place in the setting of the cement will make that portion of the mass between the sand grains absolutely solid, but the interstices must be reduced as nearly to those of molecular dimensions as possible if the resulting mass is to be impermeable under sensible pressures of water. The question of fine grinding of the cement, therefore, is thus seen to play a most important part in the attainment of a water-tight concrete. It is not sufficient that the cement as such shall be of excellent quality, but it must be ground so fine that after it is set there shall remain no spaces large enough to permit water to find its way through under pressure.

It is coming to be recognized more generally among civil engineers that the exclusion of the smaller sizes of stone from crushed rock in the making of concrete is unwise from the point of view of both economy and carrying power of the concrete, and in some kinds of stone at least it appears to be advantageous not to exclude the crusher dust. It is obviously certain from the considerations which have been set forth that this balancing of broken stone has the further valuable result of aiding materially in securing impermeability of concrete or other masonry. The presence of the smaller fragments of broken stone as well as the dust will clearly aid in an efficient manner in closing any possible channels through the completed masonry, and the same observation holds in precisely the same way in connection with balanced gravel containing the varying sizes from ordinary sand to the largest single stone permissible. Indeed, so essential a part does this balancing of broken stone and gravel play in securing water-tight masonry that it is reasonable to suppose water-tightness might be attained in concrete with sensibly less finely ground cement than were that balancing omitted. The use of the total products of the crusher as well as the naturally balanced gravel carries with it in this manner both its own economy and that of a less finely ground cement, while at the same time aiding in reaching the desired quality of impermeability.

In all experimental investigations, therefore, on the permeability of concrete it is absolutely essential, in order that the results may have their proper values, that the degree of balancing of the broken stone or gravel be determined and given as well as the fineness of grinding of the cement used. In these respects the data at present available in this particular line of work are far from complete, and in many cases so incomplete as to detract materially from the values of the results, if, indeed, that value is not sensibly destroyed. It is of little significance to state that the amount of mortar employed was 30 to 45 per cent. of the volume of the aggregate, if the sizes of the broken stone or gravel employed and the fineness of the grinding of the cement are ignored. The voids of the former may be reduced possibly to 15 per cent. and easily to 20 or 25 per cent. of the total volume with reasonable balancing, while otherwise the void space might reach 40 or even 50 per cent. of the total volume. It is clear, therefore, that 20 or 25 per cent. of mortar in the one case might answer all the purposes that 40 or 45 per cent. could in other cases. Similarly, the significance of No. 1 cement or No. 2 cement is equally indeterminate, whatever may be the rate of setting or the resistance of the mass after setting without the fineness of the material being known.

So far as experimental results now available indicate it would appear that in order to attain impermeability in concrete, whether of gravel or of broken stone, that the mortar mixture must be at least as rich as 1 cement to 2 sand, or 1 cement to 2.5 sand, the proportion of mortar being sufficient to fill entirely the voids, or possibly a little more than that in order to provide for inequalities of mixing in different portions of the mass. Although apparently mortar of 1 cement to 3 sand has occasionally been found impermeable under as high pressure as 40 pounds per square inch, there is little evidence that such a mixture can in general be relied upon. In addition to the importance of these matters of composition to be employed for a permeable concrete, it is undoubtedly also of essential importance that the concrete should be kept thoroughly moistened during the entire period of setting; otherwise not only the ultimate resistance may be impaired, but also the impermeability by the slight contraction of setting in air which has been observed repeatedly. This has a marked influence upon the use of concrete in the walls of buildings, which in their subsequent experience may be exposed to driving rain storms, against which ordinary walls of masonry have frequently been found ineffective.

The Most Pressing Problem of municipal government is to keep the tax rate down and the service up, according to Mr. Denis Mulvihill, the boiler tender who was recently elected mayor of Bridgeport, Conn. He has sent a New Haven paper a brief statement of the useless expenditures he stopped, and remarked concerning the criticisms his course had aroused that he had noticed a loose pulley on a hot shaft often made more noise than a 1,000-horsepower engine.

William Hasell Wilson, Hon. M. Am. Soc. C. E.

Through the courtesy of Mr. Joseph M. Wilson, M. Am. Soc. C. E., The Engineering Record is enabled to print the following notes of the career of his eminent and beloved father, William Hasell Wilson, Hon. M. Am. Soc. C. E., who died in Philadelphia on August 17. His long and useful career as an engineer is one of the most creditable records of the profession in America, of which he was, during many years, one of the leading members.

William Hasell Wilson, son of Major John Wilson and Eliza Gibbes, was born at Charleston, S. C., November 5, 1811. The former was the son of Lt. John Wilson, of the 71st Highlanders, who was actively engaged during the Revolutionary War, for most of the time on engineer duty as assistant to Major Moncrieff of the Royal Engineers. The father of Lieutenant Wilson was James Wilson, an engineer and architect of Stirling, Scotland. At the close of the war, Lieutenant Wilson married a daughter of Dr. Robert Wilson, of Charleston, who was a native of Fifeshire, Scotland, and after some years of active service settled at Stirling.

Upon the death of Lieutenant Wilson, his widow returned with her family to Charleston, where her son John, who had been educated at the University of Edinburgh, entered into business as an engineer and surveyor. Upon the breaking out of the war with Great Britain in 1812, he volunteered his services to his adopted country and under Gen. Thomas Pinckney planned and constructed the fortifications at Charleston. At the close of the war he received a commission as Major in the Topographical Corps, U. S. A., but having duties assigned to him that were not congenial resigned after a few months' service.

From the years 1818 to 1822, Major Wilson held the position of "Civil and Military Engineer" of the State of South Carolina. He subsequently practiced his profession at Charleston, but removed with his family to Philadelphia in the year 1826. In 1827 he was appointed by the Canal Commissioners of the State of Pennsylvania, chief engineer to conduct the surveys, location and construction of a railroad from Philadelphia to the Susquehanna River, but was compelled by ill health to resign his position before the completion of the work, and died in 1833.

His son William Hasell Wilson, from an early age, pursued a classical course of education at private schools and at the Charleston College, being at the latter institution from 1823 to 1826. In June, 1827, he accompanied as a volunteer the surveying party under his father, but served for most of the time during the summer months as a chainman, having for an associate, John Edgar Thomson, subsequently chief engineer and president of the Pennsylvania Railroad company. In March, 1828, a large corps was organized for the location of the Philadelphia & Columbia Railroad, in which the subject of this sketch served as rodman; continuing in service as assistant engineer on construction during the year 1829 and 1830, and as principal assistant engineer in charge of the work on the eastern 40 miles of the road, from March, 1831, until its completion and the disbandment of the engineer corps in October, 1834.

In the spring of 1835 he took charge as principal assistant under Messrs. Moncure and Wirt Robinson, of the final location and construction of the second division of the Philadelphia & Reading Railroad, extending from a point a few miles east of Pottstown to Bridgeport, opposite Morristown. In June, 1838, the work under his care being about completed, he accepted from the canal commissioners the appointment of chief engineer of the Gettysburg extension of the State Railroad, the grading of which was then in progress. The work upon this line, as well as upon most other portions of the State improvements, was suspended in the early part of the year 1839, and a depressed condition of business and financial affairs ensued, that for several years checked the progress of any works of public improvement.

The prospect of satisfactory professional employment being unpromising Mr. Wilson at the beginning of the year 1841, turned his attention to farming, in which becoming much interested he continued until the close of the year 1858, although for the last few years of the period he was more or less engaged in professional matters.

During the summers of 1852 and 1853 he made extensive surveys for the Pennsylvania Railroad Company, and located a line of railroad from Philadelphia, via Phoenixville and the French Creek and Conestoga Valleys, to a connection of the Harrisburg & Lancaster Railroad about eight miles west of Lancaster. The latter road was operated under lease by the Pennsylvania Railroad Company, and the construction of the proposed new line was contemplated for the purpose of affording the company an independent route, free from the many annoyances attendant upon the use of the State Railroad as a part of the through line between Philadelphia and Pittsburg. The subsequent sale of the State works, and the acquisition of the "main line" by the Pennsylvania Railroad Company, put a stop to the proposed construction of the alternative line.

Early in the year 1854 Mr. Wilson took the position of chief engineer of the Philadelphia & West Chester Railroad then being constructed. After the road was completed as far as Media, and the grading and bridging thence to West Chester well advanced, work was suspended for want of funds, and he left the service at the end of the year 1855.

During the succeeding eighteen months, he made surveys for a railroad between Morristown and Allentown, and for an extension of the Pennsylvania Railroad to the Delaware River, in addition to making two trips to Ohio, Indiana and Illinois, investigating railroad matters for the Pennsylvania Railroad Company. Upon the purchase of the main line of State improvements by that company, he was appointed resident engineer of the line between Philadelphia and Columbia, and entered upon his duties August 1, 1857. In the following year his division was extended to Mifflin on the Juniata River, and in January, 1859, he was placed in charge of the entire line to Pittsburg with its branches. This rendered necessary the abandonment of the farm and a change of residence to Altoona, which was the headquarters of the operating department of the company.

The duties of the resident engineer included not only the care of the roadway, bridges and buildings, which constituted maintenance-of-way, but the designing and supervision of all new constructions, surveys for branch lines, the purchase and management of real estate, and the furnishing of fuel and water for the motive power. All purchases of materials for the repairs and construction of the works under his charge also devolved upon him for several years until the organization of a purchasing department by the company. In 1862 his title was changed to chief engineer. He was assisted by an engineer of bridges and buildings and a resident engineer on each of the three divisions of the main line and on the Tyrone division.

The constantly increasing duties of the maintenance-of-way, together with the large amount of construction work devolving upon the Engineer's Department, had by the close of the year 1867 accumulated to such an extent as to render a division of labor necessary. A department of construction was accordingly organized to take charge of new work, which went into operation on January 1, 1868, under Mr. Wilson as chief engineer, with headquarters at Philadelphia. The maintenance-of-way remained under the general superintendent of transportation as a separate department.

During the succeeding six years a very large amount of new work was constructed to provide increased facilities for the growing business of the company, embracing passenger, freight, water and coaling stations, additional tracks, car-shops, piers and coal-chutes at the Delaware River, and the straightening of several miles of road on the Philadelphia Division. During the same period, the construction department had charge of a considerable amount of new work on the Philadelphia & Erie and the Lewisburg Railroads.

The financial troubles in the latter part of the year 1873 caused a suspension of new construction, and the engineer's department was discontinued. From the commencement of the year 1874, whatever engineering operations were necessary came under the direction of the general manager of transportation.

In November, 1873, Mr. Wilson was elected president of the Philadelphia & Erie Railroad Company, but was continued in the service of the Pennsylvania Railroad Company with the title of consulting engineer, for the purpose of closing up the work previously under his charge. In July, 1874, he resigned the presidency of the Philadelphia & Erie Railroad Company and was placed at the head of a new department of the Pennsylvania Railroad Company, entitled the "real estate department," which he organized and to which was entrusted the charge of the real estate on the lines owned or controlled by the company, as far as regarded the completion and arrangement of maps and records and the financial control of the properties.

In March, 1884, Mr. Wilson left the real estate department, having been elected president of the Philadelphia & Erie Railroad Company and of several other companies whose lines were controlled by the Pennsylvania Railroad Company. These positions were resigned by him in the early part of the year 1894, with the exception of the presidency of the Belvidere Delaware Railroad Company, which he retained until his death.

The Engineering Exhibits at the Louisiana Purchase Exposition will be under the charge of Col. J. A. Ockerson, M. Am. Soc. C. E., the chief of the Department of Liberal Arts. This department will be housed in a 750x520-foot building already briefly described in this journal, and embraces thirteen groups of subjects, of which one is civil and military engineering, another models and designs for public works, and a third architectural engineering. There will be no charge for space and a limited amount of power for the operation of mechanical devices to illustrate processes of special interest will be furnished free. It is eminently proper that a great exposition celebrating the acquisition of the Louisiana Territory, which has been developed more by the engineer's ability and hardihood than any other single influence, should be marked by a larger and better engineering exhibit than has been displayed before. Colonel Ockerson's long connection with the profession insures a sympathetic management of such a representation, and a circular he has recently prepared for the use of intending exhibitors indicates a strong desire on his part to make the display one fully worthy of engineering in its broadest and best sense.

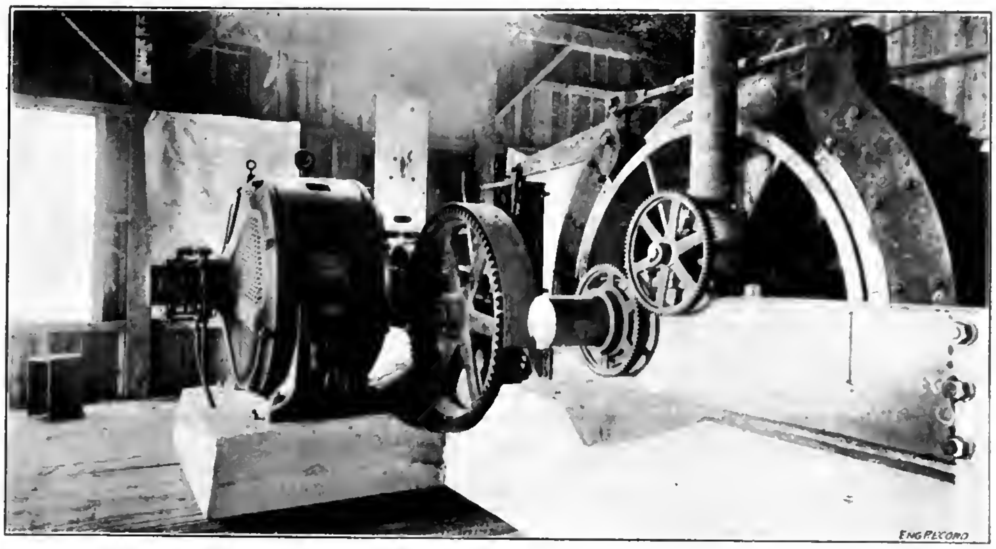
Electrical Equipment of the C. & C. Shaft, Virginia City, Nev.

By Leon M. Hall, Consulting Engineer.

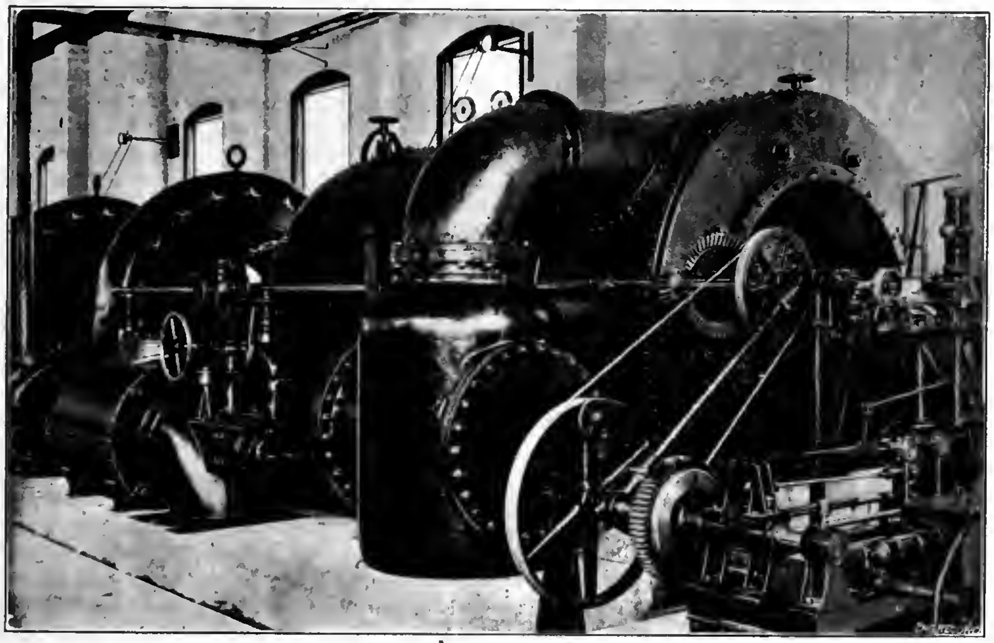
When the mining properties on the Comstock Lode were first developed, operations were carried on by means of steam-generated power, wood being used as the fuel. This was very costly on account of the scarcity of wood. The milling was, until quite recently, done at a distance of some 15 miles from the mine, at a point on the Carson River, where cheap water power could be obtained. About two years ago the question of electrical transmission for the purpose of supplying power for deep mining operations on the Comstock Lode was taken up, and since then extensive hydraulic developments have been carried out at Floriston, Cal., on the Truckee River. Power is now transmitted 35 miles to the mines in Stotey County and a dozen or more of the properties have been equipped with electrical machinery. Among these is the C. and C. shaft of the Consolidated California & Virginia Mining Company, which has a world-wide reputation as a bullion producer.

The power plant on the Truckee River is about two miles east of Floriston. The river is dammed just below the Floriston pulp and paper mill, and the water is conveyed about 600 feet through a canal and then 8,600 feet through a wooden flume 6 feet 8 inches high and 10 feet wide, to a point directly above the generating station. It is then conducted through two wooden stave pipes 160 feet long and six feet in diameter to the wheels, upon which there is a head of 84½ feet. There are two pairs of 27-inch horizontal McCormick turbines, direct-connected to Westinghouse, three-phase, sixty-cycle generators of the revolving armature type. These generators are separately excited by two 22½-kilowatt direct-current machines. The wheels will each develop 1,400 horse-power at 400 revolutions per minute with the above head of water. They are regulated by two type B Lombard governors. Current is generated at 500 volts and is raised to 24,000 volts by means of six 300 kilowatt, Westinghouse, oil-insulated transformers, at which potential it is transmitted 33 miles over a double circuit of No. 4 hard drawn copper wire to the sub-station at Virginia City. The line is composed of square redwood poles 30 feet in length, with pine cross arms and locust pins, upon which are mounted 7½-inch Locke insulators. The telephone circuit is carried on the same poles by oak brackets with pony insulators. At the sub-station at Virginia City, the potential is lowered to 2,300 volts by means of six 450 kilowatt, Westinghouse, oil-insulated transformers, and at this potential current is distributed to the various mining companies. The distribution circuits are composed of weather-proof wire and are designed for 4 per cent. drop under full load. The generating station at Floriston is constructed of brick with a galvanized iron roof and the sub-station at Virginia City is entirely covered with corrugated galvanized iron. [A more detailed illustrated description of this plant appeared in The Engineering Record of December 14, 1901.]

The plant has been in continuous operation to balanced electric hoist, which will be described later; a 100-horse-power, type C, 2,200 volt Westinghouse induction motor, belted to a 16½x30-in., single-stage air compressor; a 30-horse-power type C, 440-volt Westinghouse induction motor, operating circular saws; a 15-horse-power motor of the same type, driving tools in the machine shop; a 10-horse-power, type C motor operating a Blake rock breaker at the ore bin; three 15 kilowatt, indoor type, Westinghouse transformers, transforming from 2,200 volts to 440 volts; one 5-kilowatt, Westinghouse lighting transformer, transforming from 2,200 volts to 110 volts; two Manhattan arc lamps; fifty incandescent lamps, together with necessary lightning arresters, fuse blocks, cut-outs and switches.



CONTINUOUS ROPE HOIST DRIVEN BY 200-HORSE-POWER MOTOR.



TURBINE SETTING IN POWER PLANT AT FLORISTON.

The apparatus underground consists of the following: a 15-horse-power, type C induction motor, operating at 440 volts and driving a fan on the 250-foot level; two 10-horse-power motors of the same type, driving fans on the 1,950 and 2,150-foot levels; three 225-horse-power, type C motors, operating at 2,200 volts and geared to three duplex double-acting Reidler pumps located on the 2,150-foot level; three 10-kilowatt, type O. D. transformers, transforming from 2,200 to 440 vol s, located on the 1,750-foot level; a 3-kilowatt lighting transformer, transforming from 2,200 to 110 volts, on the same level; three 15-kilowatt, type O. D. transformers, transforming to 440 volts, on the 1,950-foot level; two 5-kilowatt O. D. lighting transformers, transforming from 2,200 to 110 volts, on the same level; three 10-kilowatt transformers, transforming to 440 volts, on the same level; and a 5-kilowatt lighting transformer, transforming to 110 volts, on the same level. These are all Westinghouse transformers and supply the motor and lighting circuits within the mine.

There are 250 16-candle-power incandescent lamps scattered through the workings underground. A No. 6 B. & S. three-conductor lead-covered cable armored with iron wire extends from the surface to the 2,150-foot level, and a No. 0, three-conductor cable to the pumps on the same level. The weight of the No. 6 cable is 6 tons and of the No. 0 cable 10 tons. The cables were lowered down the shaft by means of the hoisting rope and then securely clamped to the wall plates. At each station a water-tight junction box is used and the lead covering sweated into a tight-fitting sleeve located in the side of the box.

The power is brought into the works over two separate circuits, each of which is provided with a single-pole switch at the entrance of the building and, also a Westinghouse inte-

since October 20, 1900. The Truckee River General Electric Company sells power to the various mining companies at $7 per horse-power per month, the amount used being based on a maximum peak load of two minutes duration. This, with other conditions, has made advisable the installation of machinery of the very highest grade and the introduction of some features which are rather unique in character. In the C. & C. shaft at Virginia City every precaution has been taken to secure thorough reliability and the highest efficiency.

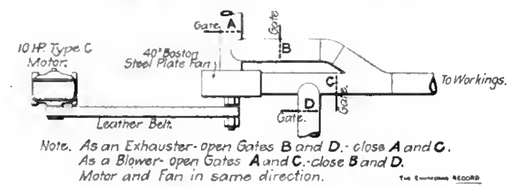
The electrical machinery in operation on the surface consists as follows: A 200-horse-power, type F, 2,200 volt, variable speed, three-phase Westinghouse induction motor, geared grating wattmeter with its transformer. The pump circuit is further equipped with an ammeter, a frequency indicator, a power-factor indicator and a static ground detector. Oil break switches are used on the cable circuits and upon all of the 2,200-volt motors. The smaller motors, both on the surface and underground are equipped with auto-starters, quick-break switches and slate base fuse blocks. Some of these machines are located in warm places and operate under severe conditions.

The entire installation is wired with lead-covered cables or with rubber-covered copper wire mounted on glass insulators or porcelain knobs. The greatest care is used in installing the wiring, with the result that it is safe and gives absolutely no trouble. Candles have been entirely discarded, incandescent circuits having been carried directly to the working faces and into the stopes. The current is taken into the mine at a potential of 2,200 volts, through the cables above mentioned, and the potential is lowered in the mine by transformers, which are located as near as possible to the point of consumption.

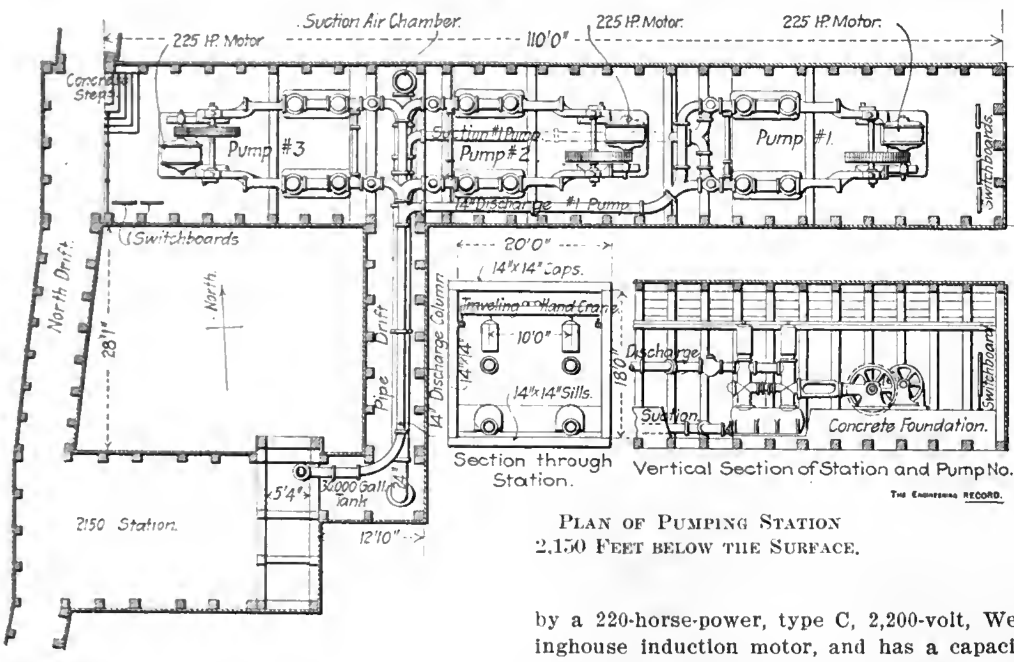
The compressed air plant, supplying air for drilling, a number of underground hoists and the hydraulic pump, consists of a 16½x30-inch Rand & Waring single-stage air compressor, driven at 73 revolutions per minute by a 100-horse-power, type C Westinghouse motor. The motor speed is 580 revolutions per minute, which is reduced by a counter shaft with wooden rim pulleys and rubber belting. No automatic regulator is used at the present time, as the compressor is working to its full capacity and the motor is developing 96 horse-power.

The electric hoist is a decided departure from usual practice in deep mine hoisting plants and embodies what is commonly known as the balanced, continuous or tail-rope system. This was adopted in order to reduce the cost of operation and, also, the size of the motor to the lowest size compatible with the duty required, viz.: to hoist 500 tons daily from the 2,500-foot level by means of double-deck cages carrying 3,600 pounds of rock. The hoist consists essentially of a main driving drum and an idler, around which is wrapped a 1⅛-inch plow steel wire rope. The rope passes down one compartment, around a movable tail sheave and up the other. One cage is inserted between the ends of the rope and the other fastened to it by means of heavy iron clamps. The main driving drum is geared to a 200-horse-power, type F, variable speed Westinghouse, three-phase induction motor which operates at a maximum speed of 580 revolutions, moving the cages through the shaft at 1,250 feet per minute. The speed of the motor is readily controlled by means of variable resistances inserted in the secondary winding, but external to the motor itself. The variation of the resistance is accomplished by the use of a special controller resembling an ordinary street-car controller; the primary circuit is controlled by means of an oil-break switch. The hoist is equipped with heavy post brakes, hydraulically operated, and the machine is handled with remarkable ease. In tests that have been made these hoists show a net efficiency of about 75 per cent., counting all electrical and frictional losses.

The pumping plant consists of three duplex double-acting 24x6 11/16-inch Reidler pumping engines, located on the 2,150-foot level. These pumps take their water supply from a tank on the east side of the shaft just below the 2,150-foot station. Each pump is separately driven



Arrangement of Ventilating Ducts.



Plan of Pumping Station 2,150 Feet below the Surface.

by a 220-horse-power, type C, 2,200-volt, Westinghouse induction motor, and has a capacity, at 110 revolutions per minute, of 1,500 gallons per minute to the height of 450 feet, or to the Sutro tunnel level. The motors run at a speed of 495 revolutions per minute, the necessary reduction being obtained by the use of cut gearing with stepped teeth. The total capacity is 4,500 gallons per minute and is intended to take the water from the hydraulic elevator as long as it is used as a sinking pump.

The pumps are located in a station 30 feet north of the shaft. This station is cut from the solid rock and is 18 feet by 17 feet 8 inches in section and 110 feet long. It is timbered with 14x14-inch pine timbers with 3-inch planking. A drift 5 feet by 10 feet 6 inches in section connects it with the shaft, and ventilation is obtained by means of a small electrically-driven blower. The motors are all wired with lead-covered cable and the station is lighted with incandescent lamps. A 10-ton hand crane travels the entire length of the station so that the labor of handling and installing machinery has been reduced to a minimum.

This plant is undoubtedly one of the best and most complete mining installations in the world, and its operation has been entirely satisfactory both in regard to economy and reliability. Up to the time when electrically transmitted power was adopted, the cost of motive power was never less than \$20 per horse-power per month, while under existing conditions, it is reduced to \$7. For example, the cost of operating the 100-horse-power air compressor usually averaged about \$1,800 per month, while to-day it is only \$672. The entire plant was installed according to my plans and specifications and under the able direction of Superintendent Jos. R. Ryan. It has proved an unqualified success from the very beginning.

The Pennsylvania R. R. Trainshed, Pittsburg.

The trainshed for the new depot of the Pennsylvania Railroad at Pittsburg is about 555 feet long, 260 feet wide and 110 feet high over all. It is one of the largest in this country and will have sixteen tracks with platforms between them, each track having a capacity for one twelve-car train or two five-car trains. The design of the shed is almost identical with that at the same company's Jersey City terminal, and the dimensions are approximately the same, the two structures being practically alike except for some modifications of details.

In this shed, as in those at Jersey City and Philadelphia for the same railroad, and at Philadelphia for the Philadelphia & Reading Railroad, at Buffalo for the New York Central & Hudson River Railroad, at Cleveland for the Lake Shore Railroad, the entire area is unobstructed by columns or walls and is covered by a curved roof supported on high arched trusses. This construction has the advantage of allowing the tracks and platforms to be arranged in any way, involves no waste floor space, avoids any obstructions from intermediate columns, and presents an imposing interior. On the other hand, the long-span roof trusses are heavier and costlier than shorter ones supported on columns and covering the same area. It is difficult to keep the skylights and upper steelwork clean, and the curved roof sheathing is very expensive. Very large trainsheds for the Union Depot at St. Louis, for the South Terminal at Boston, and for the Pennsylvania Railroad at Camden, N. J., have been made with short, flat roof trusses, supported on two or more rows of interior longitudinal columns, as shown in The Engineering Record of January 21, 1899, and September 14, 1901. These buildings require less steel for a given length and width, are more quickly and cheaply erected, more easily lighted and cleaned, can be much more economically roofed, and are considered to lend themselves about as well to an attractive exterior treatment.

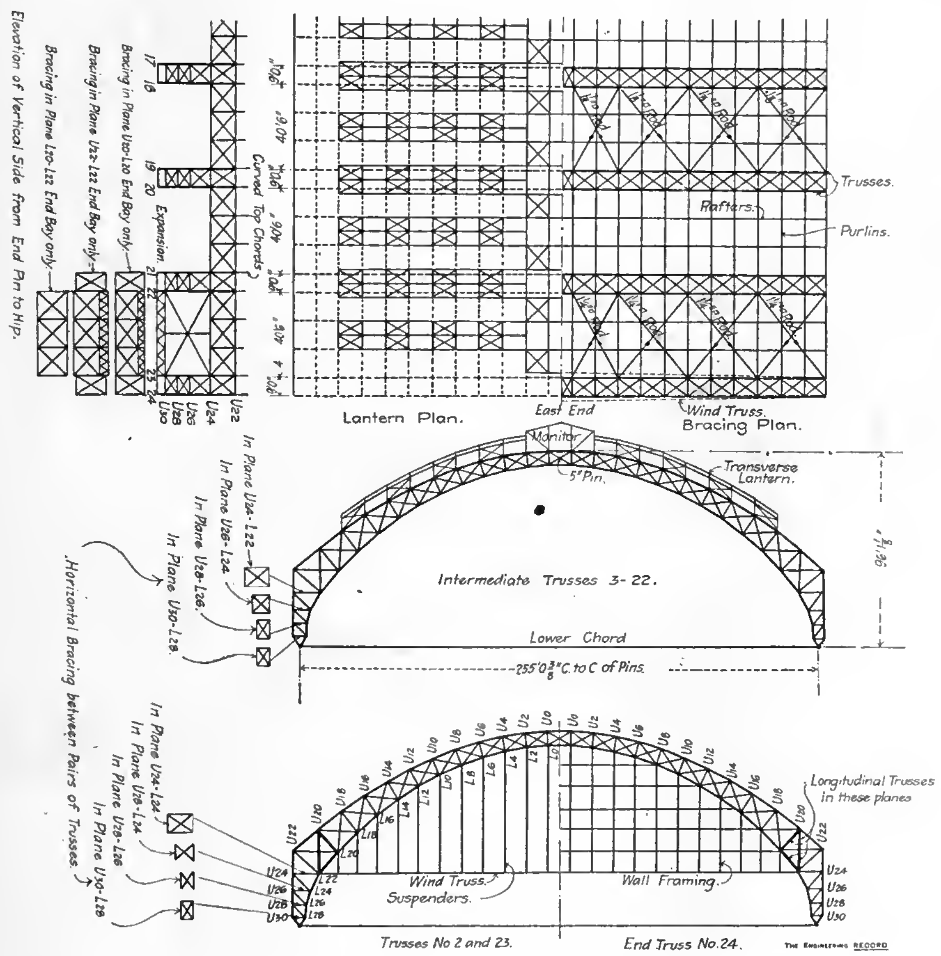
The principal members of the framework are twenty-four three-hinge arch trusses, which are spaced alternately 9 feet and 40½ feet apart on centers and are braced together in pairs and connected by longitudinal girders and trussed purlins. The outline and general dimensions of the trusses are shown in the diagram elevation and the lateral bracing in the plane of the top chords is shown in the roof plan. There are twenty-two lines of purlins which are lattice-girders in the planes of the radial truss members. The short panels between the trusses of each pair have ¾-inch square pin-connected diagonal rods in every panel of the top chords and purlins, and the long-panels between the pairs of trusses are braced by diagonal rods 1¼ inches square, which extend across one or two intermediate purlins.

Each end of the building is braced against lateral and wind strains by a lattice-girder in a horizontal plane through the fourth panel point above the end pin of the arch truss, about 25 feet above the ground. Horizontal struts and X-braces at all the panel points up to the hip connect the trusses of each pair, and are made of angles with riveted connections. The vertical ends of the trusses up to the hips, about 35 feet above the end pins, are braced on each side of the building by a continuous line of lattice-girders about 12 feet deep, which reach from the hip to the next panel point below. Besides this the wall panel between the end two pairs of trusses is braced by a horizontal longitudinal lattice-girder at the bottom and by diagonal rods, and the vertical posts in each pair of trusses from the end pin up to the hip are braced with horizontal struts at panel points and X-brace angles in each panel thus formed. Besides these braces, each pair of struts is additionally braced at the hips by longitudinal horizontal struts and diagonals in the three planes of web members, which are indicated by heavy lines in the elevation of the arch truss.

There is a monitor with clere-story windows on the center line of the roof, which extends to within about 10 feet of each gable, and there is a transverse lantern 8 feet high and 15 feet wide over each pair of trusses except the end pairs, and in the center of each panel between pairs. Both monitor and lanterns have opaque roofs and glazed sash on horizontal pivots in the sides. The purlins support two intermediate jack-rafters parallel to the top chords of the arch trusses in each panel, and these carry longitudinal I-beams not shown in the roof diagram, on which are sheathing boards covered with copper. Both gable ends of the building are open for a heighth of about 25 feet, up to the horizontal wind truss, and above that are closed with flat plates and corrugated galvanized iron on angle iron framing; the latter is supported by vertical and horizontal struts attached to the suspenders which carry the wind truss from the lower chord of the end arch truss. These members divide the space into rectangular panels from 10 to 15 feet wide and high.

The arch trusses have a rise of 93 feet and span of 255 feet on centers of pin, and have a clear height of about 87 feet above the rail base. They are alike in the intermediate and end panels except that in the latter the weights of the angles are lighter and the connections vary. They are 7 feet deep at the crown and about 6½ feet deep on a radial line at the hips. Each semi-truss was shipped in six sections of two or more panels each, varying according to the depth of the truss and the length of the panels. The adjacent sections have their chords spliced with field-riveted cover plates like ordinary lattice-girder bridge work, except at the crown. This joint is made in the center of a panel and the diagonals are made extra heavy to carry the chord stresses to the 5-inch center pin, which engages reinforced jaw plates locking the two sections together. The abutting vertical surfaces at the pin are milled to ¼-inch clearance and the top and bottom chords are spliced with bolts through slotted holes in the webs to allow for temperature distortions. The chords are straight and slightly divergent between panel points, and each chord is bent to a slight angle at every panel point.

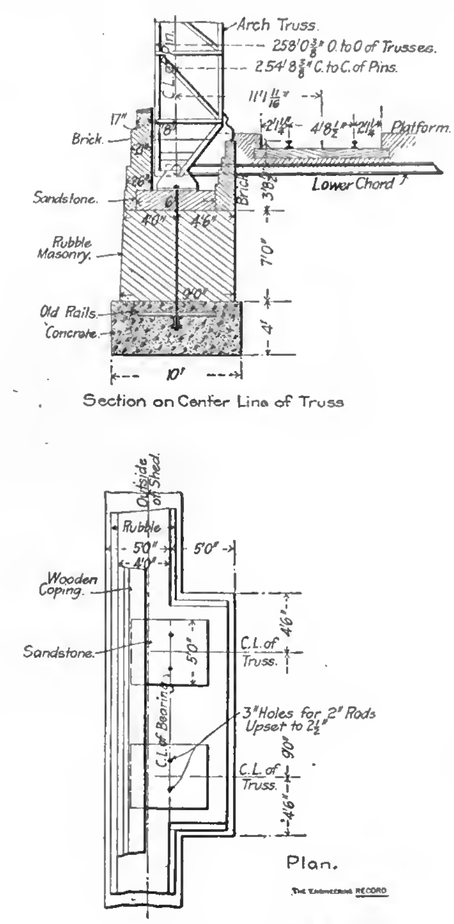
From Uo to U22, eleven panels down from the crown to the hip, the truss is made similar to the panels shown next to the crown. From the hip to the end pin the four panels were shop-riveted complete, the top chord is replaced by an intersecting vertical post in the plane of the exterior wall and the radial web members are replaced by vertical ones. The chord web plates also disappear in the two lowest panels and the members are lighter and proportioned chiefly for direct vertical loads. Connections not shown in the drawing are made to the horizontal truss members for the longitudinal and diagonal braces to the next trusses. In the gable trusses 11x½-inch plates are riveted between the pairs of angles in the web members and, projecting beyond both edges of them, make flanges to which and to the inner edges of the chord web plates, 5/16-inch solid web



GENERAL DIAGRAMS OF PENNSYLVANIA R. R. TRAINSHED, PITTSBURG.

plates are field-riveted, as shown in the drawing of section U18, U22, to form a wall surface closing the whole area of the truss.

A double-web shoe is field-riveted to the horizontal lower flange at the end of the truss, and has a semi-cylindrical bearing and jaw plates engaging the lower hinge pin and locking it to the pedestal. The web plates of the shoe are heavily reinforced and are connected by two oblique transverse diaphragms, which converge from the feet of the truss chords to the pin centers. The pin receives the end of the horizontal lower chord or tie which takes the thrust from the foot of the arch truss. This chord is a single 12-inch 100-pound I-beam with the web reinforced to 5½ inches thickness for the pin bearing. It crosses the trainshed in



PIERS FOR ARCHES.

a closed trough under the floor level, and is composed of 30-foot sections spliced with 62 ⅞-inch field rivets through double web and single flange cover plates.

The shoes are alike at both ends of the trusses, but the pedestal at one end has a center rib riveted to the base plate to lock and guide it on a nest of six 3-inch rollers 2 feet long, which travel on 3x7-inch bearing strips on a ⅞-inch bed plate 30 inches square. At the opposite end of the truss the fixed pedestal is like the roller one, except that it is about 3 inches higher to compensate for the absence of rollers, and is seated directly on the pier masonry, to which it is anchored by two 2-inch bolts upset to 2¾ inches.

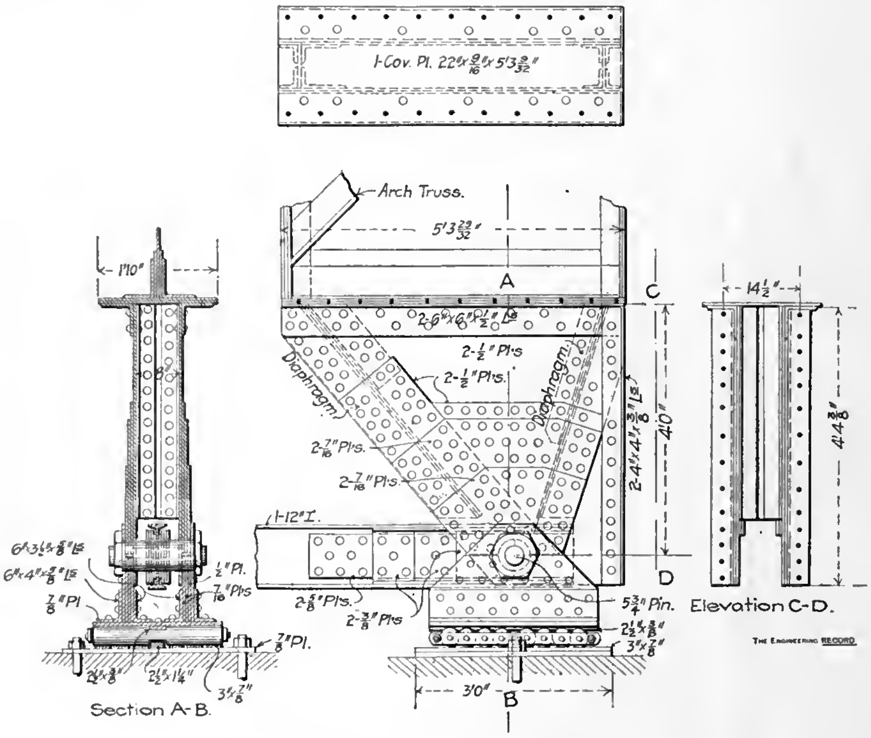
Around the four sides of the building there is a rubble masonry wall about 5 feet wide and 7 feet high, with a concrete footing 6 feet wide and 4 feet thick carried down about 16 feet below the tracks. This wall is enlarged on the inside to form piers 8½ feet wide and 16 feet long on top which each receive the pedestals for a pair of arch-roof trusses. Horizontal grillages of six old rails 6 feet long are bedded in the tops of the concrete footings for anchorages to the vertical rods 10½ feet long which engage the pedestal base-plates and have nut bearings on saddle pieces. The latter are made of two 6-inch channels, back to back, which distribute the reactions across the undersides of the grillage rails. After the trusses are erected low brick retaining walls will be built on the inner and outer edges of the foundation wall and carried up above the track level to meet the metal siding on the exterior of the trusses and enclosing the pedestals and receiving a sort of curb girder just above track level inside, as indicated in the cross-section of the piers.

The purlins are lattice-girders about 40½ feet long and 3 feet deep, with T-shaped members, consisting of pairs of angles back to back with connection plates between them. The chords are 4x3x5/16-inch angles and the zig-zag diagonals are 3x2x¼-inch angles. At each end, the girder has a 12x5/16-inch web plate 4 feet long, which projects 1 foot below the bottom flange and forms a connection plate field-riveted to the arch truss. And every third panel the holes in the ends of the purlins are slotted to make expansion joints.

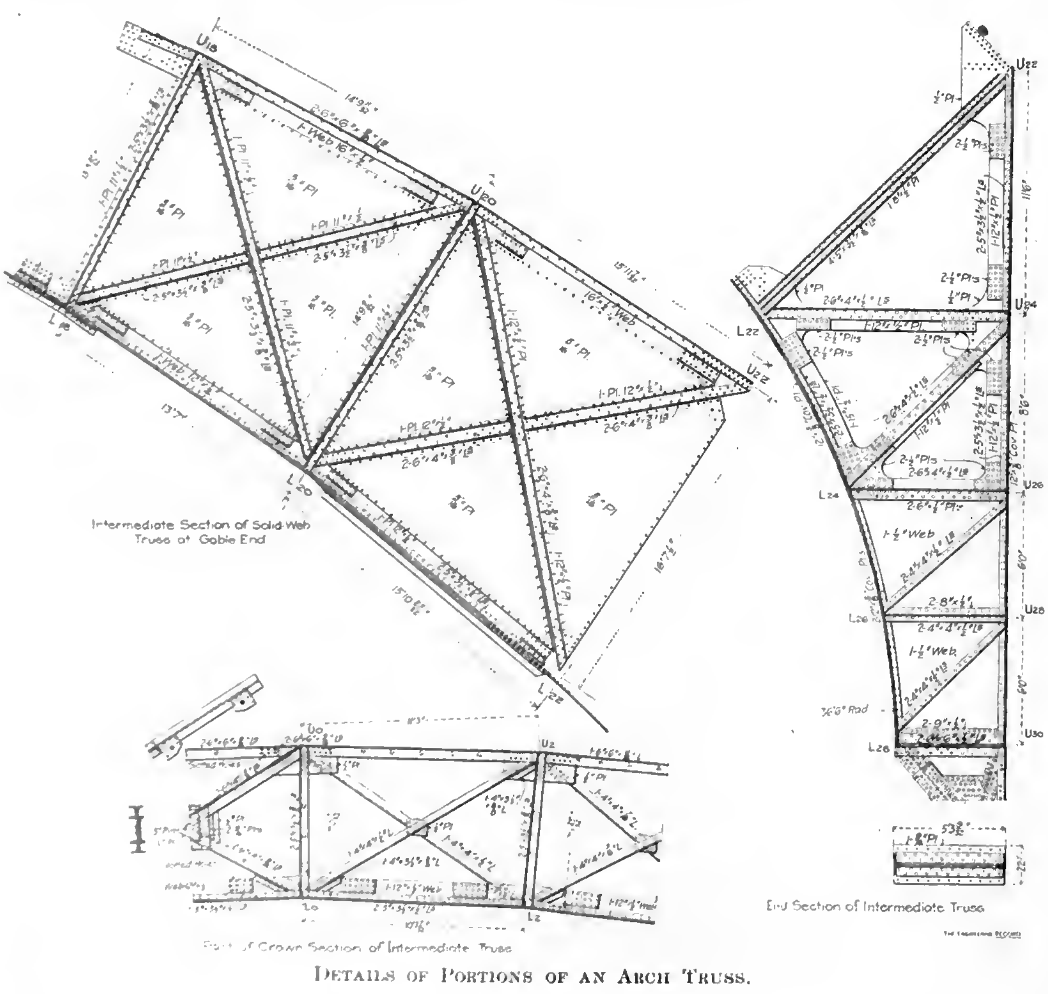
Each transverse bent of the monitor frame has four vertical posts consisting of pairs of angles braced by diagonal angles and supporting rafters made of pairs of 6-inch channels riveted together back to back with web plates between for connection to the tops of the verticals. The feet of the vertical posts have horizontal flange angles for seats on the top flanges of the roof arch trusses. All members are shipped separately and field-riveted in place. The purlins are 3x5-inch angles 3½ feet apart, which are bolted to angle clips on the rafters. The bents of the transverse lantern frames have two vertical posts and the ends of their double-pitched rafters are connected by a horizontal member, which with them and the vertical center tie plate form a sort of triangular truss 2½ feet deep and 15 feet long. Each member is composed of two angles riveted together back to back with web plates between for connections which, at the tops of the vertical posts, are field-riveted.

The wind trusses in horizontal planes at the ends of the shed are latticed girders about 10 feet deep at the ends and 14 feet in the center, with both chords equally and symmetrically curved. They are divided into 23 panels from about 9 to 10½ feet long with cross struts and X-bracing in every panel. The T-shaped chords are pairs of 6x6-inch angles back to back with double 14x½-inch cover plates. Connection plates are shop-riveted between the webs of the chord angles and field-riveted to the ends of all the web members. The cross struts are pairs of angles connected by tie plates and the diagonals are single angles with their flanges turned in opposite directions so as to clear at intersections. To support the truss near every panel point connection plates are field-riveted between the flanges of the cross strut angles and shop-riveted to the bottoms of the vertical suspension angles, which have connection plates and flange angles field-riveted to the lower chords of the arch roof trusses.

The trainshed was designed in the engineering department of the Pennsylvania Railroad Company, Mr. W. H. Brown, chief engineer. The drawings were made and the work executed under the direction of Mr. W. A. Pratt, M. Am. Soc. C. E., now assistant to the chief engineer. Mr. Geo. C. Clarke is the assistant engineer in charge of construction. The steel work weighs about 2,350 tons and was made by the Edgemoor branch of the American Bridge Company and erected by the employees of the Pennsylvania Railroad Company in charge of Mr. A. Braun.



End Details of an Arch Truss.



Details of Portions of an Arch Truss.

The Stoddart Continuous Sewage Filter.

The subject of continuous filtration is one about which there probably exists a very considerable difference of opinion among engineers and bacteriologists. A description of a continuous filter which, it is claimed, may be worked at unusually high rates, with no devices for artificial aeration, and still produce an imputrescible effluent is therefore of general interest. There has recently been published in "The Surveyor" a paper by Mr. F. Wallis Stoddart, giving the results of his experience and investigations as analyst for the city of Bristol, England, in that direction. The following article has been prepared from this paper and also from a description of one of Mr. Stoddart's filters installed at Knowle, Bristol, and described in the same publication about a year ago by the city engineer, Mr. T. H. Yabbicom, M. Inst. C. E.

The main principle underlying the continuous filter may be stated to be the preservation of the interstices of the filter as air spaces in the freest possible communication with the external atmosphere. There is evidence of some weight to show that the ventilating currents essential for providing the necessary supply of oxygen follow closely the course of the liquid applied to the filter, and that the vertical continuity of the air spaces is of more importance than the horizontal; from which it follows that there must be no hindrance to the access of air to the surface and base of the filter. Experience proves, indeed, that while no appreciable difference can be detected in practice between a filter wholly open at the sides and one so enclosed as to leave the base only in communication with the air, complete closure of the sides and base of the filter (with the exception, of course, of an outlet for the effluent) results in a total cessation of its oxidizing action. A primary consideration, therefore, is that the filter body, especially as regards its base, must not be enclosed within impermeable walls.

Passing to the construction of the filter body itself, there are three chief contributing factors to the ultimate closure of the interstices of the filter, and therefore to the cessation of its activity after a longer or shorter time, whatever its relation as a whole to the external atmosphere. These factors are, in order of importance, the disintegration of the medium, the deposition of sewage solids, and coating of the medium with organic growth. Of these by far the most serious is the first, because the resulting fine material is quite permanent and resists biological destruction. However carefully the filtering medium is prepared, fine gritty dust appears at the outlets of the filter, at first in a considerable quantity, later, for a prolonged period, in smaller traces. Means of assuring its removal must therefore be provided. Sewage solids in the very finely divided condition in which alone they should be allowed to pass on to a filter are largely amenable to microbic action, and, indeed, are not recognizable in the effluent from a filter in good condition; by themselves they will not do more than temporarily depress the action of a well-constructed filter, but, of course, they will materially add to the mischief caused by the retention of the clinker debris. The third factor, organic growth, is of two kinds, according to its position. That in the interior of the filter, at a greater depth than about 6 inches, rapidly assumes a permanent condition, and can therefore be satisfactorily allowed for. Upon the surface of the filter, however, as is well known, a more or less continuous layer of fungoid matter frequently forms, varying in extent and thickness from time to time, and may interfere with the proper feeding of the filter. It is probable that the best remedy for this condition is a superficial layer of very large clinker, so that the growth is unable to extend from particle to particle. It has been suggested that the formation of this growth is promoted by the continuous dropping of tank effluent upon the same spots, and is obviated by the use of intermittent appliances of short period, known as rotating sprinklers. This suggestion is completely disproved by the experience at Bristol, where of two continuous filters and one filter fitted with an intermittent sprinkler, all being supplied with sewage of similar domestic character, the last alone has developed a "blanket" growth of a troublesome kind.

These materials, and especially the clinker dust, are, under the influence of the continuous flow, constantly making their way to the base of the filter, and if arrested there, will, more and more rapidly as they accumulate, destroy the action of the filter. Means must be provided for their escape, and the first to be considered is the design of the floor. A plain surface sloping towards the nearest exterior has proved in practice to be the most effective, while it also lends itself to the conditions of ventilation noted above. The even sweep of the liquid over the plain surface seems to keep it clear of obstructions, as shown by the uniform discharge of effluent at all points in the circumference of the filter. The introduction of channels, especially if associated with inclined surfaces not in the direction of flow, checks the current and encourages sedimentation.

Next in importance is the grade of medium, the selection of which is necessarily a matter of debate, since two directly antagonistic considerations have to be weighed. The capacity for work of the continuous filter is in direct proportion to the extent of surface offered by the medium, and that surface is obviously greater the smaller the particles of which that medium is composed. The most active filter, therefore, will be that in which the grade of material is finest, provided the interstices are kept open. The latter proviso demands a certain coarseness of medium in order to prevent choking by the agencies already referred to. Now, a long and tedious series of experiments has shown that coarse sand becomes ineffective in a day or two, ¼-inch clinker in three months, ¾-inch clinker in seven months, and so on. On the other hand, the 3-inch material ultimately adopted by Mr. Stoddart was deliberately chosen as being entirely free from tendency to choke; and this is so valuable a feature as to render it worth while to sacrifice a certain amount of additional temporary efficiency to secure it. It is, however, quite open to others to maintain that it may be possible by means of an improved material, and perhaps at the expenditure of some trouble in cleansing, to keep a finer filter open and obtain increased efficiency. It is probably the desire to retain the use of a fine medium that has led to the introduction from time to time of various systems of aerating pipes into the body of the filter. This is, according to Mr. Stoddart, a perfectly useless proceeding, for if the medium at the termination of the pipe is impervious the latter is useless; if the interstices are open aeration will look after itself. In any case one layer of 6-inch material on the floor is advisable.

Reference has already been made to the question of a retaining wall and to the necessity of freely piercing any such wall at its base. On grounds of economy alone it would seem advisable to dispense with masonry altogether. Furnace clinker, which up to the present has given the best results of all the numerous materials tried, forms an excellently coherent bed, the outer surface of which may be almost or quite vertical without danger. The appearance is by no means bad, and the least possible obstacle is offered to aeration. As an instance of the danger of departing, even to a slight extent, from the conditions here laid down, mention may be made of the continuous filter erected at the Manchester sewage works, since it has already been made the subject of a public report. In this case, although the upper part of the filter is retained by spaced boards only, the lower part, to a depth of about 2 feet was sunk in the soil, egress for the effluent being provided by 2-inch pipes. The floor of the filter was dished to the center. The effect, as was foreseen, has been exceedingly unsatisfactory. Not only is there a total absence of the essential basal aeration, but there is no free exit for the solids, and no doubt the greater part of the filter after a few weeks' flow became completely closed, especially as coke, the medium used in this case, is very friable. A subsequent attempt to improve matters by digging away the soil on two sides did not lead to the desired result, partly because the mischief was already done and partly because it effected no improvement in the faulty direction of the flow, which remained, as before, directed towards the center instead of towards the circumference of the filter.

In reference to the method of feeding the filter, it will only be necessary to state here that the most satisfactory will be that which in the most economical manner combines the most complete comminution of the liquid with the least expenditure of force and the least disengagement of odor. If the maximum amount of work is to be obtained from a given volume of filter body by uniformly maintaining the proper proportions of liquid and air, Mr. Stoddart thinks that there can be no advantage, but, on the contrary, a loss of efficiency, in arranging for alternating periods of rest and overdosing. The distributing apparatus therefore should work perfectly uniformly over long periods of time, and should, if possible, be practically independent of supervision.

The distributer invented and used by Mr. Stoddart consists of a number of V-shaped gutters arranged at right angles to the supply channel and resting upon its margin and upon suitable supports at the other end. The tank effluent flows from the supply channel into these gutters, over the edges of the gutters and down the outside, finally dropping onto the clinkers from rows of vertical points arranged on the bottoms of the gutters. There are thus no fine perforations to become clogged, and the action of the distributer does not in the least depend upon the subdivision of the sewage by fine apertures or tubes, but there is a perfectly free passage for the sewage from the supply channel to the filter itself. The whole of this system must be laid perfectly level, no fall whatever in the supply channels being required. Care should be taken also to see that the filter is not overworked, for the trifling display made by the drops of liquid falling from the points is very deceptive.

Mr. Stoddart points out that a dilute tank effluent is more amenable to treatment than a strong one, because the additional water provides means of applying more dissolved oxygen to the oxidizable impurities. In many localities, therefore it would be an advantage in every way to add a certain amount of sub-soil drainage water to the tank effluent before its application to the filter, making the total volume treated about 60 U. S. gallons per head of population. In regard to the rate of filtration, he states that there is no difficulty in dealing with 3,000,000 U. S. gallons per acre per day with a filter 3 feet deep. The cost of the filter is stated to vary from $2.30 to $4.60 per square yard, according to the size.

It has frequently been suggested that prolonged and severe cold must prejudice the bacterial treatment of sewage, by inhibiting the activity or micro-organisms generally. However true this statement may be of some steps of the process, Mr. Stoddart states that there are no good experimental reasons for assuming it to extend to the final stage of oxidation. The known persistence of nitrification in the surface soil throughout the winter, and some direct experimental proof that rise of temperature tends to stay the series of changes at the next to the last stage of nitrosification, are sufficient to throw doubt upon the cessation of biological oxidation at temperatures short of actual freezing; moreover, the largely increased solvent power of water for oxygen at low temperatures is a favorable indication.

However, there are mechanical as well as biological matters to be taken into consideration, and a prolonged frost afforded an opportunity of ascertaining whether the continuous sewage filter was affected as a whole by a sustained low temperature. The frost commenced with the month of February, but became severe on the 7th and continued so until the 20th. The observations taken were not so complete as they would have been if it had been possible to foresee the cold weather, but the accompanying table gives such results as were noted, and suffices to show that during the whole of the time nitrification was fully maintained, while the incubator test proved the effluent to be uniformly imputrescible. The lowest temperature noted for the effluent from the filter was 35 degrees Fahrenheit.

Table Showing the Relation of Temperature to Nitrification. Horfield Continuous Sewage Filter.

Date.	Minimum temp. of air, Fahr.	Nitric nitrogen, parts per 100,000.
Feb. 7-13	15 to 26	Greater than 2.0
14	18	2.90
15	19	2.75
16	20.5	....
17	18	3.10
18	21	2.75

Analysis of the filter effluent on February 15 gave the following results, in parts per 100,000: Saline ammonia, 9.1; albuminoid ammonia, 0.33; nitric nitrogen, 2.75; oxygen absorbed in 4 hours at 80 degrees Fahr., 1.51; chlorine as chloride, 11.70.

The Stoddart sewage filter at Knowle, Bristol, was first put into operation in April, 1899, to afford temporary relief until connection could be made with the general sewage system of Bristol, but the population in the neighborhood increased so rapidly as a result of the abolition of cesspools, that changes and enlargements were soon necessary, and the works as finally arranged in July, 1900, provided for a settling tank capacity of about 31,000 U. S. gallons, a filter area of 30 square yards, and a depth of 6 feet of 3-inch clinkers for filtering material. The settling tank is considered necessary with all such filters. During the 12 months previous to June, 1901, the minimum flow of sewage per 24 hours was 24,000 U. S. gallons, and the maximum 360,000, which is equivalent to rates of 4,066,000 and 58,000,000 gallons per acre of filter per day, respectively. The latter rate seems incomprehensible.

Mr. Stoddart stated that the average composition of the effluent from this filter in 1900 was, in parts per 100,000, as follows: Saline ammonia, 1.738; albuminoid ammonia, 0.12; nitric nitrogen, 1.37; chlorine, 7.20; oxygen absorbed in 4 hours at 80 deg. Fahr., 1.04.

The average rate of flow during the year was 9,000,000 U. S. gallons per acre per day, although Mr. Stoddart had estimated that for the 6-foot depth, each acre should not be required to deal with more than 6,970,000 gallons per day. The increased quantity was, however, passed through without any detriment to the works. In fact, legal proceedings that had been commenced in July, 1900, by a neighboring council because of alleged contamination of a brook by the effluent, were dropped, and no further trouble was experienced in that direction.

The following table gives the results of analysis of samples taken on May 28, 1901, when there had been practically no rain for 14 days. On that day the flow was 56,160 U. S. gallons, or an average of about 9,060,000 gallons per acre per day. The incubator test at the same time was satisfactory. Values are given in parts per 100,000.

	Tank Effluent.	Filtrate.
Saline ammonia	3.60	2.76
Albuminoid ammonia	0.40	0.145
Nitrogen as nitrates and nitrites	None	0.67
Chlorine as chlorides	5.30	5.20
Oxygen absorbed in 4 hours at 80 deg. Fahr.	3.05	1.35

Considerable septic action took place in the settling tank, especially during dry weather flow, at which time the sewage stayed in the tank about 12 hours. At times of maximum flow, however, the passage through the tank occupied only about two hours. The amount of deposit was stated to have been very small indeed, and in 15 months had not been as much as would fill three wheelbarrows. In June, 1901, the sewage from a population of about 900 was passed through the tank and filter, and gaugings taken showed a minimum dry weather flow equal to 31 U. S. gallons per head per day. Mr. Stoddart points out that his filter does not of itself constitute a complete system of sewage disposal, some preliminary action in precipitation or septic tanks being necessary.

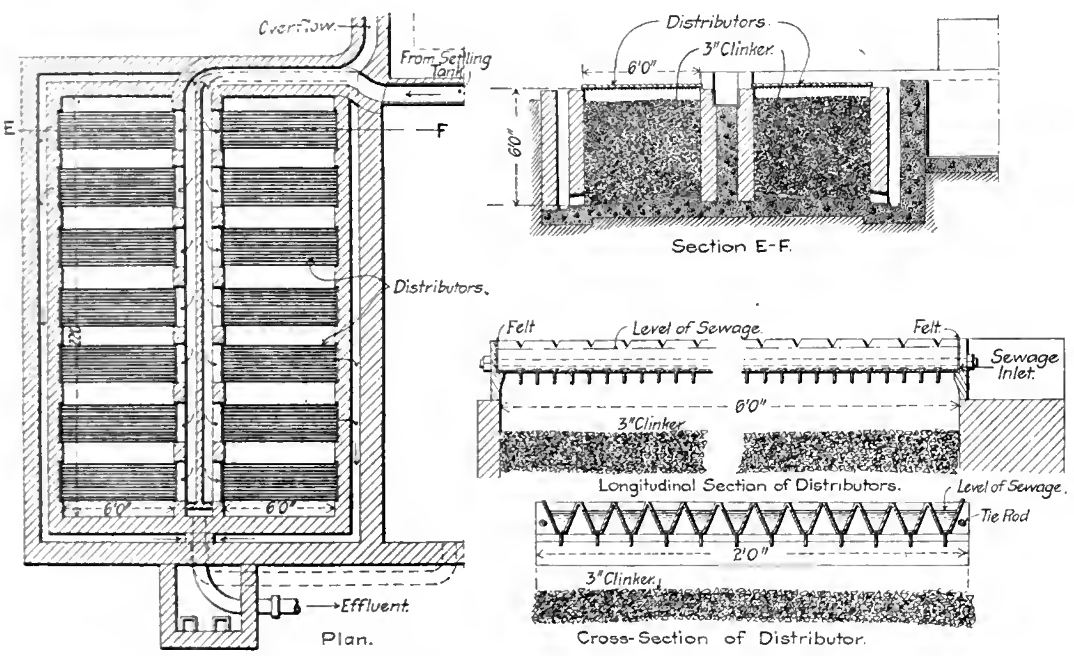


Diagram of Stoddart Filters at Knowle, Bristol.

Repairing a Leaky Cofferdam.

The hydraulic canal of the Massena power plant, at Massena, N. Y., brings the water from the St. Lawrence River to the power house on the Grasse River and terminates there in a fore-bay about 200 feet wide. This is excavated about 24 feet deep in earth and is closed, opposite the end of the power house, by a transverse cofferdam which was designed to be removed at some future time to permit the extension of the fore-bay to correspond with an addition to the power house for the installation of more 6,000 horse-power units when required. The construction of the plant was illustrated and described in The Engineering Record of January 6, February 10 and November 3, 1900.

The cofferdam consisted of two rows of sheet piles about 50 feet long driven to solid rock about 25 feet below the bottom of the fore-bay. They were braced together, and the space between them, above the bottom of the fore-bay, was filled with rammed earth, clay, etc. After the fore-bay was filled with water, leakage developed through the cofferdam and it was repaired by building an upstream addition in the dry when the fore-bay was emptied of water.

About 25 feet from the face of the cofferdam a trench parallel to it was excavated 25 feet deep to the solid rock. In it 12x12-inch vertical posts were set about 4 feet apart on centers and were covered on the side away from the cofferdam with a tight wall of horizontal 4-inch tongue and groove planks. Vertical planks 4 feet long had their lower ends sharpened to a thin flat edge, and were driven down along the face of the wall so that they broomed up and made a solid contact with the irregular rock surface. They were well spiked to the lower courses of the face planks, making a reinforced toe to the wall. Then a fillet of concrete about 2 feet wide and high was rammed into the angle between the rock and the wall on both sides of the latter, and the trench was backfilled with puddled clay.

From the top of each post in the trench a horizontal 12x12-inch sill was laid on the bottom of the fore-bay, perpendicular to the trench and reaching to the face of the cofferdam. In the vertical plane of each sill a 12x12-inch timber was set with its foot at the top of the vertical post and its upper end supported on and reaching some distance past and above the top of the first row of sheet piles in the cofferdam. These timbers were inclined about 45 degrees to the horizontal and were braced on the under side by 12x12-inch struts perpendicular to them which react against the sill or against the cofferdam. The upper side of the inclined timbers was covered tightly with a continuation of the 4-inch planking on the vertical posts and all joints were made close and calked where necessary.

In this way there was formed a practically watertight wall sloping from the top of the cofferdam to the bed of the fore-bay and thence carried down vertically inside a clay core-wall, and well joined to the rock. Its lateral thrust is resisted by the stability of the cofferdam which has now only to afford resistance to displacement and is efficient in proportion to its mass and stiffness without regard to its impermeability, which may be zero without impairing its usefulness. The under side of the inclined portion is accessible for inspection or repairs and permits the instant detection and stoppage of any leaks which may arise. The timber will be constantly saturated and may be expected to endure indefinitely, and the construction is such as can be readily removed when it is necessary to extend the fore-bay.

The repairs were made by the T. A. Gillespie Company, who were the principal contractors for the construction of the power plant, Mr. F. J. Gubleman is the contractor's engineer and Mr. C. C. Lovejoy was in charge of the work.

Plank Bank-Protection Mattresses have practically superseded those of brush on subaqueous shore protection work along the stretch of the Mississippi from the Missouri to the Ohio. They were developed by Messrs. William S. Mitchell and John O. Holman in 1897, owing to the scarcity of brush, and at present prices save about 40 per cent. of the cost of subaqueous protection where brush is employed. The planks used are 4 to 6 inches wide, 1 inch thick and not less than 12 feet long. These are woven together on inclined ways built on the decks of large launching scows, an opening of 4 to 5 inches being left between adjacent planks. The joints are made with twisted wire strands and nails.

Concrete-Steel.

Condensed from a paper by Prof. Brik in the "Oesterr. Wochenschr. f. d. Oeffentl. Baudienst."

Numerous tests have proved the high resistance of concrete-steel structures, and an extended application of the same in all engineering branches has taken place. Still our knowledge of the laws determining the relations of stresses to deformations is as yet too limited to base on it a theory of these structures which is not open to objections. For the present the facts generally established for the homogeneous materials of construction have to be applied to concrete-steel structures and the static calculations laid out on similar lines as for elastic materials of construction. The great resistance of concrete-steel is due to the characteristic behavior of the two unlike materials. The steel and the concrete adhere so strongly to each other that the composite structure acts as a homogeneous beam. It is this adhesion that offers to the concrete the resistance against sliding along the steel and thereby transfers the inner forces from one material to the other. A uniform behavior of the two materials is the result, as, for instance, in composite wooden beams.

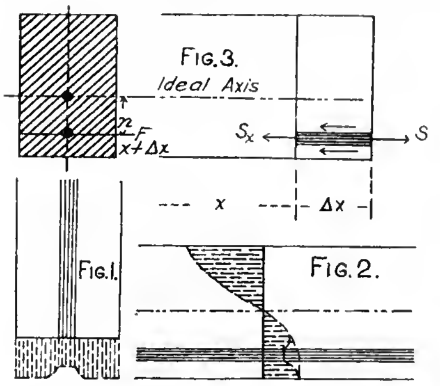
The theory of the resistance of concrete-steel beams is based on the assumption that the cross-sections of the beams remain plane after bending. This assumption simplifies the calculations essentially, but it does not actually hold true. Owing to the great difference in the values of the elastic moduli of steel and concrete, shearing stresses are induced near the steel. These stresses cause longitudinal displacements of the concrete mass around the embedded steel, which takes place even then, when sliding is prevented by the adhesive resistance. The original plane section thus becomes a warped surface with a funnel-shaped depression around the steel, as indicated in Figure 1. Even in homogeneous beams the longitudinal shearing stresses cause the section to be a curved surface instead of the assumed plane, and this is still more pronounced in the case of concrete beams. The modulus of elasticity of concrete varies with the stress on it, and concrete beams will already show a deformation of their cross-sections under the action of ordinary bending stresses. This deformation will be still further increased by the shearing stresses. If the beam is re-enforced by embedded steel the above mentioned funnel-shaped depression of the cross-section will be added to the deformation, as in Figure 2. This explains the fact that measurements of elongations taken during tests show an advance movement of the surrounding concrete relatively to the elongation of the steel. (See the results of two breaking tests with Hennebique solid floors, "Allgem. Bauzeitg.," 1901, No. 2.)

The above causes result in important errors in the common static computations so that the latter should be considered as approximations only. The effect of these errors are especially considerable in the results of deflections found by the ordinary computations. Owing to the longitudinal displacement, the deflections will be considerably greater than those given by the computations.

The value of the modulus of elasticity is of great importance in all static computation of concrete-steel structures, but this value is yet far from being established. The modulus of elasticity is dependent on the quality of the several ingredients, the proportions of the mixture and the age of the test specimen. It varies under increasing stress, decreasing more or less with increasing stresses and frequently dropping very much below the original value. A similar behavior is shown by other homogeneous materials, as steel, as soon as the stress passes the so-called elastic limit.

But while the elastic limit of steel is so high that it is and should never be reached by the working stresses, the same limit is so low in concrete that it is usually exceeded. The elastic limit of steel, for instance, may be taken at 35,000 pounds per square inch, and the modulus of elasticity at 29,000,000 pounds per square inch. Concrete on the contrary shows permanent deformations for very low stresses, and the same takes place in concrete-steel beams. In the latter case internal stresses between the embedded steel and the concrete will remain even after the removal of the external loads, if the adhesive resistance is sufficient to prevent sliding. Considere's experiments with reinforced concrete beams have shown that under repeated loads, alternating with complete unloading, the new loading caused elongations which were proportional to the stresses until the maximum of the preceding load was reached. But at the same time the modulus of elasticity kept on decreasing and every new loading which exceeded the previous limit caused a permanent elongation.

Bach's well known investigations furnish data on the numerical value of the coefficient of elasticity and its relation to compressive stress in concrete blocks of various proportions. But the information on these relations for simple tension and bending is very meager.



Considere found in his experiments on reinforced concrete beams that the concrete of the reinforced beam has the same coefficient of elasticity as simple concrete so long as the elongation does not materially exceed the amount which will cause rupture in the nonreinforced beam. If the load is increased to exceed this limit the coefficient of elasticity decreases almost to zero.

According to the above, concrete-steel structures, if stressed within the limits of elongation allowable for concrete, will have an elastic coefficient identical with the same value for simple concrete structures. Everything else being equal, the embedded steel will have none or a very inconsiderable effect on the value of the coefficient.

75-Ft. Monier Arch.—The well-known series of tests conducted by the Austrian Society of Engineers and Architects included the testing of a Monier arch of about 75 feet span. The results of this test are given in the "Report of the Committee on Arches," published in 1895. The concrete used for this arch was of Portland cement concrete of the proportion 1:3 by volume. The strength of this concrete was tested after hardening 35 to 39 days for compression and 4½ months for tension.

The tests gave for compression of cubes of about 4 inches, an average of 3,390 and 3,630 pounds per square inch for concrete set in air and water, respectively, and 2,850 and 3,175 pounds for prisms 3½ inches square and about 10 inches long. The moduli of elasticity were determined at average values of 5,180,000 and 4,660,000 pounds per square inch.

For tension the tests gave an average of 242 and 254 pounds per square inch. The moduli were found to average 5,690,000 and 6,220,000 pounds. During the test of the Monier arch careful observations of the horizontal and vertical deformations were taken and the modulus of elasticity of the whole arch determined from them. It was found to be 4,750,000 pounds. If this value of the modulus is compared with the values obtained from directly measured elongations of the same concrete, they will be found to be almost the same. It may be noted here that the modulus as found for the Monier arch has been determined from observations of the total deformations, disregarding the separation into elastic and permanent deformations. The modulus so obtained might be better termed the coefficient of deformation. In the determination of this coefficient the concrete section only was taken into account, neglecting the embedded steel. Evidently the steel did not much affect the value of the coefficient, and it may be concluded that the deflections remained independent of the presence of the embedded steel.

Prof. Melan's Tests.—In the "Jubilee Publication of the Technical High School at Brunn," 1899, Prof. Melan reports the following bending tests on concrete plates made by him. Twenty-three plates of equal dimensions but made of concrete of various proportions were tested at different ages. One of these plates, of 1:5 proportions, had an inverted T of steel, 1 9/16x1 9/16-inch, embedded in the lower side. The span was 1 meter, and the load was concentrated at the center. The breaking stresses for plates, 2½ to 3 months old, gave the average results:

Proportion.	
1:5	199 lbs. per. sq. in.
1:6	171 " " " "
1:8	128 " " " "

Plates one month old gave 152 pounds for 1:5 mortar and 142 pounds for 1:6. From the observed deflections the moduli of elasticity were deduced. The modulus of elasticity for 1:5 concrete was 938,000 pounds, and for the same concrete with steel embedded, as mentioned above, 955,000 pounds. Evidently here also the steel had little influence on the deflection of the plates.

Solid Floor Hennebique.—The writer reported in the "Allgem. Bauzeitung," 1901, on tests of solid floors of the Hennebique system. The results of elaborate calculations on the observations made during these tests are condensed in the following short table:

Load per sq. ft., lbs.	Coeff. of deformation, lbs. per sq. in.	Extreme fiber stress at center, lbs. per. sq. in.
102	2,490,000	199
215	1,990,000	292
323	1,422,000	328
430	1,025,000	342
610	600,000	356

As can be seen from an inspection of the above table, the coefficient of deformation decreased with increasing load, and the extreme fiber stress increased very slowly after passing the ultimate tensile resistance of the concrete. Exactly such a behavior of concrete-steel beams was directly proved by Considere's experiments, "Etude experimentale des propriétés du béton armé."

Value of Coefficient of Deformation and Its Effect on Results of Computations.—The question may be raised whether the coefficient of deformation or that of elasticity should be used in computations of concrete steel structures. The former corresponds to the total deformation, the latter, after elimination of the permanent set, corresponds to the elastic deformation and shows the purely elastic behavior of the specimen. Both coefficients represent numerical values of the ratio of the stress to the change of length caused by it per unit of length. According to the main assumption of the concrete-steel theory the change of length of the concrete must be equal to the change of length of the steel for the same layer. Both materials, hence, share uniformly in the deformations and all permanent changes of length must be common to both. This causes internal stresses in the member after the load has been completely removed. The permanent elongation of the concrete resists the elastic contraction of the embedded steel and induces thereby tensile stresses in the steel and compressive in the concrete. Each succeeding new load then causes stresses which have to be added to the existing internal stresses.

The above consideration leads to the conclusion that for the computation of concrete-steel beams the total deformations are determining and that the coefficient of deformation must therefore be used.

To illustrate the effect of the value of the coefficient of deformation on the calculated stresses in concrete-steel beams the same were computed for the above mentioned Melan plate with embedded T for different values of the coefficient. For a load of 2,200 pounds and a span of 1 meter the following stresses were computed for the plate, m denoting the ratio of the coefficient of elasticity of steel to the coefficient of deformation of concrete.

	Lbs. per sq. in.		
	m=10	m=20	m=30
Upper fiber stress.......	— 483	— 467	— 448
Lower fiber stress.......	+ 421	+ 352	+ 309
Greatest stress in steel..	+4,210	+7,060	+9,260

If it is assumed that concrete cannot resist tension and that it has to be wholly taken up by the steel, we get:

	Lbs. per sq. in.		
	m=10	m=20	m=30
Upper fiber stress......	— 690	— 561	— 505
Average stress in steel..	+10,600	+11,000	+11,400

Since the coefficient of deformation for the same plate has been found to be 955,000 pounds, the ratio m = 31 will be found to be correct for the given case. The stresses in the first of the above tables, based on the assumption of m = 30, will, therefore, most nearly represent the actual stresses. Of course, the assumption of a lower value for m will result in higher calculated stresses for the concrete and lower stresses for the steel.

Sliding Resistance.—The above-mentioned assumption of the theory of concrete-steel structures will hold actually true only when the sliding resistance of the embedded steel reaches the required amount. Should the resistance fall below it, sliding of the concrete along the steel will take place. Both materials will act independently, and the total resistance of the member will be materially reduced. To have a clear idea of the resistance of a concrete-steel structure an investigation of the sliding resistance is essential.

In Figure 3 let us consider the stress in the steel bar at the section X and at the section $X + \Delta X$ The increase of stress in the distance ΔX is:

$$S_{x+\Delta x} - S_x = \Delta S.$$

The steel tends to elongate under the action of this stress, but the sliding resistance of the surrounding concrete opposes this elongation with the surface a of the steel and the sliding resistance t per unit of surface; $\Delta S = at\,\Delta X$.

If ΔA_n is the difference in stress on the layer n between the sections, the theory of flexure gives

$$\Delta A_n = n\,(M_{x+\Delta x} - M_x)\ :\ I$$

Here I is the ideal moment of inertia of the section, or in other words, the moment of inertia of the newly formed composite section. Let F denote the area of the steel then

$$\Delta S = S_{x+\Delta x} - S_x = F\,m\,\Delta A_n.$$

If R_x represents the shear in section x at the distance n from the center of gravity of the steel from the ideal neutral axis

$$M_{x+\Delta x} - M_x = \Delta M_x = R_x\,\Delta x.$$

Substituting this expression in the expression for ΔA_n we get

$$\Delta A_n = R_x\,n\,\Delta x \div I,$$

and hence

$$\Delta S = R_x\,n\,m\,F\,\Delta x \div I = at\,\Delta x.$$

The sliding resistance t per unit of surface is thus given:

$$t = R_x\,m\,F\,n \div Ia.$$

For circular steel rods of diameter d

$$F = \tfrac{1}{4}\pi d^2;\ a = \pi d,$$

$$\text{and } t = \tfrac{1}{4}R_x\,mdn \div I.$$

The condition for required sliding resistance is then:

max. $t = \frac{1}{4}\,mdn \times$ max. $R_x \div I$, which equals or is less than q, if q is the greatest allowable sliding resistance.

Working Stresses.—The allowable working stresses on the materials of construction are determined by the principle that the probable loads which may come on the structure should not cause stresses which may endanger the continuous existence of the structure. It is well known that a beam will fail not only by a stepwise increase in the static load, but that also considerably smaller loads, if frequently repeated, will cause failure. The static load itself, therefore, does not furnish a sufficient indication of the safety of the structure. The latter is determined by the greatest stresses which frequently repeated will, according to experience, not endanger the structure. Considere's experiments on concrete-steel have shown that these greatest stresses are caused by frequent loads, which are only about two-thirds of the greatest static loads. The results are similar to those obtained by Woehler's experiments on wrought iron and steel. The consideration of the effect of frequently repeated loads becomes of special importance because of the probability that the sliding resistances along the embedded steel will decrease in time under frequently repeated loads. This result may be particularly expected if these loads are accompanied by shocks and vibrations. The decrease of the sliding resistances, again, means a decrease of the carrying capacity and, together with the same, of the factor of safety.

Another important consideration for the safety of concrete-steel structures is the possible danger which may arise from cracks in the concrete. The weakening of the section where the cracks occur results in a displacement of the neutral line as well as in sudden changes of stress. Under the action of movable loads the work of deformation which is induced at such points may easily lead to dangerous overstressing of the steel. Besides, cracks in structures exposed to the weather are always apprehensible because of the liability of moisture penetrating and freezing taking place. The writer is therefore of the opinion that the dimensions should be so chosen as to prevent such stresses as may cause cracks.

Aside from the above considerations in adopting unit working stresses, the inaccuracy of the method of computation and the effect of shocks and vibrations have to be considered. The writer advises making the allowable unit stress on concrete for compression one-seventh of the compressive resistance, the unit stress for tension due to bending one-half of the bending resistance of concrete, and the allowable unit sliding stress one-eighth to one-tenth of the sliding resistance.

The ratio m of the coefficient of elasticity of the steel to the coefficient of deformation of the concrete may be taken for thin plates as m = 20; for beams of greater depths m = 10. Steel should not be stressed to more than 14,200 pounds per square inch.

Since the writer believes it to be absolutely necessary to prevent any cracks, the tensile bending stresses should be determined first and in no case should they be allowed to exceed the allowable stress. For the computation of the embedded steel, however, the tensile resistance of the concrete should be neglected and the computation be made on the assumption of existing cracks at the section under consideration.

In all computations the probable load, in so far as it causes shocks and vibrations, should be increased by 20 to 50 per cent. and sometimes even more.

Christophe ("Le béton armé et ses applications," 1902) recommends m = 10, and gives two degrees of safety:

	Lbs. per sq. in.
1. *Safety of first degree.*	
Allowable compression on concrete.......	427
" " " steel	12,800
2. *Safety of second degree.*	
Allowable compression on concrete.......	711
" " " steel	21,400

He neglects in the computations the tensile resistance of concrete.

For the allowable shearing stress 21 to 35 pounds per square inch is assumed and the same values are also used for the sliding stress. All of the above values refer to stresses caused by flexure. The allowable stress for pure compression for the first degree is given as 355 pounds per square inch, for the second degree as 569 pounds. Long columns have to be figured according to a formula based on the well known Gordon formula. For columns of a square cross-section of side b and length l the coefficient by which the acting stresses have to be multiplied is given as $(1 + 0.0003l^2/b^2)$.

Data on Compression, Bending and Shear of Concrete.—The concrete used by the Committee on Arches of the Austrian Society of Engineers and Architects for the above mentioned Monier arch was of the proportion 1:3 and 4-inch cubes gave 3,500 pounds per square inch in compression. The second Committee on Arches of the same society tested prisms of concrete and masonry 20x20x39 inches. The concrete blocks of 1:5 proportion and 3½ months old gave an average compressive resistance of 1,800 pounds per square inch. Blocks of the same age and 1:8 proportion gave 911 pounds; and of 1:10 proportion 655 pounds. On the other hand, blocks reinforced by steel rods of the proportion 1:3½ and 3½ months old gave an average compression of 3,980 pounds per square inch. The embedded steel represented 8/10 per cent. of the concrete section. For m = 10, the ideal cross-sectional area would show the average compression of the concrete to be 3,700 pounds. The bending resistance of concrete was determined by tests made by Prof. Hanisch and J. Spitzer on specimens 6 months old of the following proportions.

Proportion.	Bending resistance.
1:3	597 to 711 lbs. per sq. in.
1:3½	470 to 569 " " " "
1:4	342 to 427 " " " "
1:5	228 to 284 " " " "
1:6	171 to 214 " " " "

For shearing resistance of concrete M. Teret, director of the laboratory of the Ponts et Chaussées at Boulogne, assumes that it is proportional to the compressive resistance. He deduced the ratio between the two to be 0.16 to 0.2.

The sliding resistance was found by Bauschinger to be 640 pounds per square inch, but more recent experiments have given results differing considerably from this figure. According to the experiments of Considere, the sliding resistance is very much influenced by the mixing of the concrete, especially by the amount of the water used. An increased percentage of water increased the sliding resistance considerably, and M. Considere found it at 157, 171 and 71 pounds per square inch, according to the percentage of water used in mixing. If the rolling scale was left on the steel rods, the sliding resistance amounted to 256 pounds. The concrete used for these experiments consisted of 300 kilos of cement and 1 cubic meter of sand and gravel in equal parts.

Extracts from Building Codes of German Cities for the Computation of Concrete Steel Floors.—Berlin: The static computation must prove that concrete-steel structures are able to carry 10 times the prescribed load, including their own weight, and that the steel alone is able to resist the tensile stresses.

Dresden: The static computations must be based on:

	Lbs. per sq. in.
Concrete in compression	356
Steel in tension and compression	12,500
Steel in shear	10,000

To prevent buckling of Hennebique columns the concrete of the same must have dimensions which will fully guarantee the avoidance of any dangerous stresses. The columns must therefore be figured not only for direct compression, but also for flexure. For the load acting centrally on the column the equation $I = 60Pl^2$, and for slightly eccentric action $I = 100Pl^2$ is to be used. In these equations I represents the least moment of inertia of the column sections in centimeters, P the load in metric tons and l the unsupported length in meters. If the eccentricity is comparatively great the resistance of the columns must be figured according to the rules of the theory of resistance as to eccentric action of forces.

Dusseldorf: The proportion of concrete must be such as to give after 28 days 2,140 pounds per square inch. The allowable compressive stress on concrete is 427 pounds and the tensile resistance, that is, the stress at which it is assumed the concrete will break, is 570 pounds per square inch. If a higher compressive resistance than that prescribed is proved to be available, a corresponding increase in working stress is allowed.

The highest working stress on the steel is 12,500 pounds for compression or tension and 10,000 pounds for shear. For wire rods 14,200 pounds and 11,400 pounds may be used. The stresses which may be ascribed to the steel are to be based on the ratio of the coefficients of elasticity of concrete and steel. The ratio $m = 10$ must be used. The embedded steel must be so designed that, in addition to the calculated tensile stresses, it shall also be able to take care of the shearing stresses in so far as the latter have not been provided for otherwise. Columns are to be designed according to the formula $I = 60Pl^2$. (See above).

Frankfort: Concrete-steel floors should carry their own weight and 10 times the prescribed load without any noticeable deformation. (See Berlin). Columns of concrete-steel are not permitted. The compressive stress on concrete must not exceed 356 pounds per square inch. All tensile stresses must be taken by the steel.

Hamburg: Allowable stress in direct compression 427 pounds, in compression due to bending 356 pounds, in tension zero. Allowable stress on steel, tension or compression, 12,500 pounds; shear, 10,000 pounds per square inch. Floors which are subjected to vibrations require an addition of 20 per cent. of the prescribed load. The reinforcing steel must be able to properly take care of the shearing stresses. In addition, the shearing stresses of the concrete section should not exceed 22 pounds per square inch. Columns to be computed as according to the Dresden rule.

Contract Troubles.

It is a rather marked characteristic of contracts drawn by capable engineers and architects, without the assistance of lawyers or reference to legal forms, that the requirements are stated in language so clear as to leave no question concerning the technical requirements laid down. Unfortunately when such a document reaches a lawyer for revision he is often tempted to cast it aside in utter disgust; it is wrong from beginning to end as a contract, although entirely satisfactory as a bald statement of what is required. The engineer or architect thinks that the lawyer is a windbag and the lawyer is sure that the man who drew up the alleged contract is an imposter. It is the lack of appreciation by the man of one profession of the needs of the other which produces this unfortunate condition. It is accordingly of interest to notice some suggestions to engineers and architects drawing contracts, which were recently made by Mr. John C. Wait, M. Am. Soc. C. E., assistant corporation counsel of New York City, who is engaged almost exclusively in revising the many contract forms needed by the municipality. The full paper by this engineer-lawyer will be found in the "Transactions" of the Association of Civil Engineers of Cornell University, and it deserves careful study.

One common reason why engineers' or architects' contracts for city work cannot be used, this author states, is their lack of conformity with the statutes, charter provisions and ordinances governing such contracts. Laws and ordinances are framed in terms and phrases which the caution and experience of a lawyer teaches him to repeat in his contracts. If the requirements of the charter be couched in lengthy and round-about expressions peculiar to legislators, the lawyer employs the same verbose language in his contract, feeling that if the courts have some time construed the statute, that the same interpretation would apply and must apply to the terms of his contract; and that he thereby limits or extends the powers and duties described in the contract to the same extent as was intended by the legislature and as interpreted by the courts. The engineer, not having before him the ordinances, laws or charter, and not knowing their language, sneers at the peculiar, extraordinary or inapplicable language of the contract and attributes it to the ignorance of the lawyer, without knowing or considering its source.

The engineer seeks to abbreviate the contract, to accomplish which he would combine clauses required by different provisions of the charter, ordinances or laws. As an example, in municipal contracts it is required by the ordinances and by the general village laws of the State, and by a special act of the legislature, and by the charter of The City of New York, that no person, public officer, school commissioner, or any officer of any bureau, department, etc., shall be interested directly or indirectly in any contract for public improvements or supplies. The language is different in each law and the questions arise whether or not they should all be inserted in the contract, or whether a provision should be made which should embody the purpose or intent of all four, or whether that provision passed expressly for the city in its charter alone should be utilized. These provisions being required to be inserted, the lawyer would insert them in the precise language of the statute, as nearly as may be, while the engineer would express in his own language the intent of the legislature as he might interpret it. These are differences in methods which make the disparity between contracts prepared by lawyers and those prepared by engineers.

Another feature of an engineer's contract is his apparent desire to extend his power over the contractor and to reserve to himself power without regard to their rights. The chief object of putting work into the hands of an independent contractor is to avoid the responsibility that attaches to an employer for the acts and negligence of his servants. By extending the powers of an engineer or architect the contractor is frequently made a servant whereas the owner intended that he should be an independent contractor, Mr. Wait points out; the test being whether or not the owner maintains the direction and control of the contractor. By reserving to the engineer the control of the contractor, the contractor becomes a servant, and the owner becomes responsible for the acts and the negligence of the contractor and his servants.

Another objection to extending the powers of the engineer, making him an arbitrator to determine all questions, is that it ousts the courts of their jurisdiction to determine disputes between litigants, which is guaranteed to the constitution and renders the provision of the contract providing for the engineer's determination of questions void, as being against public policy. Contracts are frequently drawn which make the determination of the engineer conclusive upon the contractor only; and further provide that the owner shall not be precluded from showing the correct amount and character of the work done, etc. Such contracts are construed either as not binding, or as binding upon both parties as if the decision of the engineer was made final and conclusive upon the owner as well as the contractor. The clause that the owner shall not be precluded from at any time showing the true amount and character of the work done is interpreted to mean that the city may dispute the determination of the engineer when the parties have not had the benefit of his honest judgment for which it is assumed they stipulated. Therefore, it is held by the courts that the owner, city or contractor may question the engineer's decision when it is made in bad faith or when there has been such a gross error as to necessarily imply fraud. These are conditions the proof of which will upset the determination of the arbitrator in any case, so that the extra efforts on the part of the engineer to protect the interests of his employer are without avail.

The provision for liquidated damages is another rock upon which engineers' contracts are wrecked. The clause for liquidated damages is regarded by some engineers as a club with which to menace the contractor and to urge him to a speedy and satisfactory completion of the contract. In their efforts to wield so large a club, i. e., by making the damages so large, they show to the court that the so-called liquidated damages are in truth a penalty, which it is the avowed policy of the courts not to enforce against the contractor, in whole or in part. Moreover, if the amount stated be damages strictly, assessed for the purpose of indemnifying the owner or city for actual losses by what authority can the engineer release the contractor from the obligation to make such losses good? The engineer, in his attempts to coerce the contractor, betrays to the court and the jury the true reason for inserting the clause, viz.: to provide for a penalty or forfeiture.

The relation of the bid or proposal, the contract, the specifications and the plans, is frequently not well understood and is discussed by Mr. Wait at length. The terms bid, contract, specifications and plans, as designating instruments or documents separate and distinct from the contract, are misnomers. The "contract" should embody all these. If there be conflict between the parts, it is simply an ambiguity which is to be cleared up by the application of general rules for the interpretation of instruments, the aim and object of which is to ascertain the intention of the parties. If the intention be known, it will prevail. If there be no ambiguity, no evidence of the intention of the parties will be admitted by the court, and no evidence will be admitted of understandings, conversations or terms arrived at previous to or at the time of making the contract. The written contract will be presumed to contain all the terms of the agreement.

The specifications are regarded generally by engineers as a place to describe the materials of construction and the quality of workmanship required. They should enumerate, carefully describe and embody the plans, and together these should give a full and complete description of the materials and work to be furnished and of the structure to be erected. Together they should contain all the dimensions, instructions and directions necessary to secure the result sought to be accomplished. They should definitely describe the site of the structure, and usually should define the process of manufacture of materials, and the finished materials of construction, not only positively as to good properties, but negatively by naming the defects that they shall not contain. They should provide for inspection and tests at the mills and shops, and for inspection during erection, and every type of work should be described in sufficient detail to enable the builder to complete the structure without further directions from the engineer or superintendent.

The several parts of a contract must be connected. If they be not physically joined together, then they constitute different documents, unless there be a clear reference in one to the others. Without such reference one cannot be read into the other so as to define or modify the obligations assumed by the parties. Without it parol evidence cannot be introduced to identify the parts of a contract.

A requirement frequently made by architects is that the specifications and drawings shall remain the property of the architect, and that they must be returned to him before the contractor shall be entitled to his final certificate and payment for work done. This stipulation is unreasonable to the contractor, because, if insisted upon, it takes from him evidence which properly belongs to him and is essential to the establishment of his rights to recover for regular or extra work done and materials furnished. The plans and written instructions and directions of the architect are the contractor's best evidence of what he has been required to do, and he is justified in refusing to part with such evidence. It is at least doubtful if the architect can claim any ownership to specifications and plans which he has prepared as against the owner who has employed him and paid him therefor, though he may have incorporeal rights in the designs and creations which the drawings and specifications embody.

The engineer should see that his specifications and plans and the lawyer's contract are not in conflict. This will occur when the contract and specifications are prepared by different persons of different professions. The duty of the court is to determine the intention of the parties, and, in order to determine that intention, the entire contract will be considered, not only in the construction of any part, but in the interpretation of the whole. If compatible with the rules and maxims of the law, the mutual intention will prevail. The court will, so far as possible, put itself in the position of the parties at the time the contract was executed, and will consider the condition and circumstances under which they assumed the contract obligations. The conduct of the parties and the practical interpretation which they themselves have given to the contract will be given their proper influence if the intention be not clear as expressed.

Other things being equal, the contract is usually held to prevail over the specifications. The former is a more ceremonious undertaking, and usually defines the obligations of the parties. On the other hand, the specifications and plans are descriptive of the work and the manner in which it is to be performed, and are almost always subject to change or modification, as conditions and circumstances attending the performance of the work may arise. With regard to plans, it may be said that they are not easily carried about; to make alterations in them requires drafting instruments and scales; while the specifications may be changed quickly by a pencil or a writing pen, which are always at hand. It is therefore suggested that the specifications would probably be controlled ordinarily by the plans, so far as representing the original intention of the parties, but as any part of the contract is subject to modification by the parties, alteration in the specifications might control so far as the execution of the work was concerned, whatever might have been the original intention of the parties.

Another circumstance to be considered in the interpretation of clauses which are in conflict is that the courts usually construe stipulations most strongly against the parties who used or prepared them. This rule has been applied generally, except where the government or public are the parties, in which case it is usually held that the meaning will be adopted which is most favorable to the government or public, holding that the interest of the public should be protected, because there is nobody who has the interest in the public's welfare that a person has in his own.

It is a practice among lawyers to provide in their contracts that the materials and work shall be the best and that the whole job shall be completed in a first-class, thoroughly workmanlike manner, this being the wish of the owner. The engineer or architect, on the other hand, is trying to keep within the sum available for the job and is describing the work and materials to meet the money in hand. The result is that what the contract requires, the specifications do not provide. The question arises as to whether the contractor is excused from making a first-class, workmanlike job if he has completed it according to the specifications and plans.

An undertaking to construct a piece of work is an undertaking to do it well and in a workmanlike manner, whether this is expressly stipulated or not, but if the owner specified the materials, workmanship or the manner in which the structure is to be erected, and if, after completion, it proves to be defective and does not fulfill the purpose for which it was intended, then the loss falls upon the owner. Anybody who undertakes to erect a structure impliedly warrants that he is reasonably skillful in his trade or calling, and that the materials he uses should be suitable for the purpose for which they are used. The fact that the price to be paid is grossly inadequate does not excuse the contractor from fulfilling his undertaking to do a thoroughly workmanlike job.

The court sometimes distinguishes those cases in which the contractor is merely to build according to plans and specifications from those in which he is to completely finish and deliver up a structure ready for use. If the contractor undertakes to deliver a structure complete, the courts frequently hold that such an undertaking is a guarantee that the plans and specifications are sufficient, and that by undertaking to complete and deliver a finished structure the contractor adopted and approved of the plans and specifications. This was held where a building was built according to various detailed plans and specifications, and, owing to the latent condition of the soil, the foundation settled. The court held that the contractor, having agreed to completely finish the building, fit for use and occupation, that he was bound by that covenant. So, too, where a contractor was to construct a well for a certain sum, according to specifications which called for a curb of a certain shape and size, to be made of timber and planking of a prescribed size and quantity, it was held that the contractor could not recover for the work and materials lost by the caving in of the well before completion, notwithstanding it was due to the weakness of the curb specified.

When a structure is to be built according to specifications and to the satisfaction of the engineer, it may be doubted if his acceptance will hold unless the work has been done according to the contract. Much must be left to the engineer's discretion and judgment, which is for his own honest determination, but so far as the contract and specifications show an evident intention to limit the engineer's discretion and to fix the quality of the work and the degree of its perfect execution, so far must the engineer follow the specifications and instructions. He may decide whether work has been executed in a workmanlike manner, if materials are of the kind required, but it cannot be contended that the engineer can accept something totally unlike that which is called for, even though it is substantially built and for all practical purposes as good or even better than the structure specified in the contract. An acceptance by the engineer of a different class of work or of inferior materials will not bind the owner nor will it relieve the contractor from his agreement to perform according to plans and specifications.

Often the owner insists that work shall be completed to his satisfaction, and is indulged by providing for it in the contract. If the specifications have been prepared, or a certain result is to be obtained which has been defined and described, and the work be completed according to such specifications, or in such manner as to accomplish a certain definite result, the question arises if the owner must be satisfied. If the contractor has undertaken to do the work to the full satisfaction of the employer, he cannot be considered to have fulfilled his contract obligations until he has completed the work to the satisfaction of the employer. If the structure to be erected be one that cannot be removed and be a benefit to the owner or employer, it is unreasonable and unjust that the contractor should be denied a recovery for the reasonable value of his work and materials, or at least for such an amount as the owner or employer has been benefited. The courts are therefore in sympathy with a recovery to the contractor in such cases. The case of work upon chattels and manufactured articles is distinguished from that of work upon buildings or structures. In the former case, the courts maintain that the contractor can virtually be placed in statu quo by the return of the chattel or manufactured article which does not suit the employer, and therefore the courts usually hold that no recovery can be had. But, when the work has been the erection of a bridge, or a piece of machinery or a house, which, by virtue of its permanent character has become attached to the land of the owner, the courts hold that if the work has been done according to the plans and specification prepared and submitted by the owner, that it should be and must be to his satisfaction, and that therefore he must recompense the contractor. The courts hold in such cases that work need be completed only to the owner's reasonable satisfaction.

A provision that is often omitted in contracts, and which is of considerable importance at times, is one to require that extra work or "extras" shall conform to the specifications and plans. Clauses which provide for the engineer's determination and acceptance in regard to materials and work done under the contract, have been frequently and generally held not to apply to extra work. This question is rarely raised because it is probably a foregone conclusion among contractors and engineers that it was the intention of the parties to have materials employed in extra work conform to that work which is expressly provided for in the contract. The manifest intention of the parties is to have good, substantial work done and to employ materials of good quality and make; and in order that the job or structure should conform throughout to good workmanship, it is a natural inference that the specifications should be followed in providing and furnishing extra materials and work, as for the work specially provided for; but this conclusion is perhaps no stronger than that it was intended that the engineer should determine questions in regard to extra work as well as questions in regard to regular work.

Electro-Pneumatic Control of the Moon Island Sewage Reservoir, Boston.

The sewage of the Boston Main Drainage system flows by gravity to a point on Dorchester Bay known as the Cow Pasture. Here it is at a depth of 14 feet below low water, and is pumped through a 90-inch tunnel under Dorchester Bay to Squantam and thence flows to Moon Island, where it is stored in four reservoirs having a total capacity of 50,000,000 gallons, from which it is discharged into the outer bay at low tide. The gates regulating the flow of the sewage into and out of the reservoirs are operated by a turbine, which in turn derives its power from the flow of the sewage either into or out of the reservoirs.

As the discharge from the reservoirs is at a low velocity and at the same end of the tanks as the inlet, a considerable amount of sediment is left in the bottom. To prevent the accumulation of this deposit, there was built at the further end of each tank from the outlet, a gate chamber from which, after the tanks have been emptied, raw sewage is discharged at a comparatively high velocity, thus washing all the sediment out through the discharge gates. These flush gates being necessarily at quite a distance from the shaft which runs the main inlet and outlet gates the power from the turbine could not be directly utilized in their manipulation. A system which would make use of the energy supplied by the turbine and be admissible of carrying the power thus generated to a considerable distance for application is found in the use of compressed air controlled by electricity, as arranged in the Westinghouse electro-pneumatic devices, some slight alterations from the standard form in use on railways being necessary to suit the special application here. An interesting description of this installation was given some time ago in "The Railway and Engineering Review," from which the following account has been taken:

The essential features embodied in this installation are: First, the operation of one to four gates located at a distance of from 950 to 1,500 feet from the center of control; second, a power sufficient to operate under varying heads of flow, causing a variance of power required; third, a means of control for each or all gates, by which any one or all may be opened or closed; fourth, an indication of their position, closed or open or in motion.

Operating power is supplied by an Ingersoll-Sergeant air compressor driven from the shafting connected to the turbine. It has a capacity of 69 cubic feet per minute, at a speed of 120 revolutions. From the receiving tank, located in the engine house with the compressor, a 1½-inch air pipe is carried along the side and end of the basins, and from it ¾-inch pipes branch into the four houses erected over the flush gates, being there connected to the operating mechanism. All pipe is carried under ground in hard pine trunking and auxiliary reservoirs are located in manholes at points of connection to the houses and also at the exit of the main air pipe from the engine house. These collect any moisture or sediment which may be contained in the air pipe and carried along by the air, and by means of blow-off cocks may be emptied at any time, thus insuring a supply of clean, dry air at the point of appliance.

The flush gates are of iron and are raised vertically through grooves in a frame fastened against the granite wall, friction being minimized by the use of composition metal plates on the sliding surfaces; and to insure a minimum leakage they are forced tight against the frame, when down, by wedges attached to the four corners of the gates, the weight of the gate being sufficient to cause the wedges to perform their function. Connected to the gate is the piston rod of a 4 foot by 10-inch vertical cylinder or ram and by the introduction of air at sufficient pressure above or below the piston head, the piston is forced up or down, thus opening or closing the gate. Pipes of ¼-inch diameter are tapped into the top and bottom of the ram and are carried to an electro-pneumatic valve mechanism, placed on an iron shelf against the side of the building.

In the engine house a cabinet containing 15 cells of Edison-Leland battery, the only source of electrical energy required, is used for the push-button machine by which the operation of the gates is controlled and in which the indication is shown. The circuits required for the control of the gates and the indication of their position, are carried on two waterproof wires for each gate, the air pipe affording ample means of common return. All wires are run underground in the same trunking with the pipe, but in a separate groove, and as an extra precaution against injury by the action of sewer gas, both are covered with pitch poured over them while hot.

From the machine a 10-wire cable (two wires being spare) is carried to gate house No. 4; from house No. 4 to house No. 3 a six-wire cable is run; from house No. 3 to house No. 2 a four-wire, and from house No. 2 to house No. 1 a two-wire, the cable in each of the houses being brought to a terminal board. This is done to facilitate the tracing and location of any trouble which might occur, all wires being in short stretches.

In the gates houses the wires are connected to the magnets controlling the motion of the slide valve, which, by assuming either of two positions, admits air into the pipes to the ram for an upward or a downward throw; and by the use of a mechanical arrangement of gears, connected by a wire run over pulleys to a light rod which projects through the top of the ram, and which, being a continuation of the piston, travels with it, a new circuit is formed, remaining constant while the gate is in operation and ceasing when the gate reaches either extreme position, up or down. By this latter circuit indication is made in the machine in the engine house, where, during the movement of a gate a corresponding marker shows red, but upon the completion of the stroke and a consequent ceasing of the current, the marker is released and assumes a new position by gravity where it shows white.

The controlling buttons in the machine are in pairs, one above the other, as in railway switch operation, and as the upper one is pushed in, setting the indication arm and making contact which forms the circuit for raising the gate, the lower one is forced out and in this way the position of the buttons indicate the position of the gate.

The two pipes from the slide valve to the ram are used alternately as a passage for air applied in the ram or exhausted from it, the exhaust reaching the open air through a small chamber which is part of the valve. On the up-stroke, for opening the gate, air is admitted to the bottom of the ram, and as the piston is forced upward the air above is exhausted through the pipe connecting the top of the ram with the valve mechanism. On the down-stroke, for closing the gate, the operation is reversed, the top pipe acting as supply and the bottom as exhaust.

The gates weigh 1,500 pounds and this, when the weight of the piston, the friction in the ram and on the sliding surfaces is added, will be equal to about 2,000 pounds to be lifted. With no head in the sewer the gate rises at 15 pounds pressure, and with extreme head at 35 pounds.

On the down stroke, the weight of the gates, etc., would have a tendency to cause a rapid fall if the pressure supporting it was at once discontinued. To obviate this difficulty a swing check valve having a small hole drilled in the seat, is so inserted in the pipe from the bottom of the ram that pressure to the ram causes a full opening, but exhaust causes it to close, the drilled hole allowing but a small escapement of air, which, by its slow passage, forms a cushion in the ram and offers sufficient resistance to prevent any sudden fall. Shortly before the time of flushing, the compressor is thrown into service and in about 15 minutes enough air (a gauge pressure of 35 to 40 pounds) is stored in the receiving tank and pipe line for the operation of all the gates. The compressor may then be shut down until air is again wanted for another operation.

During the ten years of the operation of this plant, no changes have been made except the enlarging of the basins to twice their original capacity, as described in The Engineering Record of November 4, 1899, this enlargement making necessary the system of flushing which has now been installed for about 9 months. Storage of the basins takes place for 20 hours each day and 4 hours is allowed for discharge, this being ample time, for the sewage passes out at the rate of 1,000,000 gallons per minute, and the basins may be emptied in about 50 minutes. During discharge, sewage is noticeable for about two miles down the harbor, but in a short time after closing down it is so thoroughly mixed with the salt water that it is entirely lost to observation.

Electrolysis of water mains on the Cob Dock at the Brooklyn Navy Yard is causing serious trouble.

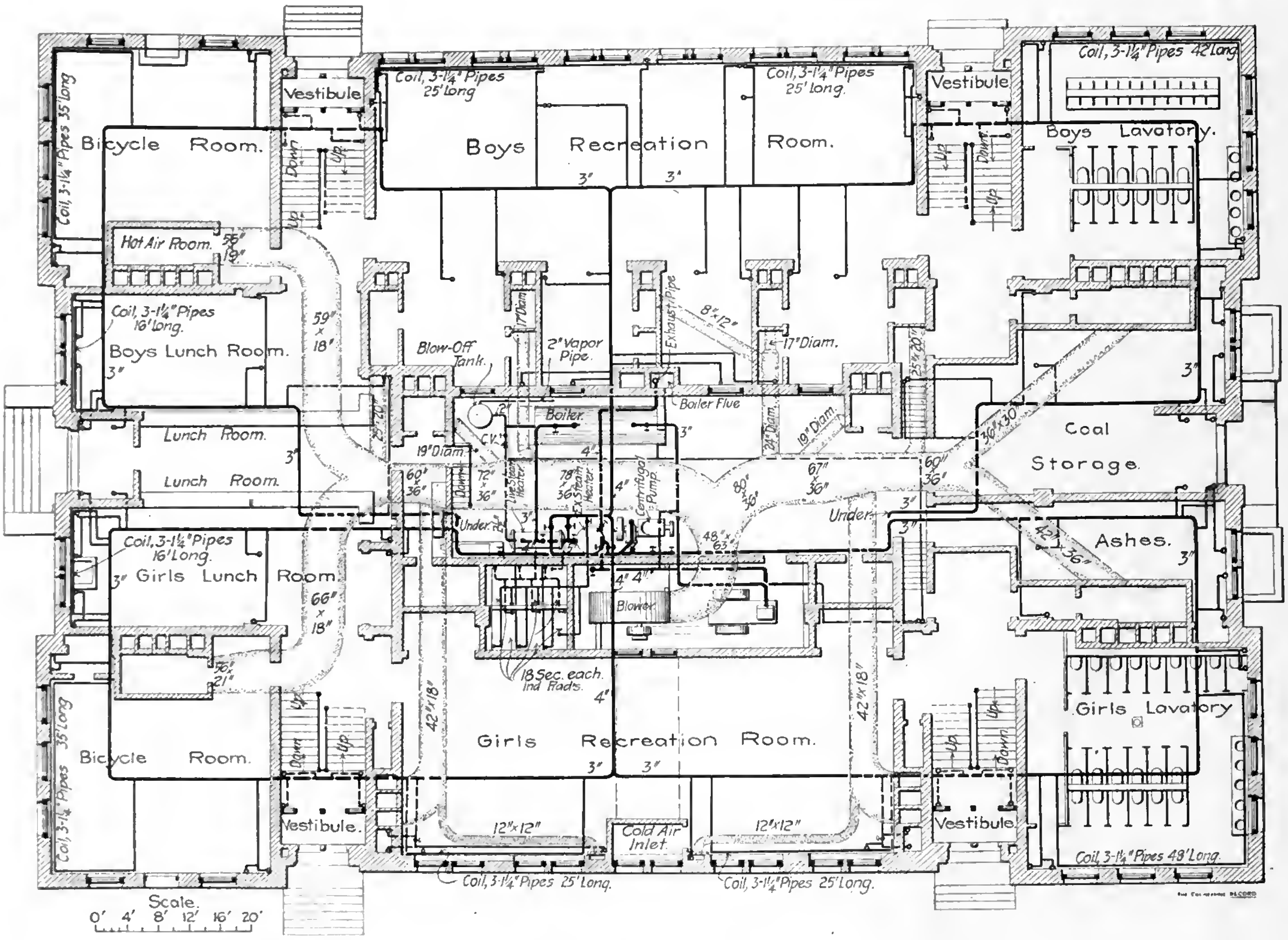
Ventilating and Heating the Worcester, Mass., High School.

The City of Worcester, Mass., has recently completed a new high school building which is warmed by hot water under a forced circulation. The system is of the direct radiation class, with the air supply for ventilation only. The air is, of course, tempered, indirect hot-water radiators being used; and an exhaust as well as a plenum fan are employed to circulate the air. The water warming apparatus comprises two heaters, one to utilize all exhaust steam without back pressure, and the other, to receive live steam when the supply of exhaust is insufficient. For the generation of steam, a single boiler has been relied on. The apparatus is arranged compactly with reference to easy control, and both the air and the water are distributed in an interesting manner.

The building is a three-story and basement story, where it has a gallery, and it has a seating capacity of 1,200 persons. On this plan may be pointed out the distribution of flues for the air system between rooms and corridors and the unusual location of wardrobes economizing the spaces between flues. As stated the assembly hall occupies space in the second story, which is arranged like the first story, with school rooms on three sides, separated from the assembly hall by corridors. The third floor consists largely of laboratories, which are arranged on all four sides, with a drawing room in the center lighted by overhead skylights in the roof. Four stairways rise through the building.

The ventilating system has been designed to supply and exhaust about 40,300 cubic feet of air per minute. The total number of seats in the school rooms is 1,240, so that the per capita supply of air on this basis is about 32.5 cubic feet of air per minute, 2.5 cubic feet charged through a system of ducts and flues to openings in the rooms. The tempering surface consists of Bundy Newport indirect radiators supported in two tiers on tee irons and pipe standards, comprising altogether 12 stacks of 18 sections each, and aggregating 4,320 square feet. As the blower is designed to handle 40,330 cubic feet of air per minute, 560 cubic feet of air are passed per hour per square foot of the tempering stacks.

The fan is a full-housed, steel-plate blower made by the American Blower Company, of Detroit, and has a wheel 8 feet in diameter and a discharge outlet 53.5 inches square. It is driven by belt from a 10x10-inch horizontal center-crank piston valve engine built by the blower maker, and under ordinary operation is depended on to furnish about 40,330 cubic feet of air per minute. The air is delivered through a top horizontal discharge and into the duct work which, as usual, is of galvan-



PLAN OF THE BASEMENT.

structure, 109x156 feet in plan, and contains 37 rooms, exclusive of a large assembly room and the basement. It has six entrances, four giving access to both the basement and the first floor. The plans of the basement, first floor and attic are shown in the accompanying drawings. As indicated on the plan of the basement, the rooms of that story are only occupied for short periods and are not provided with special means for ventilation, except the main lavatories from which separate vent passages are furnished to prevent a diffusion of the air from those rooms into the rest of the building. The apparatus for heating and ventilation has been located in the center of the basement with space for coal storage and for ashes at one end.

In the first story, as shown, are a number of school and teachers' rooms and an assembly hall. The latter extends through the second above the State requirement. In the case of assembly hall air is delivered through eight fresh air openings aggregating 48 square feet in gross area; with a velocity of 400 feet per minute through the openings, on the basis of the gross area stated, 32 cubic feet of air can be supplied per minute per person with 600 people in attendance. This means with 1,200 people, the full capacity of the hall, that 15 cubic feet are delivered per capita per minute. On account of the short periods of occupancy, it was not considered justifiable to make provision for greater air supply.

The air for the ventilating system is received through basement windows in the front of the building into a cold-air chamber walled off from the girls' recreation room, and is then carried in an underground passage to the tempering chamber. From the tempering stacks it is received by the blower and then discharged ized iron suspended from the ceiling. The duct system, however, is comparatively simple, in that it consists in a general way of large ducts which deliver to hot-air rooms, so called, spaces bricked off at the foot of different clusters of flues. Dampers are provided for directing the air to the hall flues, when desired. The individual supply to the rooms is taken from these points and the air flows into the room through an opening in the inside wall of the room, 8 feet from the floor. Over the room opening is fitted a bronzed wire screen, and to control the air flow each supply flue has a balanced damper in it, with a rod extending through the brick wall into the room, fixed permanently to equalize the distribution of air throughout the system. At the room opening there is a deflector to control the direction of flow. A velocity of 2,000 feet per minute is allowed in the main ducts.

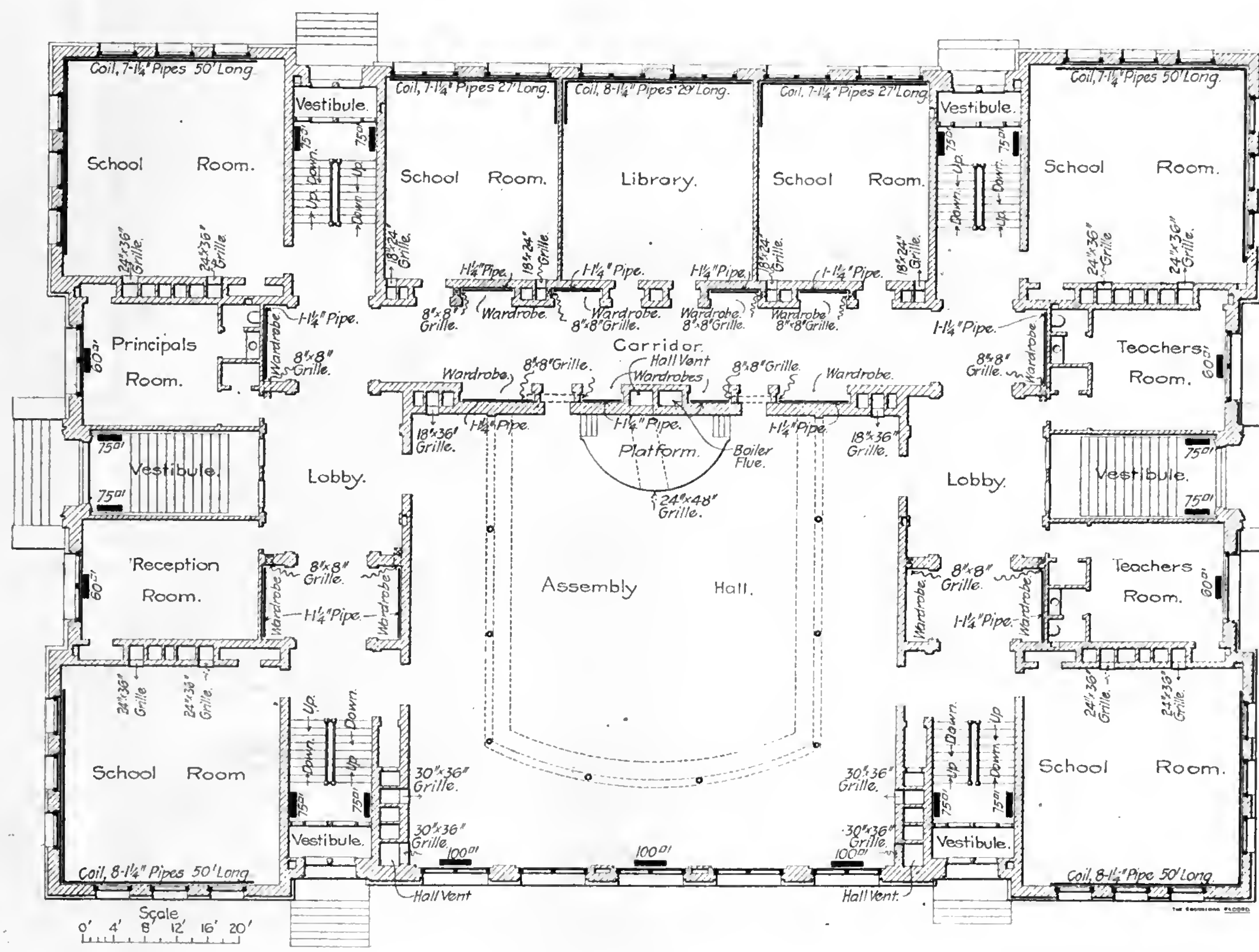
The escape of air from the rooms is accomplished in the usual way through vent openings likewise protected with grilles, the vitiated air rising to the attic space, where ducts convey the air to a central chamber. From this it is removed by means of a disk fan discharging into the atmosphere. In connection with the ventilating system, care has also been taken to provide for ventilation in the wardrobes. An outflow of air is arranged for through galvanized-iron vent flues 8 inches square running to the attic and connected into the system of vent ducts described. These rooms, as explained, are distributed along the corridors and the air passing from them comes from the corridors. Besides thus providing ventilation, the corridors which are furnished with no direct radiation, are warmed somewhat by radiation which has been installed in the wardrobes in the form of a short run of pipe, for the purpose of heating the wardrobes and drying the clothes. The corridors are, of course, comparatively unexposed and on the first floor are warmed by the intermittent inrushes of hot air from the vestibules when doors are opened. The attic fan is an American Blower disk fan 84 inches in diameter driven at 200 revolutions per minute by belt from a 7½-horse-power Eddy motor. The motor is arranged to be controlled by means of a rheostat in the boiler room.

The main toilet rooms in the basement are ventilated independently of the rest of the building. The air rises from each in a flue to the attic, where it is collected, as indicated on the attic plan, at a 30-inch Emerson ventilator and discharged into the atmosphere. For accelerating the air flow through this system, a steam radiator, fed with live steam, of the circular vertical-tube pattern, and having 100 superficial feet of surface, is located below the ventilator. When the heating apparatus is not in use the acceleration of the air flow is accomplished by small cast-iron stoves placed at the base of each flue in the basement.

The Evans exhaust hot-water system was the method adopted for warming, the principal apparatus, as stated, being in the center of the basement. The steam boiler is of the horizontal tubular type with an overhanging front. It was built by Stewart Boiler Works, of Worcester, and consists of a shell 18 feet 4 inches long and 66 inches in diameter and 80 tubes 3 inches in diameter and 17 feet long. It is provided with the Sydney Smith feed heating system. Steam, which ordinarily is generated at 80 pounds per square inch, is carried from the front outlet to the engine of the circulating pump, the blower engine and to the aspirating surface for the toilet ventilation, and from the rear outlet, to which is connected the safety valve, to the auxiliary or live-steam heater belonging to the hot-water heating apparatus. The exhaust of the engines is led to the exhaust heater, which is of the vertical closed steam tube type, and the condensation is piped to the blow-off tank. As usual, the exhaust may by-pass the heater and reach the atmosphere through the usual exhaust riser, which, however, has no back-pressure valve. The auxiliary heater is suspended horizontally from the basement ceiling, so that the condensation can be returned directly to the boiler, and it is of the water-tube pattern. The heaters are designed as feed-water heaters are, account being taken of the small range of temperature through which the water is heated. The circulating pump is a 4-inch Lawrence centrifugal pump, and ordinarily is operated at 400 revolutions per minute from a directly connected vertical Lawrence engine. The pump maintains a difference of pressure of 8 to 10 pounds per square inch between the return and flow connections to it, to overcome friction resistance in circulating. A 5-horse-power 500-volt electric motor has been installed as a relay to the Lawrence engine and for use also at night, when the fires are banked. By this means the heat of the steam generated by the low fire may be distributed throughout the building to the direct radiation surface, preventing much of a drop in room temperature and at the same time doing away with the necessity of a night man.

The method of distributing the water is quite interesting. From the pump the water is forced in turn through the two heaters, both of which are provided with by-passes. The main starts 5 inches in diameter. First the tempering stacks are supplied with a 3-inch branch and the main is then subdivided, as indicated in the basement plan, into four 3-inch loops, each supplying the heating apparatus in one-quarter of the building. The various radiators and coils are all provided, of course, with flow and return connections, but the separate circuits are shunts upon the 3-inch main. The main thus acts as both flow and return, and the four loops are all joined at the centrifugal pump, where the water is again forced through the system. The coils in the rooms of the second and third floors are supplied from the same pair of risers, while those in the first story are connected to independent risers. Similarly the basement coils are independently connected to the main. The ratio of cubic contents to direct radiation surface varies from 60 to 1 to 90 to 1.

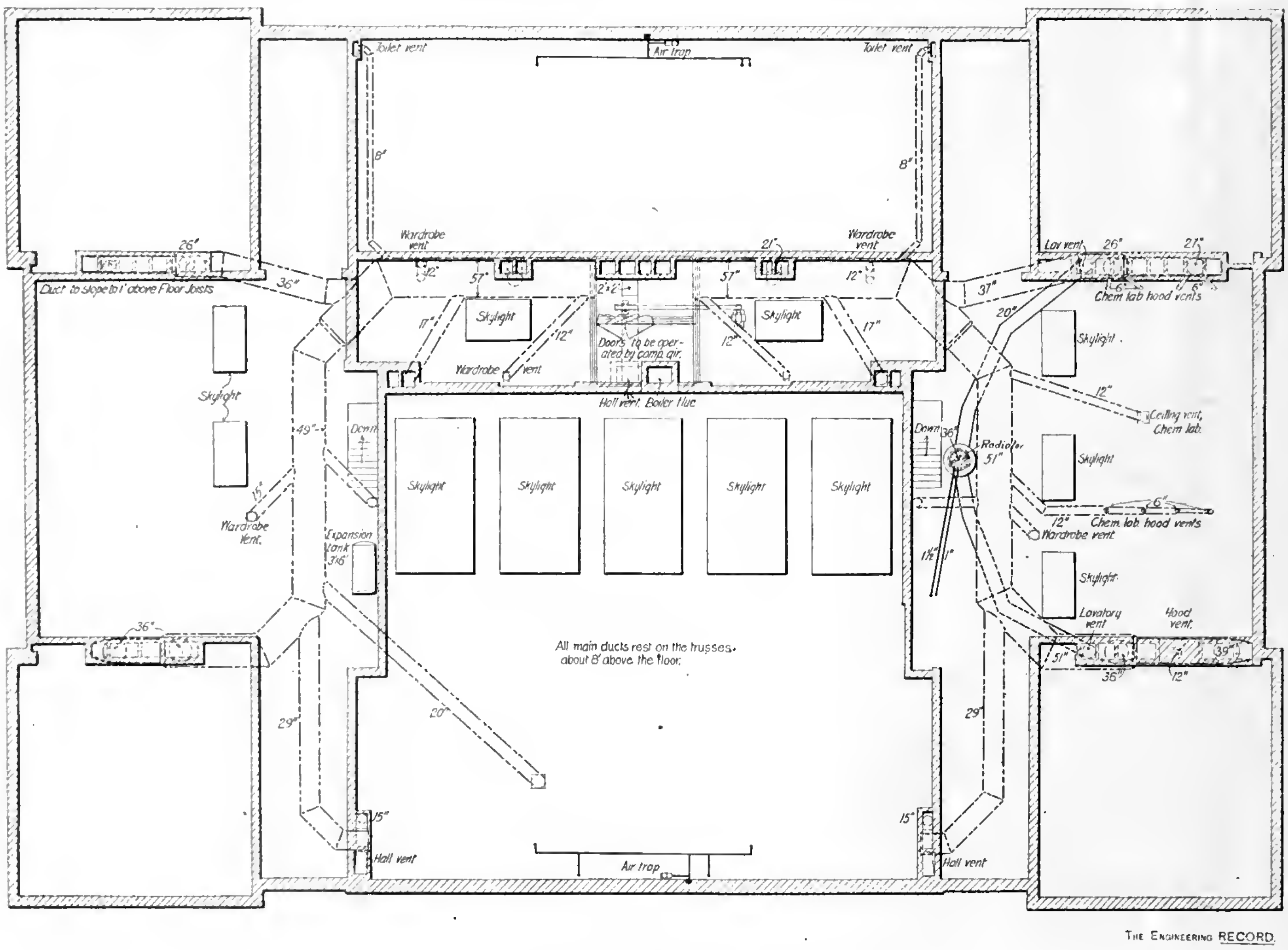
The expansion tank is located in the attic, built of 5/16-inch steel, and is fitted with a 2-



PLAN OF THE FIRST FLOOR.

inch, nickel-seated, pop, safety valve, set to blow at 15 pounds pressure and discharging by a pipe to the blow-off tank in the boiler room. A water-pipe connection is made to the tank and a Kieley automatic boiler feed furnished to maintain a water level near the center of the tank. At two high points in the system, shown in the attic plan, are placed two float traps inverted and used as automatic air vents. The Johnson system of temperature regulation has been installed, with the diaphragm valves controlling the flow of water through the direct radiation coils.

The architects for the building were Messrs. Frost, Briggs & Chamberlain, of Worcester. The heating and ventilating apparatus was designed by Messrs. Evans, Almirall & Company, of New York, patentees of the system of hot-water heating installed. The contractors for the work were O. S. Kendall & Son, of Worcester. The plant cost about $18,000. During the first winter's heating 200 tons of anthracite coal were consumed and two janitors sufficed for all work.



PLAN OF THE ATTIC.

Two English Portland Cement Works.

The general interest in concrete construction which is now evinced abroad is reflected in the numerous articles in the foreign technical press on the manufacture and uses of Portland cement. Among these recent articles were two relating to English cement works, from which a few notes are given below. The first article was a description of the Greenhithe plant of I. C. Johnson & Company, described in "The Engineer."

The works are located over a bed of chalk and close to the River Thames, which affords ample shipping facilities. On a portion of the site the chalk is overlaid by a rich bed of excellent gravel held in sand and loam. This would have in any case to be removed somehow in order to get at the chalk. As a fact, it is being quarried hydraulically by a subsidiary company, which pays a royalty for the privilege, the process having the advantage, besides removing the material, of separating it from the sand and loam. The washing water is led over depositing beds, where the loam falls down in a slurry. This, when mixed with a certain amount of waste from the chalk pits, was found to be an excellent material for making bricks. A brick factory was therefore added, and bricks are manufactured on the site, kilns for this purpose having been erected. The sand, gravel, and larger stones find a ready market. The chalk is brought from the workings on narrow gauge cars and dumped near the wash mills, and the clay is brought to the same place by similar cars running from the wharf where the barges which bring it from the Medway are unloaded.

The clay is kept uniform in quantity at these works and the variation in the proportions of the raw materials is made by changing the amount of chalk. The materials are loaded separately into handbarrows, wheeled over scales where they are weighed, and then dumped into the wash mills which mix them with water into a slurry. The foreman in charge of the weighing is also in charge of the wash mills and is in close communication with the laboratories, which designate at frequent intervals the proper proportions of the ingredients. These variations are stated to be only one pound in 500 pounds in some cases.

The wash mills employed are of the ordinary type, having revolving spider arms carrying depending stirrers. The mingled slurry finds its way through gratings into catch-pits placed at that side of the wash mills remote from the holes into which the clay and chalk are charged. From these pits the mixture is in each case lifted by means of a revolving bucket wheel, which takes it to such a height that it can flow down wooden shoots leading to horizontal stone mills. There are in all six mills driven by bevel gearing from the shaft running under the floor of the building, which is raised off the ground. This shaft also drives the pump, which forces the ground slurry as it comes from the mills through flanged pipes to every part of the works where it is required. The engine for driving these grinders and pump is a horizontal compound condensing engine driving through gearing on a horizontal shaft. It obtains its steam at 80 pounds pressure from a battery of elephant type boilers. This engine runs condensing—as, indeed, do the other main engines in the works. The water necessary for this is obtained a few feet below the surface.

These works, it is said, witnessed the birth of the Johnson chamber kiln, and there are no less than 54 kilns of this kind, but of different types, in various parts of the works. Some of these are of the ordinary tank form, in which the gases go direct over the top of the slurry, when it is being dried, to the chimney. In the later designs the slurry is held on a floor of iron plates carried on brick arches. In these the heated gases generated by the combustion of the charge are first led over the top of the slurry to the end remote from the kiln as in the original form; they then descend by two vertical flues to two horizontal flues running under the iron plates towards the kilns again, these flues being connected to a further horizontal flue running also under the iron plates back to the far end of the chamber and thence to the chimney. Then there are kilns with firing pits, and others—the latest—where these pits are done away with, the fire being carried on removable girders.

Taking them on the average, each kiln will produce 27 tons of clinker per "burn," and three "burns" are obtained from each kiln every 14 days. The tanks are, of course, filled with slurry from the flange pipe already mentioned.

When the burning is finished and the charge has cooled, the clinker, after being carefully inspected and the underburnt portions removed, is taken in trolleys running on narrow-gauge lines to either one of two grinding mills. The first of these consists of three horizontal stone mills in conjunction with a tube mill. The clinker is first broken in a crusher, and is then elevated by means of a bucket conveyor to the stone mills, the delivery from which descends to a tube mill, which in its turn delivers on to an endless belt. This belt drops the cement into a conveyor which communicates with the various bins in the cement warehouse. The engine driving these mills and their accessories is a horizontal cross-compound condensing engine of about 300 horse-power. It obtains its steam from the elephant type boilers already alluded to.

The second and more modern grinding mill has ball mills in place of stone mills, though the finishing is done, as in the first instance, by means of tube mills. Rope-driving is employed throughout—in fact, rope-driving is largely used in all parts of these works—and any one of the mills can be stopped or started at will, irrespective of the others. For taking the cement in its various stages of manufacture about from place to place, either trough conveyors with worms or endless belts are used. Practically speaking, the cement is never touched by hand from the clinker stage until it is delivered, finished, in the storehouses. Here the delivery could be made, were it necessary to do it, direct into sacks or casks for despatch, the length of time it is on the belt serving practically to bring the temperature of the recently-ground cement down to that of the atmosphere. If it is necessary to take the material to a higher level this is done by means of encased bucket conveyors. Here there is a complete dust-collecting plant, the dust being drawn into ducts placed in various positions, and all delivering into a settling room, where the dust collects and falls down shoots to a traveling belt at the lower level. The 225-horse-power engine driving this part of the works obtains its steam from Lancashire boilers. The total storage available on the premises amounts to some 10,000 tons. The weekly output of the works is about 1,300 tons on the average.

The second of the English works to be described is the plant of Martin, Earle & Company, on the Medway near Strood. There are really two plants, the first established in 1894 and the other unfinished at the time of the publication in "Feilden's Magazine" of the notes from which the following account has been condensed. The materials used are chalk obtained just back of the works and clay from marsh land in the vicinity.

The old plant is not unlike others of the same period. The materials are mixed into a slurry in wash mills, ground in wet mills and then run into basins from which pumps supply the 95 Johnson kilns. The clinker is then ground and passed in a finished state to the warehouse, holding 10,000 tons. All stages of the process are supervised by a central laboratory. These works turn out from 2,500 to 3,000 barrels a week.

The new works are noteworthy for the extensive use of American methods of production, and are about equal to the old plant in capacity. The raw materials are mixed in wet mills, but the slurry is passed through a new type of mill before it is pumped to the kilns. The latter are of the rotary type but contain a number of modifications of the pattern usual in the United States. The final form was not adopted until two years of practical working with a full-size kiln had demonstrated its value. Sixteen of the kilns, each 90 feet long and 6 feet in diameter are to be used. They are all driven by worm gearing from a single shaft actuated by a pair of 350-horse-power engines, built in the shops of the company.

The kilns use powdered coal which is dried by the heat of the kilns themselves. It is placed in one end of an annular chamber about the cylindrical shell of the kiln, the revolution of the latter gradually moving the fuel along to the other end, where it is discharged upon conveying apparatus running to the coal mill.

The clinker from the kiln drops into a conveyor which takes it to an elevator running to the top of a cooling tower. Here it passes downward slowly and is cooled by blasts of air forced into the tower at different elevations by a blowing engine. When cooled it is taken by conveyors to a grinding house containing thirty Griffen mills, each mill provided with a chute that discharges directly into the storehouse alongside. This storehouse has a capacity of 10,000 tons.

Personal Notes.

Mr. Ralph H. Sparks has been elected city engineer of Terre Haute, Ind.

Mr. A. O. Cunningham has been appointed bridge engineer of the Wabash Railroad, with headquarters in St. Louis.

Mr. Fred Pardee has been elected constructing engineer of the water and electric light plant to be installed at Hazlehurst, Miss.

Mr. Rudolph Hering has been retained as engineer of the Passaic Valley Sewerage & Drainage Board, which was recently organized to build a joint sewerage system for the cities of that New Jersey district.

Mr. George H. Fenkell has resigned his position as chief draftsman in the engineering department of the Detroit Water Commission to become the civil engineer of the Erie, Pa., Water Commission, which proposes to make extensive improvements of the works under its charge.

Mr. Alonzo C. Hoover has been elected superintendent of the Lebanon, Ind., water-works.

The ownership of the Carthage, Mo., Water-Works Company has changed hands, and Messrs. George G. Bayne and J. M. H. Young, both of Joplin, have been elected president and secretary respectively.

Mr. Epes Randolph, general manager of the Los Angeles Railway Co., has been elected president and general manager of the Cananea, Yaqui & Pacific Railway Co., which is to build a line through Arizona, New Mexico, Colorado and south along the Gulf of California through Sonora and Sinaloa, Mex.

The Tunnel of the Niagara Falls Power Company was inspected on June 1 after five years' use. No brick was out of place and the work seemed as sound as when first put in use. The brickwork was laid in Giant Portland cement mortar.

Civil Engineers are Wanted in the Bureau of Yards and Docks of the Navy Department, and candidates will be examined at Chicago and New York on September 29. No person will be appointed under 27 or over 35 years of age nor one without satisfactory physique, a diploma from an engineering school of repute, five years' practical experience in civil engineering and three years' responsible charge of work. The character of the examination was fully explained in The Engineering Record of February 16 and 23, 1901.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xvi, xviii and xxvii.

WATER.

Roslyn, N. Y.—The contract for furnishing a water supply for fire purposes to Great Neck Water Supply Dist. (bids opened Aug. 18), has been awarded to McFarland & Pierson, 1123 Bway., New York City, at $30 per year each for 40 fire hydrants (5-year contract).

Hartwell, Ga.—J. W. Barnett and O. H. Sheffield, of Athens, Ga., have received the contract for the preparation of plans and specifications for a water works and electric light plant.

Springfield, O.—Bids are wanted Sept. 16 for the purchase of $30,000 bonds issued to provide for the extension of water mains and pipe lines, and for enlarging and improving the water works system. R. N. Lantz, City Clk.

Caldwell, Idaho.—Bids are wanted by the Bd. of Directors of the Pioneer Irrigation Dist. until Sept. 15 for the purchase of bonds to the amount of $197,500. Irwin Bissitt, Pres.

Navajo Agency, New Mex.—See "Government Work."

Middleport, N. Y.—Gen. Mgr. Wallace C. Johnson writes that the Middleport Lighting Co. has an electric light plant now constructed in Middleport and is considering the installation of a water works plant, but no definite steps have as yet been taken.

Cleveland, O.—Bids are wanted Sept. 15 for the purchase of $5,000 sewer bonds maturing Apr. 1, 1914, and $60,000 sewer bonds maturing Oct. 1, 1912; $100,000 water works bonds; $100,000 elevated roadway bonds; $30,000 Walworth Run bridge bonds, and $100,000 market house bonds. H. D. Coffinberry, City Treas.

Minneapolis, Minn.—Bids are wanted by the Com. on Ways & Means Sept. 5 for the purchase of $250,000 municipal bonds. Joshua Rogers, City Compt.

Jamestown, O.—Corp. Clk. Chas. A. Davis writes that the question of constructing water works is under consideration.

Johnstown, Pa.—John Birkinbine, Engr., Odd Fellows' Temple, Philadelphia, writes that the Manufacturers Water Co. is merely investigating possible sites for a dam in Quemahoning Valley; nothing definite has as yet been done.

Mt. Sterling, Ill.—Bids are wanted Sept. 1 for $10,000 bonds issued for the purchase of the present water works; bids are also wanted at the same time for furnishing an elevated water tower and for approximately 2,150 ft. of 6-in., 1,900 ft. 4-in. and 200 ft. of 8-in. standard weight pipe. Engrs., Sturtevant & Todd, Fisher Bldg., Chicago, Ill. J. F. Smith, City Clk.

Roundlake, Minn.—Village Recorder J. C. Thomsen writes that the contract for constructing a system of water works, bids opened Aug. 6, has been awarded to the Des Moines Bridge & Iron Wks., Des Moines, Ia., for $5,440.

Victor, Colo.—City Engr. J. S. Babcock writes that the contract for constructing the Bison Park storage dam, approximately 40,000 cu. yds., has been awarded to Dunphy & Nelson, of Victor, for $23,000.

Grand Rapids, Minn.—Recorder Fred A. King writes that the contract for constructing a water works pumping station has been awarded to Alexander Roberts, Duluth, Minn., for $4,890.

Meadville, Pa.—City Engr. W. A. Doane writes that the city has purchased a site 1¼ miles west of the present water works pumping station (where successful tests were made last year for pure water), and will place the new 4,000,000-gal. pumps there when received.

Galveston, Tex.—City Engr. C. G. Wells writes that it is proposed to lay a water main across the bay; size, 16 in., 24-in. or 30-in.

Kenmore, N. Y.—Busch Bros., Engrs., Mooney Bldg., Buffalo, write that the lowest bids opened Aug. 15 for a water distributing system for Kenmore were as follows: For furnishing pipe, U. S. Cast Iron Pipe & Fdy. Co., at $9,966; for furnishing valves, etc., Darling Pump Mfg. Co., Williamsport, Pa., at $1,700; for pipe laying, L. J. Richardson & Co., Owego, N. Y., at $5,309.

St. Francisville, La.—Bonds to the amount of $10,000 have been issued for water works and an electric light plant.

Brockton, Mass.—City Engr. Chas. R. Felton writes that bids will soon be wanted for a 6,000,000-gal high duty pump.

Ft. Scott, Kan.—This city proposes to require the Water Co. to install filters.

Seguin, Tex.—Dudley D. Baker is Engr. in charge of construction of proposed irrigation plant, estimated to cost $6,000.

Blackduck, Minn.—The Council proposes to put in a water tower and tank.

Dickinson, N. D.—L. A. Simpson and others have asked for a franchise for a water works system.

Wonewoc, Wis.—Village Clk. John Reidy writes that W. G. Kirchoffer, of Baraboo, is Engr. in charge of proposed water works. Estimated cost, $10,000.

Moorefield, W. Va.—The Council is said to be about to offer for sale $6,000 water supply bonds.

Sumas, Wash.—Press reports state surveys are now being made for a system of water works.

Shelbina, Mo.—The matter of establishing water work is under consideration.

Sandwich, Ill.—It is stated that this city will expend $9,000 in repairing and improving the water works and electric light plant.

Ruthven, Ia.—Press reports state that W. H. Lewis will receive bids for the construction of a well 20 ft. in diameter and not over 30 ft. deep.

Madrid, Ia.—The Council is considering a water works system.

Two Harbors, Minn.—T. F. McGillivray, of Duluth, is reported to have been engaged to furnish plans for the new intake pipe, and putting in intake well and constructing a new building for pumping and lighting station.

Peabody, Mass.—Town Clk. Elmer M. Poor writes that Snow & Barbour, of Boston, are the Engrs. in charge of construction of proposed water works. Estimated cost, $150,000.

Hudson, N. Y.—Plans are under consideration for the improvement of the water supply; one plan, which is said to involve an expenditure of about $200,000, provides for a supply from Lake Charlotte.

Oxford, Ind.—The Town Bd. has passed an ordinance providing for the municipal ownership of the water works and electric light plant.

Northampton, Mass.—The City Government has passed an order providing for the issue of $50,000 water bonds.

Bowling Green, O.—Articles of incorporation for the City Water Co., of Bowling Green, have been filed by M. L. Case, F. A. Baldwin, A. W. Rudulph and others.

Dyersville, Io.—The contract for constructing a system of water works, including a 60-ft. steel tower, a pine tank, etc., is stated to have been awarded to G. H. Meridith, of Cedar Rapids, for $6,861.

Mt. Sterling, Ill.—The Council is reported to have ordered the expenditure of $10,000 in improving the water supply.

Girard, Kan.—The Com. on Water Wks. has recommended the purchase at once of a 60-H.-P. boiler, and that the city adopt the meter system of supplying water.

Saticoy, Cal.—The Saticoy Development Co. has filed articles of incorporation, with a capital of $25,000, for the purpose of constructing reservoirs, dams, ditches, pipe lines, pump stations, to furnish and distribute water for irrigation. Directors: David Darling, Chas. N. Kimball, Geo. W. Good, and others, of Saticoy.

Paterson, N. J.—Bids are wanted Sept. 10 by the Jersey City Water Supply Co. for building a reservoir dike at Parsippany, N. J., as advertised in The Engineering Record.

Lansing, Ia.—This city wishes the services of a competent engineer to make plans and specifications for a water works reservoir, as advertised in The Engineering Record.

Athol, Mass.—Local press reports state that the Athol Water Co. proposes to build a dam 30 ft. high to secure a new and additional water supply from Buckman Brook. Estimated cost of new system, $40,000.

Martinsburg, W. Va.—W. S. P. Shields and Geo. A. Rumsey, Jr., of Philadelphia, have submitted a proposition to the City Council Water Bd. to buy, improve and operate the water works in Martinsburg and to install a sewerage system, for which they offer to assume the entire present bonded indebtedness of the corporation of Martinsburg, amounting to $75,000.

Duluth, Minn.—The City Council has passed an ordinance declaring for the purchase of the West Duluth Water & Light Co.'s plants.

New York, N. Y.—Bids are wanted Sept. 4 for furnishing and laying water mains in numerous streets. Robt. Grier Monroe, Comr. Water Supply, Gas & Electricity.

Lorain, O.—It is stated that bids are wanted Sept. 15 for $32,000 water works improvement bonds. J. J. Mahoney, City Clerk.

Ellendale, Minn.—Bids are wanted Aug. 29 for $6,000 water works bonds. E. M. Thompson, Village Recorder.

Burlington, Ia.—The Citizens' Water Co., of Burlington, has filed articles of incorporation. Incorporators: Jas. A. Guest, Seymour H. Jones, W. W. Baldwin, and others, of Burlington. Object, to acquire and operate, improve and extend the existing system of water works in this city, by the consent of the city and under contract with the city. Capital stock, $330,000.

Sacramento, Cal.—Russell L. Dunn, of San Francisco, has made a proposition to the Bd. of Trus. to furnish Sacramento with clear water supply of 11,000,000 gal. daily from the North Fork of American River near Towles, Placer Co.

Salt Lake City, Utah.—The City Council has adopted a resolution providing that a committee, associated with the Mayor, the City Engr. and the Water Comr., consider the feasibility of constructing storage reservoirs to hold flood water in City Creek, Emigration and Parley's canyons.

Scottdale, Pa.—A charter has been granted to the Menallen Water Co., of Scottdale; capital, $1,000. Directors: Chas. E. Loucks, I. D. Evans, Scottdale; S. F. Potter, Greensburg, and others.

Greensburg, Pa.—A charter has been granted to the Donohue Water Co., of Greensburg; capital, $1,000. Directors: John P. and Edw. E. Donohue, Greensburg; B. F. Overholt, Scottdale, and others.

Hebron, Ill.—Press reports state that steps are being taken towards securing a water supply. It is proposed to issue $5,500 bonds to pay for the pumping plant. The $9,300 necessary for water mains to be raised by special assessment.

San Bernardino, Cal.—The City Bd. of Trus. has, according to press reports, decided upon a plan for a city water supply which provides for the purchase of Hubbard water, the building of a reservoir and the laying of new mains, etc.; estimated cost of new plant, $200,000.

Parkersburg, W. Va.—The City Council has appointed a committee to investigate the proposition to secure a pure water supply from wells.

Elma, Wash.—The City Council has decided to employ an engineer to survey McDonald Creek as a proposed source of a gravity water supply.

Barre, Vt.—The City Council has sold bonds to the amount of $60,000 for the purpose of completing the Orange Brook extension of the water works.

Cohoes, N. Y.—The matter of securing a better water supply is under consideration.

Findlay, O.—Engr. McKibben, who has charge of the new water works construction, has made a preliminary report to the Water Wks. Bd. and Council Com. in which he places the estimated cost of the 20-in. cast iron pipe line, with reservoirs, etc., complete, at $217,685.

Barboursville, Ky.—A plan is said to be on foot for the construction of water works.

Bethlehem, Pa.—The Keystone Const. & Engineering Co., of Easton, is reported to have entered into a contract with the Bethlehem Consolidated Water Co. for a sand filtration plant, estimated cost $20,000, to be built in accordance with plans and specifications prepared by J. Marshall Young, of Easton.

Seattle, Wash.—Plans are being prepared by the City Engr. for a new water system in Green Lake and vicinity, also an estimate of the probable cost of building a standpipe in Woodland Park and a pumping station to supply water for that section of the city.

Homestead, Pa.—The Council has sold bonds to the amount of $164,000, said bonds to be used to make repairs to the Boro. water works, erect a garbage plant and redeem outstanding debts.

Washington, D. C.—The Commissioners have issued orders that $50,000 be taken from the water fund and used for continuing the extension of the high service system of water distribution; also that the bid of M. J. Drummond & Co., opened Aug. 16, for furnishing 12-in. cast iron water pipe at $30.70 per gross ton is accepted.

Hawkesbury, Ont.—Bids are wanted Sept. 1 for about 750 tons of cast iron water pipe and special castings, 30 fire hydrants and 22 stop valves, according to specifications prepared by Wm. Kennedy, Jr., Montreal, Que. Address D. Doyle, Town Clk.

Elyria, O.—Contracts for the proposed new water works (Lake Erie to be source of supply) are reported to have been awarded as follows: Valves and valve boxes, to Rensselaer Mfg. Co., Troy, N. Y.; hydrants, to Thos. B. Shaw, Chicago; pipe for force main, to U. S. Cast Iron Pipe & Fdy. Co., $31.50 per ton, total $123,609; intake and crib, to Thather & Shirley, Toledo, $12,850; pipe laying, to Baldwin Bros. & Graham, 55 cts. per ft. for force main, $23,530; 3,000,000-gal. pump, to Snow Steam Pump Co., Buffalo, $20,996.

Enfield, N. H.—Engr. in Charge Arthur W. Dudley, of Manchester, N. H., writes that bids were opened by the Water Comrs. on Aug. 12 and contract awarded to Arthur W. Stone, of Hartford, Vt., as follows: Clearing and grubbing 25 acres, $285; excavating dam site, 2,000 cu. yds., 10 cts.; rock excavation, 50 cu. yds., $3; excavation for core wall trench, 200 cu. yds., 50 cts.; rubble masonry, 420 cu. yds., $5; puddle dam core, 8,000 cu. yds., 40 cts.; earth slopes, 5,800 cu. yds., 35 cts.; masonry waste weir, 110 cu. yds., $5; concrete screen chamber, 20 cu. yds., $6.50; slope paving, 1,875 sq. yds., 60 cts.; total, $16,710.

Yonkers, N. Y.—The following bids are stated to have been received by the Bd. of Water Comrs. for furnishing and erecting at the service station a horizontal high duty compound condensing duplex direct-acting pump having a capacity of 8,000,000 gal. in 24 hours: Thos. A. Lewis, $13,300; R. D. Wood & Co., $23,800; Snow Steam Pump Wks., $18,000; M. P. Davidson, $23,200; Barr Pumping Engine Co., $51,000; The d'Auria Pumping Engine Co., $19,550; Henry R. Worthington, $25,800.

Bids were also received as follows for furnishing and delivering 335 lengths of 24-in. pipe at 2,811 lbs. per length of 12 ft.: John Fox & Co., $32.45 per gross ton; Dimmick Pipe Co., $31.75; U. S. Cast Iron Pipe & Fdy. Co., $34.70; Camden Iron Wks., $32.40; Warren Foundry & Machine Co., $31.

The Bd. of Water Comrs. has adopted a resolution instructing the President to recommend a consulting engineer to perfect plans for the increase of the city water supply from Nepperhan River at the tube well station property and filtration by the sand system.

SEWERAGE AND SEWAGE DISPOSAL.

Harrisburg, Pa.—Bids are wanted Sept. 3 for constructing approximately 3 miles of concrete and expanded metal intercepting sewer, and appurtenances, as advertised in The Engineering Record.

Salem, O.—Bids are wanted Sept. 10 for the construction of sewers in E. 5th, Vine and E. 7th Sts. Geo. Holmes, City Clk.

Alliance, O.—Bids are wanted Sept. 10 for constructing sanitary sewers Nos. 19, 21 and 46. Approximate quantities, 5,840 lin. ft. of 8, 10 and 12-in. pipe. Chas. O. Silver, City Clk.

Cleveland, O.—See "Water."

White Plains, N. Y.—Bids are wanted Sept. 1 for constructing a storm water sewer through and along the Davis Brook; also for a sanitary lateral sewer through Winchester St. Peter Paulding, Village Clk.; B. F. Darling, Village Engr.

Hammond, Ind.—Bids are wanted Aug. 26 for constructing a main sewer of 2-rings brick in Atchison Ave., 115th St., Roberts Ave. and Indiana Boulevard, said sewer to have 2 ft. internal diameter for a distance of 991 ft., the remaining 2,966 ft. to have 3 ft. internal diameter; with manholes, catch basins, etc. Peter J. Lyons, City Engr.

Alton, Ill.—Property owners on Ridge, Union, North and Pearl Sts. have petitioned the Bd. of Local Improve. for the construction of a sewer to drain the northern part of the city.

Cudahy, Wis.—The proposition to issue $25,000 bonds for a sewer system is under consideration.

Oshkosh, Wis.—Bids are wanted Sept. 9 for the construction of sewers in 9th, 10th and Ohio Sts. Frank Monahan, Chmn. Bd. of Pub. Wks.

Bridgewater, Mass.—Town Clk. H. L. Crane writes that surveys have been made by Snow & Barbour, of Boston, for a sewerage system, estimated to cost $50,000, which this town has under consideration. No action will be taken before March next.

East Washington, Pa.—The contract for constructing a sewage disposal plant is stated to have been awarded by the Boro. Council to Wm. Pickett & Co., Washington, Pa., for $5,103.

Green Bay, Wis.—An ordinance before the Council provides for the issue of $50,000 bonds for sewer purposes.

Little Rock, Ark.—The Bd. of Pub. Affairs has been petitioned for a general sewer system for Sewer Dist. No. 28.

Pittsburg, Pa.—Bids are wanted Aug. 30 for constructing 15 and 24-in. pipe and 30-in. brick sewers in portions of Brushton Ave. and for constructing 9, 15 and 18-in. pipe sewers in portions of numerous streets and alleys. The total estimated cost of sewer and paving work, for which bids will be opened Aug. 30, is $250,000. J. Guy McCandless, Dir. Dept. Pub. Wks.

Galveston, Tex.—The contract for 4,800 lin. ft. of 36 to 12-in. vitrified sewer pipe for Tremont St. sewer has been awarded to May & Wainwright, of Galveston, for $10,174, f. o. b. Galveston.

Guthrie, Okla. Ter.—City Engr. T. A. White writes that on Aug. 28 contracts will be let for 13,000 ft. of 8-in. lateral sewers and 6,500 ft. 10-in. mains.

Leominster, Mass.—Town Clk. C. A. Joslin writes that a committee has been chosen to investigate the matter of constructing filter beds for the sewerage system, and to report next spring.

Brooklyn, N. Y.—Bids are wanted Aug. 27 for constructing sewers in Ave. G, Flatbush Ave. and numerous other streets in the Boro. of Brooklyn; the engineer's estimate includes 3,260 ft. of 90-in. and 5,660 ft. of 84-in. brick sewer; 6,230 ft. of 66-in. to 36-in. brick sewer; 4,890 ft. of 24-in. to 12-in. stoneware pipe sewer; 94 manholes; 49 receiving basins, 1,800,000 ft. sheeting and bracing; 895,000 ft. foundation planking and pile capping under sewers, etc. Bids are also wanted Aug. 27 (extension of date) for constructing a sewer in Bedford Ave., from Montgomery St. to Flatbush Ave.; the engineer's estimate includes 1,370 ft. 96-in., 695 ft. 84-in. and 2,460 ft. 78-in., 4,460 ft. 60-in. and 810 ft. 48 and 36-in. brick sewer; 510 ft. 18- to 12-in. pipe sewer; 69 manholes; 44 receiving basins; 250,000 ft. foundation piling; 1,200,000 ft. sheeting and bracing, etc. J. Edw. Swanstrom, Pres. Boro. of Brooklyn.

Bridgeport, Conn.—City Surveyor H. G. Scofield writes that the letting of contracts for 1,200 ft. of 40-in. brick sewer has been postponed (bids were to have been opened Aug. 20).

Bloomington, Ill.—See "Paving and Roadmaking."

Northfield, N. H.—A. W. Dudley, Engr., Manchester, writes that the contract for 7,100 ft. of pipe sewers, 5 flush tanks and 10 manholes, has been let to Osgood Bros., of Nashua, at 50 cts. per lin. ft. for 6 and 8-in. pipe, $1.10 for 10-in. 10 to 18-ft. branches, flush tanks $20 to construct only and manholes $16 to construct only.

Aurora, Ill.—An assessment is in preparation for new system of sewers estimated to cost $4,700.

Champaign, Ill.—Bids will be received until Sept. 6 by the Comrs. of Kaskaskia Special Drainage Dist. at the office of Ray & Dobbins, this city, for furnishing f. o. b. cars at Sadorus, 5,280 ft. of 16-in. tile with connections and laying same in Sub-Dist. No. 9, in said Special Drainage Dist. Abram Crist, Chmn.

San Francisco, Cal.—The City Engr. has been instructed to prepare plans and specifications for the construction of 6th St. main and adjacent sewers. Cost about $40,000. Bids for construction will be received when plans are completed.

Ensley, Ala.—The Council is said to be considering the question of issuing $75,000 bonds for constructing a sewer system, for which preliminary surveys have already been made.

Springfield, O.—The Bd. of Pub. Affairs has adopted resolutions declaring its intention to construct sewers in Ludlow Ave., estimated cost $5,105; Clifton St., $3,305; and Washington St., $2,356.

Erie, Pa.—The City Engr. has placed the estimated cost of constructing an intercepting sewer system in Mill Creek Valley, and across the northern portion of the city, at about $85,000.

Martinsburg, W. Va.—See "Water."

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until Sept. 16 for constructing sewers in Rock Spring Joint Sewer Dist. Work to include 10x12 ft. concrete and brick sewer; 1,020 ft. of 10.5; 310 ft. of 10-ft.; 1,540 ft. of 8-ft., and 1,630 ft. of 7.5 ft. brick sewers, with all necessary appurtenances. Hiram Phillips, Pres.

Delaware, O.—The Council has passed a resolution authorizing the contract with Ulrich & Williams, of Springfield, for a sanitary sewage disposal plant for $12,900.

Jersey City, N. J.—Mayor Fagan has signed the resolution providing for the reconstruction of sewers in Gardner, Monticello, Belmont and Jewett Aves., and relief sewers in Division St., Harrison, and Ocean Ave. and Henderson St. Total amount to be spent, $47,000.

Ligonier, Pa.—The Council has agreed to accept the plan for a sewerage system, as prepared by J. J. Janeway.

Paducah, Ky.—City Engr. L. A. Washington writes that the matter of extending the sewerage system about 3 miles is now before the Council. Probable cost of proposed improvement, $16,000.

Ludwick, Pa.—Boro. Engr. J. J. Neel, of Greensburg, Pa., writes that the contract for constructing 10,500 ft. of 8 to 24-in. pipe sewers, with 20 manholes, has been awarded to Ott Bros., of Pittsburg, for $6,908. The trench to average 7.5 ft. in depth.

Vincennes, Ind.—The estimated cost of constructing St. Clair St. sewer is placed at $9,000 for brick sewer 42 to 48 in. in diameter.

Cincinnati, O.—The Bd. of Pub. Service is reported to have decided in favor of the construction of a complete sewerage system for the southern portion of Price Hill. Estimated cost of improvement, $46,000.

Boone, Ia.—City Engr. Chas. E. Russell writes that it is proposed to build about 7,000 ft. of 8 and 9-in. sewer in Fair Ground addition.

Port Huron, Mich.—The Common Council has taken preliminary steps toward the construction of a sewer, at a cost of $50,000, to drain the Tunnel Section of the city.

Dallas City, Ore.—It is stated that bids are wanted Aug. 30 for constructing the Washington St. sewer system. Earl Sanders, City Recorder.

Progreso, Mex.—The N. Y. "Journal of Commerce" states that the Municipal Congress of Progreso has issued a call for bids and plans for the drainage of the swamp near the city. It also states that Felipe G. Canton, Columbia Bldg., 29 Bway., N. Y. City, may be able to give further information.

Rapid City, S. D.—The Special Com. to whom was referred the matter of sewering the city has reported recommending the establishment of a sewerage district.

Kenosha, Wis.—An ordinance before the City Council provides for the extension of the present sewer system to all portions of the city not now provided for.

Aberdeen, S. D.—City Engr. VanMeter has completed the survey for proposed surface drainage preparatory to paving the business part of the city.

Fond du Lac, Wis.—Residents of the recent flooded districts have petitioned the Council for a $40,000 storm sewer.

Yonkers, N. Y.—The Aldermanic Com. on Pub. Wks. has recommended that plans and specifications be prepared for a sewer in South Broadway.

Irvington, N. J.—Local press reports state that bids will be received by the Town Council until Sept. 16 for constructing a lateral sewer system.

Monmouth, Ill.—Bids are wanted by the Bd. of Local Improv. until Aug. 30 for constructing sewer outlets and a sewage disposal plant, as advertised in The Engineering Record.

Wauwatosa, Wis.—The Joint Com. on Pub. Bldgs. & Almhouse of the Co. Bd., Milwaukee, has appointed a sub-committee to investigate plans for improving the sewerage system at the county institutions in Wauwatosa. Estimated cost of improvement, according to plans submitted, $8,950 for filter bed, or $16,500 for new septic tank.

New Albany, Ind.—The Special Com. having the matter of providing a system of sewers under consideration has recommended that the City Engr. prepare plans and specifications for such improvement.

New Britain, Conn.—According to local press reports the lowest bid received Aug. 18 for Section 1 of the proposed sewage disposal system, which calls for the building of 31 filter beds, requiring the removal of 130,000 cu. yds. of material, and the laying of about 7 miles of underdrains and 1 mile of 24-in. main trunk feed sewer, etc., was from Jas. F. Gaffney, of Waterbury, at $31,250.

Saratoga, N. Y.—Sewer bonds to the amount of $50,000 have been sold by this city.

High Point, N. C.—Local press reports state that a municipal sewerage system is about to be constructed.

Waukegan, Ill.—The estimated cost of constructing the south side sewer has been placed by Engr. Smith at about $30,000.

Dubuque, Ia.—The City Council has under consideration the expenditure of $50,000 for the extension of sewers in the northern part of the city.

Watertown, N. Y.—The Bd. of Pub. Wks. has passed resolutions providing for the construction of sewers in Brainard, Pleasant and several other streets, at a cost of about $9,600.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Sept. 13 for constructing sewers in the District, as advertised in The Engineering Record.

Marblehead, Mass.—F. L. Fuller, of Boston, is making surveys and plans for a system of sewerage for this place.

Burlington, Ia.—City Engr. Emmet Steece writes that the City Council has ordered 9,000 ft. of tile sewers.

Abilene, Kan.—Burns & McDonnell, Consulting Engrs., Kansas City, Mo., write that the contract for 24,654 ft. of 6 to 15-in. pipe sewers, 54 manholes, 4 lampholes and 18 flush tanks, has been awarded to Rackliffe & Gibson, of St. Joseph, Mo., for $14,592. The trench to average 9 ft. in depth and be excavated in earth.

Indianapolis, Ind.—The Bd. of Pub. Wks. has, according to local press reports, awarded the contract for constructing the Northwestern Ave. sewer to W. K. Cooper, at $6.42 per lin. ft.; total length of sewer 10,825 ft. This sewer in 24th St. is to be semi-circular 10 ft. in diameter, and in Northwest Ave. for a distance of 1,400 ft. it is to be constructed of concrete and steel, 12½ ft. wide and 3 ft. deep. Street cars will run over this portion. Nearly the entire sewer outside of the concrete section is to be of brick. Engineer's estimate of the cost, $74,750.

Vicksburg, Miss.—The following bids were opened Aug. 14 for grading and drainage of Sections 2 and 3 (6 miles) of Confederate Ave., in Vicksburg National Military Park; the work includes 33 pipe culverts, with masonry head walls, and 75,200 cu. yds. of excavation: Israel Bobbitt, $23,050, 8 months; Nicholson & Williamson (awarded), $20,545, 7 months; H. B. Garbish, $21,200, 8 months; Helgason Bros., $25,012, 8 months; A. L. Dalton, $22,835, 6 months.

BRIDGES.

St. Paul, Minn.—The property owners have petitioned the Aldermanic Com. on Streets to construct a bridge, 40 ft. wide, at Arcade St. Probable cost, $66,000.

Brooklyn, N. Y.—Press reports state that Barth S. Crowin has secured the contract to construct a bridge at U Ave. for $15,800.

The Brooklyn Rapid Transit Co. has been granted permission to construct an iron bridge at Lincoln Road.

Arcola, Pa.—Press reports state that the Perkiomen R. R. Co., controlled by the Philadelphia & Reading R. R., has awarded to the Phoenix Bridge Co., of Philadelphia, the contract to build an iron girder bridge in this city, which will replace present wooden structure. The bridge is to be 65 ft. long, and will cost, according to reports, about $5,000.

Vicksburg, Miss.—Contracts for bridge to be located on Confederate Ave., Vicksburg National Military Park, have been awarded as follows: Glass Bayou bridge to the Penn Bridge Co., Beaver Falls, for $17,500; A. & V. R. R. bridge, to American Bridge Co., for $5,740; Stouts Bayou bridge, to Geo. H. Crafts, Atlanta, Ga., for $23,319.

Alexandria, S. D.—Bids are wanted Sept. 2 for 2 steel bridges in Hanson Co. H. P. Benjamin, Co. Aud.

Portsmouth, O.—Fred. Thompson, Engr. in Charge, Dept. of Yards & Docks, Navy Yard, has completed plans for a $5,000 concrete and steel bridge, which is to be constructed across Guthrie Creek, from the city to the Naval Hospital.

Ligonier, Pa.—It is stated that the building of an iron bridge across Mill Creek, about 2 miles west of Ligonier, is contemplated.

Wilkesbarre, Pa.—Local press reports state that Co. Comrs. will readvertise for bids for constructing 14 stone bridges in different parts of the county, no bids for rebuilding these bridges being received on the last advertisement.

Trenton, N. J.—The Bd. of Freeholders is considering the replacing of Olden Ave. bridge, recently damaged by freshets, with an entire new structure.

Pittsburg, Pa.—Recorder Brown is said to advocate the building of a bridge across the gully, connecting Craft Ave. with Franklin St.

San Diego, Cal.—Plans are being prepared for a wooden, a combination wood and steel bridge and a steel bridge, to be built across San Diego River, on Poway Road.

Milwaukee, Wis.—The Finance Com. of the City Council has recommended the passage of an ordinance for the issue of $100,000 bonds, with which to build a bridge at W. Water St.

Mason City, Ia.—The City Council has adopted an ordinance approving viaduct plans submitted by the Engr. of the Iowa Central Ry. and has granted authority to said Railway Co. to construct a viaduct at State St., according to said plans.

Pottstown, Pa.—The Co. Comrs. have plans for a stone bridge to be built in East Coventry Township.

Bath, N. Y.—Bridges in this county are stated to have been damaged by freshets to the amount of $30,000, and the Co. Superv. are contemplating the issue of bonds with which to replace several.

O'Fallon, Ill.—The building of an iron or steel bridge in this town is being considered.

Philadelphia, Pa.—Ch. Brooks of the Bureau of Highways, in his report to the Dir. of Pub. Wks., estimates that $37,000 will be needed to repair about 14 structures in this city, which require immediate attention.

Local press reports state that plans have been approved by the Bd. of Superv. for 3 piers and western abutment of the proposed Passyunk Bridge, for which $50,000 is available, and bids will soon be asked. The total cost of the structure will be about $1,000,000.

Valley, Neb.—The Commercial Club has petitioned the Co. Comrs. to construct a bridge across Platte River, in Valley, and have offered to contribute $5,000 toward the construction provided a $15,000 structure is built.

Flandreau, S. D.—Bids will be received by the Co. Comrs. until Sept. 2 for constructing an 80-ft. steel bridge across Big Sioux River. A. J. Vallier, Co. Aud.

Louisville, Ky.—The Special Com. of the Bd. of Trade has recommended that viaducts or tunnels be constructed at 9th, 7th and 14th Sts., according to plans prepared by the City Engr., said viaducts to be not less than 14 ft. in the clear and to be large enough to permit the passage of street cars.

Reading, Pa.—Engr. M. M. Dreibelbis has prepared plans for 2 bridges, which are to be built in Berks Co. very shortly. One, an 80-ft. steel single span structure, is to be built across the West Branch of Perkiomen River, in Washington Township; the other, a 60-ft. structure, also across Perkiomen River in Hereford.

Wellsburg, W. Va.—Press reports state that the Wellsburg-Brilliant Bridge & Ferry Co. has been chartered to construct and operate a toll bridge and to operate a ferry across Ohio River, between Wellsburg and Brilliant. Capital stock, $50,000.

Colfax, Wash.—Local press reports state that bids will be received by the Co. Comrs. in Sept. for the building of a steel girder bridge on the South Palouse, and that bids for building the retaining wall, abutments, and other work necessary to reach the bridge will be received by the City Council some time soon.

Perkins, Okla. Ter.—It is stated that the Co. Comrs. at Stillwater have decided to construct a steel bridge across Cimarron River, in this city, and will soon ask bids for constructing same.

Gonzales, Tex.—E. P. Alsbury & Son, of Houston, are stated to have secured the contract to raise and replace the steel bridge across Guadalupe River, in this city, which was damaged by the freshets. The contract price is said to be $5,700.

La Crosse, Wis.—Reports state that the building of a steel bridge, which will replace present pontoon structure across West Channel, is being considered. Probable cost, $7,900.

Mt. Vernon, O.—It is stated that the Cleveland, Akron & Columbus R. R. will replace its trestle in this city with a steel bridge. S. M. Russell, Engr. M. W., Akron.

Camden, N. J.—Press reports state that bridges in this County have been damaged, by the recent freshets, to the amount of $30,000.

Pittsburg, Pa.—The officials of the Pennsylvania R. R. are said to be preparing to make improvements which will eliminate many curves along the main line. These improvements, it is stated, will include the building of 4 bridges in Packsaddle Dist.

Sylvan Beach, N. Y.—See "Electric Railways."

El Paso, Tex.—The street car railway and the railroad companies have made a proposition to the City Council to construct a viaduct at San Francisco St., provided the city will accept said viaduct and keep the same in repair.

Castroville, Tex.—Plans, specifications and estimated cost, for a steel and iron wagon bridge, with 16-ft. roadway for both stone piers and steel piers separately, across Medina River at Castroville, will be received by Medina Co. Commr.'s Court at Hondo, until Oct. 1. H. E. Haass, Co. Judge.

Marshall, Ill.—Bids are wanted Aug. 28 for building a 70-ft. single span, steel bridge across Clear Creek, between Wabash, Ill., and Sugar Creek, Ind. Frank Church, Chmn. Com. of Supervisors, Clark Co., Marshall, Ill.

Cleveland, O.—See "Water."

Mansfield, O.—Bids are wanted Sept. 13 for constructing a steel viaduct, as advertised in The Engineering Record.

Bloomington, Neb.—Plans, specifications and bids will be received by the Co. Clk. until Sept. 9 for constructing a 75-ft. steel bridge at Campbell.

New Brunswick, N. J.—Bids will be received by the Co. Bd. of Chosen Freeholders at New Brunswick until Sept. 3 for furnishing material and constructing a highway bridge to be known as "Amboy Bridge" across Raritan River, from Perth Amboy to Sayreville, near South Amboy. The bridge is to consist of timber deck spans on piles and a steel swing span across the channel of said river. Appropriation, $150,000. Asbury Fountain, Dir.; Thos. H. McCann, Engr. in charge of construction.

Ypsilanti, Mich.—The King Bridge Co., Cleveland, O., is reported to have secured the contract to construct a bridge across Huron River, for $6,600.

Richmond, Va.—The construction of a bridge at 6th St. is being considered.

Boston, Mass.—Bids will be received by Wm. Jackson, City Engr., until Aug. 27 for building 3 piers of Broadway Bridge; $15,000 bond required.

Appleton, Wis.—Bids are wanted Sept. 3 for building a bridge over Fox River, as advertised in The Engineering Record.

Portland, Ore.—Bids will be received by the Co. Comrs. at Portland until Aug. 30 for reconstructing the combination Pratt truss bridge and straining beam bridge over Sandy River, about 16 miles from Portland. F. S. Fields, Co. Clk.

Philadelphia, Pa.—See "Electric Railways."

Three Rivers, Mich.—It is stated that bids are wanted Aug. 30 for constructing a cement arch bridge, 160 ft. long and 60 ft. wide, across St. Joseph River. Jas. E. Bunn, City Clk.

Bluffton, Ind.—See "Electric Railways."

Linneus, Mo.—It is stated that bids are wanted Sept. 1 for constructing 5 steel bridges in this county. T. L. McMichael, Bridge Comr.

Moorhead, Minn.—See "Electric Railways."

Belleville, Ont.—It is stated that bids are wanted Sept. 8 for constructing a steel pin-covered overhead truss highway bridge, having 1 span 95 ft. long and 16 ft. wide. Wm. R. Aylsworth, Co. Clk.

Memphis, Tenn.—Bids will be received by J. H. McBride, Co. Treas., until Sept. 2 for $100,000 bonds. Said bonds are issued for the purpose of constructing bridges and erecting a court house in said county.

South Valley, N. Y.—Bids will be received until Sept. 2 by Chas. A. Boyd, State Supt. of Pub. Wks., Albany, for constructing a bridge across Allegany River, on the Allegany Indian Reservation in South Valley.

Delphi, Ind.—Bids will be received by the Bd. of Co. Comrs. until Sept. 1 for constructing 2 arches, culverts or bridges in Madison Township; 2 arch culverts in Clay Township, and 1 arch culvert in Jefferson Township. Henry Wagoner, Chmn.

Catlettsburg, Ky.—Bids will be received by the Co. Surv. until Sept. 10 for constructing 7 steel or wooden bridges in this county. E. E. Lawrence, Co. Clk.

Fowler, Ind.—Bids will be received by the Co. Comrs. until Sept. 3 for constructing several small steel bridges. Jas. S. Smyth, Co. Aud.

Pittsfield, Mass.—A correspondent writes that the contract for constructing a 133-ft. span bridge at Dalton Ave. has been awarded to the N. E. Structural Co., of Boston, for $12,623.

Providence, R. I.—The following bids were opened Aug. 15 for the steel superstructure of the Merino Bridge over Woonasquatucket River, in line of Egan and Chattiet Sts.: *a*, steelwork complete, 328,000 lbs.; *b*, railing, 338.5 lin. ft.; *c*, totals: Boston Bridge Wks., Boston, Mass., *a* 5½ cts., *b* $3.50, *c* $19,225; Variety Iron Wks. Co., Cleveland, O., *a* 5.9 cts., *b* $4.50, *c* $20,875; New England Structural Co., Boston, *a* 5.8 cts., *b* $3.90, *c* $20,344; J. H. Tower, Providence, *a* 5.69 cts., *b* $4.25, *c* $20,102; Canton Bridge Co., Canton, O., *a* 5.95 cts., *b* $4.10, *c* $20,904. Local press reports state that the contract has been awarded to the Boston Bridge Wks.

PAVING AND ROADMAKING.

Troy, N. Y.—Bids will be received by the Bd. of Contract & Supply until Aug. 20 for regulating and paving with brick on a concrete foundation portions of Washington and 26th Sts. and Second Ave. Jas. M. Riley, Clk. pro tem.

Pittsburg, Pa.—Bids are wanted Aug. 30 for paving with asphalt on portions of numerous streets and for grading, curbing and paving with block stone on portions of 5 streets. J. Guy McCandless, Dir. Dept. of Pub. Wks.

Brooklyn, N. Y.—Bids will be received by J. Edw. Swanstrom, Boro. Pres., until Sept. 3 for regulating and repaving with asphalt on portions of several streets, requiring in all about 15,460 sq. yds. Bids will be received at the same time for regulating, grading and paving with asphalt, about 8,290 sq. yds., on Woodruff and 7th Aves., and for paving with granite on a concrete foundation with tar and gravel joints between tracks and rails of the Brooklyn Rapid Transit Co., on Flatbush Ave., from Malbone St. to Church Ave. Engr.'s estimate, 4,438 sq. yds. of granite and 500 cu. yds. of concrete.

Loda, Ill.—An appropriation of $3,000 has been made for street improvements and $7,000 will be expended in the construction of concrete walks.

Scottdale, Pa.—The Council has passed an ordinance authorizing the grading, curbing and paving with brick of Pittsbrug St. J. P. Owens, Ch. Burgess.

Randolph, N. Y.—The taxpayers have voted to purchase a stone crusher at a cost of $1,300.

Monmouth, Ill.—The Council is said to be preparing to let contracts for 10 blocks of paving.

Ludington, Mich.—The City Engr. has been instructed to prepare estimates of the cost of macadam paving on W. Ludington and S. Washington Aves. and James St.

Topeka, Kan.—The Good Roads Com. recommends that W. 6th St. road be macadamized to a width of 25 ft.

Vincennes, Ind.—Co. Auditor J. D. Williams writes that the contract for constructing about 22 miles of gravel road in Washington Township has been awarded to Cloud, Carr & Monical of Orleans, Ind., for $43,777.

St. Clair, Mich.—Bids will be received Aug. 25 for 30,000 sq. yds. of brick, asphalt block, cedar block or bituminous macadam paving. Willis F. Brown, of Toledo, Consulting Engr.

Bloomington, Ill.—City Engr. E. Folsom writes that a brick pavement and 18-in. pipe sewer will be laid on South East St.

Galveston, Tex.—The contract for furnishing 500,000 vitrified bricks for paving Tremont St., has been awarded to the Tex. & Pacific Coal Co., of Ft. Worth, at $17.60 per M. for "Thurber brick," f. o. b. Galveston.

Boston, Mass.—Bids are wanted Sept. 4 for paving street and building drains and catch basins on the Commonwealth Flats at S. Boston. Woodward Emery, Chmn. Harbor & Land Comrs.

Massillon, O.—Bids are wanted Sept. 10 for furnishing material and labor for the paving of several streets with brick, in all about 17,000 sq. yds. of paving and 4,900 lin. ft. of curb reset. T. H. Seaman, City Clk.

Nashville, Tenn.—A bill before the Council provides for the appropriation of $25,000 to pave Russell St. with bituminous macadam.

Alton, Ill.—It is proposed to pave Bluff St. with vitrified brick.

Seattle, Wash.—Property owners in the 5th Ward have petitioned for asphalt paving in 8 streets; estimated cost about $80,000.

St. Paul, Minn.—The Bd. of Pub. Wks. has under consideration the construction of a macadam road on West 7th, from Tuscarora St., where the sandstone paving will end, to the Ft. Snelling bridge, a distance of 3 miles.

Frederick, Md.—The Bd. of Aldermen has awarded the contract for paving on East Church St., to J. U. Fritchey, of Lancaster, Pa., at his bid of $1.97 per sq yd. for Mack block, and $1.12 per ft. for dressed granite curbing.

Memphis, Tenn.—Local press reports state that Union St. is to be widened and paved with asphalt.

Minneapolis, Minn.—The Council has ordered the following pavements for next year: 8 streets with sandstone, 2 streets with granite and 1 street with brick.

Wheatland, Ia.—Bids are wanted by Com. of the Town Council, until Aug. 28 for macadamizing a portion of Jefferson St.

Hamilton, O.—Bids are wanted Sept. 6 for the improvement of High St. by paving with either sheet or block asphalt, brick or macadam; also grading, curbing, etc. M. O. Burns, City Clk. L. A. Dillion, City Engr.

Windsor Locks, Conn.—Bids are wanted Aug. 26 for the construction of a telford and macadam road in this town. L. C. Seymour, First Selectman.

Duluth, Minn.—The contract for paving a portion of East Superior St. with Trinidad Lake asphalt, has been awarded to the Barber Asphalt Paving Co. for $54,760.

Three Rivers, Mich.—The City Clk. is said to have been directed to engage an engineer to prepare plans for paving Flint Ave.

Marquette, Mich.—Press reports state that the Council has decided to expend $10,000 in improving Lake Shore Boulevard.

Sterling, Ill.—The city is reported to have appropriated $10,000 for macadam streets

Chester, W. Va.—Bids are wanted Sept. 8 for grading, paving and curbing Carolina Ave., 2d St., Virginia Ave. and 1st St., according to plans on file in the office of J. C. Boyd, City Engr., East Liverpool, O. J. S. D. Mercer, Recorder.

Toledo, O.—Bids are wanted Sept. 15 (extension of date) for the improvement of Bancroft and Curtis Sts., with block pavement; bids are also wanted at the same time for block paving on Michigan St. Chas. H. Nauts, City Clk.

Property owners are said to have voted in favor of paving with asphalt block on Cherry St.; the only bid received for this material was from C. H. Burchinal at $46,456 with concrete foundation, or $38,457 with sand foundation.

Crookston, Minn.—City Engr. Geo. A. Ralph writes that the Barber Asphalt Paving Co., St. Paul, submitted the following bid on Aug. 12: asphalt paving per sq. yd., $2.25; granite curb, $1; sandstone curb, 80 cts.; 3-in. tile drain, 8 cts.; total, $47,137.

Decatur, Ill.—City Engr. G. V. Loring writes that the contract for improving Lincoln Sq. and N. Main St. has been awarded to the Green River Co., St. Louis, Mo., as follows: excavation, 25 cts.; gutter flag, 40 cts.; combined curb and gutter, 50 cts.; resurfacing, 89 cts.; asphalt paving on concrete, $1.89.

Richmond, Va.—The Permanent Street Improvement Com. is reported to have decided to ask for an annual appropriation of $300,000 for the next 10 years, for permanent street improvements. W. E. Cutshaw, City Engr.

Evansville, Ind.—The Bd. of Pub. Wks. has adopted resolutions for the improvement, by paving, with asphalt of Walnut, 1st and Mulberry Sts.

Little Rock, Ark.—Local press reports state that bids are about to be received by the Bd. of Pub. Affairs for paving W. Markham St. with asphaltum.

St. Louis, Mo.—Local press reports state that the only bid received at $71,022 for reconstructing with brick Laclede Ave. from King's Highway to Grand Ave. has been rejected by the Street Com. of the Bd. of Pub. Improv.; possibly new specifications will be prepared providing for asphalt paving.

Wheeling, W. Va.—Bids will be received by the Bd. of Pub. Wks. until Aug. 28 for paving with brick on certain streets and alleys. Wm. H. Paul, Clk.

Tarentum, Pa.—Local press reports state that the 5 miles of county road between Tarentum and Millerstown will shortly be macadamized.

Madison, Wis.—The Council has voted to lay an asphalt pavement around the Capitol park; estimated cost, $48,000; an appropriation of $15,000 has been made by the state toward this work.

Alliance, O.—Bids are wanted Aug. 30 for furnishing material and constructing flagstone and brick sidewalks in the city for a period of 1 year. Chas. O. Silver, City Clk.

Lansing, Mich.—The Council has passed a resolution directing the City Engr. to prepare plans and an estimate of the cost of paving a portion of Michigan Ave. with brick on a sand foundation.

Syracuse, N. Y.—The lowest bid received Aug. 11 for paving a portion of Butternut St. with brick was from the Syracuse Improvement Co. at $65,861 if sandstone block is used in the railroad strip, or $61,591 if brick is used in railroad strip.

Etna, Pa.—The Boro. Council has voted to pave Union St. with brick.

Springfield, O.—The Bd. of Pub. Affairs has adopted a resolution declaring the city's intention to pave Lagonda Ave., with brick, block asphalt or bituminous macadam. Estimated cost, $45,000.

Winona, Minn.—The contract for paving several alleys with vitrified brick on gravel foundation, has been awarded to John Degnan at $1.56 per sq. yd., for Purington brick.

Leavenworth, Kan.—Bids are wanted Sept. 3 for regrading and paving 4th St. with brick; bids are also wanted at the same time for curbing 4th St., as advertised in The Engineering Record.

Boston, Mass.—Bids will be received by Jas. Donovan, Supt. of Streets, until Aug. 26 for regulating and paving a portion of South St.; also for paving and regulating a portion of Merrimac St.

Marshall, Ia.—City Engr. Wm. Bremner writes that the City Council proposes to let a contract on Aug. 26 for about 8,600 sq. yds. of asphalt paving on old macadam as foundation.

Long Island City, N. Y.—Bids are wanted Aug. 28 for regulating and repaving with asphalt on concrete foundation the roadway of Greenpoint Ave., Bradley Ave. to Newtown Creek; 3,700 sq. yds. asphalt pavement and 3,000 lin. ft. new bluestone curbstone. Jos. Cassidy, Pres. Boro. of Queens.

Chico, Cal.—Bids are wanted Sept. 3 for furnishing a portable rock crusher, 5 to 15 tons capacity, and elevator and screen for same. Richard White, City Clk.

Brooklyn, Conn.—Bids are wanted by the Bd. of Selectmen until Aug. 30 for constructing a telford road in the town. Jos. R. Stetson, 1st Selectman.

St. Louis, Mo.—See "Government Work."

Green Bay, Wis.—The City Council has voted to pave a portion of Cherry St. with Trinidad Pitch Lake asphalt.

Ilion, N. Y.—Wellington R. Vedder, of Oneida, is said to have been engaged by this village as consulting engineer in relation to the proposed paving of 1st and other streets.

Clinton, Ia.—Bids are wanted Aug. 29 for paving in Dist. No. 39 with brick on a concrete foundation. W. E. Russell, City Clk.

Council Bluffs, Ia.—Press reports state that bids are wanted Sept. 1 for 5,000 sq. yds. of brick paving on a concrete base. N. C. Phillips, City Clk.

Burlington, Ia.—City Engr. Emmet Steece writes that the city has ordered 10,000 sq. yds. of brick paving.

Indianapolis, Ind.—The following bids are stated to have been received Aug. 15 for paving on Madison Ave.; the prices include asphalt paving, cement walks, brick gutters and curb; the roadway to be 40 ft. wide: the Western Const. Co. bid $6.87 a ft. on each side, S. H. Shearer $7.32 and Barber Asphalt Paving Co. $7.52.

Muscatine, Ia.—City Engr. Jas. J. Ryan writes that the following bids were opened Aug. 14 for brick paving on macadam foundation. Bidders: A, Hawkeye Const. Co., Davenport, Ia., first bid, on brick manufactured at Buffalo, Ia.; second bid, on Galesburg, Ill., brick; B, Korneman & Kemper, Muscatine, Ia., on Galesburg brick; C, McCarthy Stone Co., Davenport, Ia., on Galesburg brick; D, Fuller Bros., Muscatine, Ia. (awarded), on Galesburg brick:

Bidders.	Excav., 7,000 cu. yds.	Stone curb. 5x20-in., 3,668 ft.	Stone curb. 5x16-in., 2,400 ft.	Pavement. 11,196 sq. yds.	Total.
A........	$.23	$.56	$.58	$1.50	$21,850
A........	.23	.56	.48	1.576	22,461
B........	.25	.61½	.51	1.575	22,863
C........	.30	.60	.52	1.52	22,567
D........	.23	.63½	.40	1.48	22,467

POWER PLANTS, GAS AND ELECTRICITY.

Little Rock, Ark.—An ordinance has been introduced in Council granting permission to W. W. Hippolite to construct a gas plant.

Portsmouth, Va.—The Peoples' Light & Power Co. is reported incorporated to construct an electric light plant. John G. Tilton, Pres.

Coshocton, O.—The Coshocton Light & Htg. Co. is reported incorporated, with a capital of $250,000, to operate a heat, light and power plant in Coshocton. Incorporators: W. A. Hainsbaugh, J. D. Severns and T. L. Montgomery, all of Coshocton.

Galion, O.—The City Council has granted a franchise to the Logan Natural Gas & Fuel Co.

Royalton, Minn.—It is stated that R. E. Lester, of Little Falls, Minn., contemplates establishing an electric light plant at Royalton.

Schoharie Falls, N. Y.—Henry W. Grieme and B. E. Machold, of Amsterdam, are stated to have secured the contract for extensive repairs to the power plant of the Empire State Power Co. at Schoharie Falls for about $60,000. The present dam is to be extended 210 ft., and a dike more than 700 ft. will be constructed. It is reported that next year the company will erect a power plant at Mill Point and a storage reservoir in the Helderbergs.

Plaquemine, La.—The City Council has granted a franchise for an electric light and power plant to Dr. W. A. Holloway, Fred Wilbert, and others, all of Plaquemine.

St. Francisville, La.—See "Water."

Lodi, Cal.—It is reported that Cary Bros. will install an electric light plant for the town.

Eaton, Colo.—The Eaton Light & Power Co. is stated to have secured a franchise to construct an electric light plant. W. W. Petrikin and E. W. Goodwin are reported interested.

Clintonville, Wis.—Langstadt & Meyer, of Superior, are stated to have secured the contract for constructing the municipal electric light plant for $12,000.

Hamburg, N. Y.—The Pierce Light, Heat & Power Co., of Hamburg, has been incorporated; capital, $5,000. Directors: W. G. Venner, Hamburg; D. W. Allen, Buffalo, and H. D. Pierce, of Water Valley.

Dansville, N. Y.—The Village Trus. are stated to have granted a franchise to the Mill Creek Electric Light & Power Co. The Trus. are also reported to have awarded to the company the contract for lighting the village for a term of 5 years from Aug. 1, 1903, for $3,000 per yr.

Rochester, Ind.—The Rochester Electric Light, Heat & Power Co., of Rochester, has been incorporated; capital, $50,000. Directors: J. E. Beyer, C. F. Rosenbaum and F. E. Bryant.

Annville, Pa.—Tobias Bomberger is reported interested in the construction of an electric light plant.

Chicago, Ill.—Bids are wanted by the Bd. of Trus. of the Sanitary Dist. of Chicago until Oct. 15 for constructing certain works for the conservation of the water power on the channel of the Sanitary Dist. of Chicago and the Desplaines River; the work for which bids are asked covers two separate locations: First, in the vicinity of Lockport, the preparation of wall foundations, building of concrete retaining walls, excavation of a channel above and below the site selected for power development, building sluice ways, levees and other works auxiliary to the project of power development. Second, in the vicinity of Hickory Creek, near the southern limits of Joliet, excavation and preparation of foundations for a dam and a tail race, building of concrete masonry dam, together with coffer dams, levees and all auxiliary work necessary to execution of plans for the work. Thos. A. Smyth, Pres. Bd. of Trus.

Oskaloosa, Ia.—The Traction & Light Co. will soon let contracts for the construction of brick buildings for power house, shops and car barn; also for smoke stack 7 ft. in diameter and 125 ft. high. J. H. Springfield, of Ottumwa, is Supt.

Winterset, Ia.—City Clk. H. S. Ely writes that on Aug. 5 it was voted to issue $10,000 bonds for enlarging and repairing the electric light plant, bids for said work to be opened Aug. 25. L. O. Klein, Engr. in Charge.

Winona, Minn.—The City Council has under consideration the advisability of constructing a lighting plant to be run in connection with the present water works. Estimated cost $50,000.

Akron, O.—Bids are wanted Sept. 13 for furnishing material and supplying the city with lights for a period of 5 years. Said bids shall be for furnishing 800 or more vapor street lamps of 16 c. p. each and 1 or more incandescent naphtha lamps of 70 c. p. each, to be lighted on moonlight schedule. Chas. H. Isbell, Clk. City Comrs.

Hartwell, Ga.—See "Water."

Elmira, N. Y.—Bids will be received by Dr. Chas. F. Howard, Pres. Bd. of Mgrs., N. Y. State Reformatory, Elmira, until Sept. 3 for installing engines and generators, switchboard and connections at the Reformatory.

Columbus, O.—Bids will be received by Clarence M. Addison, Clk. Bd. of Pub. Wks., until Sept. 5 for furnishing material and constructing an electric light plant as follows: 3 cross compound condensing engines (vertical or horizontal) of 600 H.-P. each at 150 revolutions; 2 condensers (jet or surface type); 3 400-Kw. steam turbines and generators; 4 horizontal water-tube boilers, 300-H.-P. each, with straight tubes; 1 175x9 ft. self-supporting steel chimney; fuel economizers; 3 500-Kw., 2-phase, 60-cycle alternating current generators, for direct connection to engines; 1,500 7.5 ampere series alternating enclosed arc lamps. Fred J. Immel, Dir. Pub. Improv.

Oxford, Ind.—See "Water."

Baker City, Ore.—The City Council has decided to receive bids Sept. 2 for furnishing and maintaining 40 arc street lamps for a period of 1 year from Nov. 1, 1902.

Sandwich, Ill.—See "Water."

Berlin, Wis.—Geo. Warnking, of Oshkosh, is stated to have secured a franchise for a gas plant.

Houghton, Mich.—The Houghton County Electric Light Co. has been incorporated with a capital of $1,300,000. The majority of the stockholders are Boston men, who are interested in the Houghton St. Ry. Co. and the Peninsular Electric Light & Power Co., which will be taken over by the new organizstion. Extensive improvements are contemplated.

San Bernardino, Cal.—The Lytle Creek Power Co., of San Bernardino, is reported incorporated, with a capital of $300,000. Directors: H. T. Hays, Riverside; W. H. Miller, San Bernardino, and others.

Mt. Pleasant, Ia.—The Council is reported to have instructed the Water & Light Co. to secure estimates of cost of electrical pumping equipment and of additional steam equipment for light and water system.

Los Angeles, Cal.—The San Joaquin Power Co., of Los Angeles, has been incorporated; capital, $800,000. Directors: Otto Weiss, E. A. Beck and others.

Seattle, Wash.—See "Public Buildings."

Memphis, Tenn.—Bids are wanted by the Bd. of Fire & Police Comrs. until Sept. 11 for furnishing cables and all material and installing same in the conduits of the underground system of the city for the fire, police and telephone wires. W. B. Armour, City Secy.

Weiser, Idaho.—It is stated that bids will be wanted about Oct. 1 for a 100-H.-P. engine, 2 horizontal tubular boilers, an alternating current dynamo, etc.

Cheviot, O.—Bids will be received until Sept. 17 at the office of Louis Reemelin, Rm. 308 Bell Blk., Cincinnati, for furnishing 30 or more gasoline or naphtha lamps of not less than 70 c. p., with iron or wooden posts, respectively, and caring for, lighting and keeping the same in repair for a period of 1, 3 or 5 years. Service to begin 30 days after acceptance of bid. Bids will be received at the same time for furnishing 20 or more arc low tension incandescent electric lamps of not less than 1,200 c. p., or No. 3 Nernst Glower lamp of not less than 600 c. p., with the necessary wiring and caring for, lighting and keeping the same in repair, and iron or wooden posts, for after acceptance of bid. Geo. B. Tait, Clk.

Kuttawa, Ky.—The Kuttawa Water Co. is reported to have been reorganized and will at once add an electric light plant to the water works and furnish lights to Eddyville and Kuttawa. About $10,000 will be expended for this work. R. G. Caldwell, Paducah; Saml. Molloy and H. C. Cobb, both of Kuttawa, are the stockholders.

Biloxi, Miss.—E. C. Jouillan, of Biloxi, writes that he has been granted a franchise by the city for the construction, maintenance and operation of an electric railway, light and power plant, and that he intends to organize a corporation for construction and operation of said plant.

Arkadelphia, Ark.—J. W. Wilson, Pres. Wilson Water & Electric Co., writes that it is proposed to purchase poles, wire, boiler, belts and a dynamo.

Macon, Ga.—The City Council has decided to secure bids for street lighting after expiration of present contract. The contract to be for a term of 5 years.

ELECTRIC RAILWAYS.

Kewanee, Ill.—The Kewanee, Cambridge & Geneseo Railway Co., of Kewanee, has been incorporated, with a capital of $100,000, to construct an electric railway from Kewanee to Geneseo, by way of Cambridge. Incorporators: Geo. A. Anthony, Theo. Boltenberg and Robt. W. Olmsted.

Logansport, Ind.—The Logansport, Rochester & Northern Traction Co. is stated to have decided to extend its line from Logansport to Kendalville, through Warsaw and Rochester, and touching at Winona Park. W. A. Oamer, Ch. Engr., Logansport.

Muncie, Ind.—The Muncie & Portland Traction Co. has been organized, with a capital of $100,000, to construct an electric line from Muncie to Portland through Albany, Red Key and Dunkirk. G. O. Driscoll, Pres., Muncie. T. O. Boyd, Secy., Portland.

New Castle, Ind.—The New Castle, Muncie & Alexandria Traction Co. has been incorporated, with a capital of $10,000, to construct a line connecting New Castle, Mt. Summit, Springport, Oakville, Cowans, Muncie, Alexandria and Normal. Directors: E. T. Ice, Clay C. Hunt, J. F. Thompson, and others.

Winchester, Va.—Patk. Russ, of Harrisburg, Pa., is reported interested in the construction of an electric railway from Winchester to Berryville, a distance of 11 miles.

Lagrange, Ky.—It is stated that the Louisville, Anchorage & Pewee Valley Electric Ry. will probably be extended from Beards Station, its present terminus, to Lagrange, a distance of about 9 miles. It will cost about $200,000 to make the extension and increase the capacity of the power plant.

Cornwall, N. Y.—V. K. Mills, of Goshen, is reported to be surveying for a power plant to be constructed here for the Intervale Traction Co. This company was recently incorporated to construct a trolley line between Goshen and Newburg.

Philadelphia, Pa.—Local press reports state that the plans for the Market St. subway are nearing completion, and it is expected that the Philadelphia Rapid Transit Co. will soon be ready to let contracts for the work. The subway will extend from Front St. to 23d St., where it will rise to the surface, cross the river on a bridge and continue as an elevated road to the city line. Contracts for the section of the subway, west of Broad St., will be let first, and while that work is being prosecuted the arrangements will be completed for the underground work between Broad St. and the Delaware.

Phoenixville, Pa.—A trolley road is projected from Phoenixville via Kimberton and Pughtown to Fall of French Creek. Gen. F. P. Wanger, of Pottstown, is securing rights of way.

Sylvan Beach, N. Y.—The Canastota & Morrisville R. R. Co. and the Oneida R. R. Co. are stated to have secured a franchise to cross Wood River into this place on a bridge adjoining the bridge now here, eliminating one of the sidewalks.

East Alton, Ill.—The Council is stated to have granted a franchise to the Alton & East Alton Ry. Co. J. F. Porter, Mgr., Alton.

Ephrata, Pa.—The Ephrata & Lebanon Traction Co. has been formed, with a capital of $125,000, to construct an electric railway from Ephrata to Lebanon, a distance of 20 miles. R. R. Bard and S. S. Hauenstein are among the directors.

Clinton, Ia.—The citizens are stated to have voted Aug. 12 to grant the John U. May Co. a franchise to construct an electric street railway in this city. The company will build an interurban line connecting Clinton with Davenport.

Grand Rapids, Mich.—J. W. Boynton, of Grand Rapids, is reported interested in the construction of an electric railway from Grand Rapids to Alpena.

Onondaga, N. Y.—The Auburn Inter-Urban R. R. Co. is stated to have secured a franchise for a single or double track railway through the town. C. D. Beebe, Mgr., Syracuse.

Kansas City, Mo.—The Co. Comrs. are stated to have granted a franchise to the Kansas City, Forest Hill & Swope Park Ry. Co.

Tacoma, Wash.—Chas. H. Baker, Pres., Snoqualmie Power Co., is stated to have petitioned the City Council for a franchise.

Davenport, Ia.—The Superv. are stated to have granted franchises to the Davenport & Suburban Ry. Co. and to the Iowa & Illinois Ry. Co.

Harrison, Ark.—John G. Geghan, of Cleveland, O., Secy. of the Hidden Fortune Zinc Co., of Dodd City, is stated to have petitioned the Town Council for a franchise to construct an electric railway in Harrison. It is proposed to build from Dodd City via Harrison and Sulphur Mountain to Jasper.

Kensington, Md.—The Kensington Ry. Co. has been incorporated, with a capital of $25,000, by B. H. Warner, W. M. Terrell, and others. The company is stated to have acquired control of the Chevy Chase & Kensington Electric Ry., which connects Chevy Chase Lake and Kensington. It is proposed to place the road in thorough repair and extend it to Wheaton and ultimately to Garrett Park.

Reading, Pa.—The Reading Traction Co. is reported to be making a survey for a trolley line to be constructed from Reading to Birdsboro.

Biloxi, Miss.—See "Power Plants, Gas and Electricity."

Reading, O.—The Council is stated to have granted franchises to C. L. McCrea, of Dayton, representing the Cincinnati & Northeastern Ry. Co., and to the Millcreek Valley St. Ry. Co., of which W. G. Wagenhals, of Cincinnati, is Mgr.

Mt. Vernon, O.—John McCrory is stated to have commenced surveying for an electric railroad from Mt. Vernon to Newark by the way of Gambier and Martinsburg.

Canandaigua, N. Y.—The Ontario Light & Traction Co. is stated to have filed certificates for extension of its lines to Geneva and Rochester. J. L. Lavien, Supt., Canandaigua.

Stockton, Cal.—The Superv. are stated to have granted a franchise to H. H. Griffiths.

Cincinnati, O.—Col. Albert S. Berry, of Newport, Ky.; Mr. Tennis, of the Tennis Construction Co., of Louisville, Ky.; Engr. B. F. Layman and A. Robinson, representatives of the Westinghouse Mfg. Co., of Pittsburg, Pa., are stated to have started Aug. 16 to look over the route recently surveyed for a new electric line from Cincinnati to Louisville via Milton, Ky. The estimated cost of the line is $500,000, including a $75,000 power plant.

Moorhead, Minn.—The City Council is stated to have granted a franchise to the Fargo & Moorhead St. Ry. Co. Under the provisions of the ordinance the line will pass from Fargo to Moorhead over a bridge to be erected between the north bridge and the N. P. railroad bridge. It is stated that the approval of this grant will be submitted to the voters of Moorhead, at the spring election.

Urbana, O.—The City Council is stated to have granted a franchise to the Danville, Urbana & Champaign Interurban Ry. Co.

Bluffton, Ind.—The Co. Comrs. are stated to have granted a franchise to the Ohio & Indiana Electric Ry. Co., to use the pikes from the south to the north line of the county, passing through Nottingham, Petroleum, Reiffsburg, Bluffton and Ossian. It is reported that as the use of county bridges was refused, the company will have to build its own bridges.

Long Beach, Cal.—H. H. Hamilton, representing the California Pacific Ry. Co., is stated to have petitioned the City Councils of Long Beach and Los Angeles for a franchise for its line to be constructed from Los Angeles to San Pedro and Long Beach.

Stoughton, Mass.—A company is stated to have been formed here, with a capital of $30,000, to construct an electric railway from Avon to Brockton and Stoughton. Geo. Monk and H. W. Britton, of Stoughton, are among the directors.

Pasadena, Cal.—Bids are wanted Sept. 9 for an electric street railway franchise. Heman Dyer, City Clk.

RAILROADS.

Morgan, Tex.—W. C. Beach, of Waco, Res. Engr. of the Texas Central R. R., writes that the company is considering the construction of a line between Morgan and Towler, to cost about $10,000.

Morris, Ill.—It is stated that the Chicago, Rock Island & Pacific R. R. Co. is to build an air line from Morris through Bloomington and Springfield to St. Louis. W. E. Dauchy, Ch. Engr., Chicago.

Eldorodo, Ark.—A company composed of A. K. Silverthorn, H. S. Powell and others, is stated to have been formed at Eldorado to build a railroad from Eldorado to Monroe, to connect with the V. S. & P.; capital, $200,000.

Paris, Tex.—It is reported here that the St. Louis & San Francisco R. R. Co. will build an extension from Paris, Tex., to Galveston. C. D. Purdon, Ch. Engr., St. Louis, Mo.

Grenada, Miss.—A charter has been granted to the Grenada & Tupelo R. R. Co. to construct a railroad from Grenada through a portion of Grenada County to the Yalobusha County line, and through Yalobusha to Calhoun, Pontotoc and Lee to Tupelo. Incorporators: D. F. Watson, Oronogo, Mo.; D. W. Johnson, Pittsboro, Miss., and John Gore, Banner, Miss.

St. Louis, Mo.—A press report states that the Pennsylvania R. R. (W. H. Brown, Ch. Engr., Philadelphia), together with the Baltimore & Ohio R. R. (J. M. Graham, Ch. Engr., Baltimore), and other lines making up the St. Louis Terminal Assoc., have decided to expend about $5,000,000 in improving the St. Louis terminals.

Cassville, W. Va.—The City Council is stated to have granted a right of way through the village to the Norfolk & Western R. R. Co. L. E. Johnson, Gen. Mgr., Roanoke.

Knoxville, Tenn.—The contract for constructing the railroad from Knoxville to Beaver Creek for the Knoxville, LaFollette & Jellico R. R., is stated to have been awarded to Eddington, Groner & Griffitts, of Knoxville. This covers the terminal work for Knoxville, and in all about 15 miles. Amount of contract reported to be about $225,000.

The next contracts to be let will cover the erection of a depot and shops at Knoxville. It is understood that architects are to be put to work at once preparing plans for these buildings.

Bushnell, N. C.—The Southern Ry. Co. is stated to have decided to construct a line from Bushnell, N. C., to Maryville, Tenn. W. H. Wells, Engr. of Construction, Washington, D. C.

Marianna, Ark.—It is stated that the Missouri Pacific R. R. Co. intends constructing an extension from Marianna, Ark., to Trippe Junction as a part of the proposed line from Memphis which is to connect with the New Orleans & Northwestern at Clayton, La. The total distance from West Memphis to Clayton is 294 miles. H. Rohwer, Ch. Engr., St. Louis, Mo.

Sterling, Okla. Ter.—A charter is stated to have been granted to the Oklahoma & Texas R. R. Co. to build 100 miles of road between the Red River, on the southern border of Comanche County, Okla., to Cement. Principal place of business, Sterling. Incorporators: James Depenbrink, A. P. Sanford, Frank Prouty, and others.

Latrobe, Pa.—The Pennsylvania R. R. Co. is reported to be surveying for a change in the line from this place to Derry, a distance of 5 miles. The grade will be entirely changed, and the 2 tracks now in use will be supplanted by 4 tracks, at a cost of $500,000. W. H. Brown, Ch. Engr., Philadelphia.

Amarillo, Tex.—The Choctaw, Oklahoma & Gulf R. R. Co. is stated to have decided to extend its line from Amarillo to Tecumsecara, N. M., a distance of about 135 miles. F. A. Molitor, Ch. Engr., Little Rock, Ark.

The Santa Fe R. R. Co. (Jas. Dun, Ch. Engr., Chicago, Ill.) is stated to have decided to construct a cut-off from Amarillo to a point on its main line in New Mexico. The Southern Kansas (Avery Turner, Gen. Mgr., Amarillo) which is also a part of the Santa Fe system, will, it is reported, be extended from Washburn, Tex., to Amarillo, a distance of about 25 miles.

Mattson, Miss.—It is stated that the Illinois Central R. R. Co. will construct a line from Mattson to Roundaway. W. J. Harahan, Ch. Engr., Chicago, Ill.

Bradys Bend, Pa.—The Bessemer & Lake Erie R. R. Co. is stated to have decided to construct a new line into the Butler and Armstrong County coal fields to open the immense territory near Bradys Bend. H. T. Porter, Ch. Engr., Pittsburg.

New Decatur, Ala.—It is stated that most of the right of way has been secured and work will soon commence on the Central of Alabama R. R. to be constructed from New Decatur to Jasper, Ala., a distance of about 42 miles.

San Francisco, Cal.—The San Francisco Terminal Ry. & Ferry Co. is reported incorporated, with a capital of $6,000,000, to construct railroads to connect this city and the San Joaquin and Santa Clara valleys. A. C. Kains, of San Francisco, Asst. Mgr. Canadian Bank of Commerce, and John Treadwell, of Oakland, are reported interested.

Ellisville, Miss.—The Mobile, Jackson & Kansas City R. R. Co. is reported to be surveying for a new line from Ovett to Ellisville, a distance of about 17 miles. T. W. Geer, Supt., Mobile, Ala.

Houston, Tex.—The Houston, Beaumont & New Orleans Ry. Co., recently chartered to construct a railroad from Houston to Orange, Tex., and with the ultimate intention of building to New Orleans, is stated to have been organized, with Geo. J. Gould, New York, Pres., and Leroy Trice, Palestine, Tex., Mgr. Work of construction to begin this fall.

Denver, Colo.—Press reports state that next month contracts will be let by David H. Moffat, Pres. of the Denver, Northwestern & Pacific R. R. Co. The length of the line from Denver to Salt Lake City will be about 500 miles.

PUBLIC BUILDINGS.

Charlotte, Mich.—Bids are wanted Sept. 1 for building the Carnegie Library. Murl H. DeFoe, City Clk.

New York, N. Y.—Bids are wanted Aug. 29 for repairs and alterations to several armories of the N. G. N. Y., in the Boro. of Manhattan. Mayor Seth Low, Chmn. Armory Bd.

Worcester, Mass.—Cutting & Carleton, of Worcester, are the architects for the City Alms House, brick boiler house, laundry and bakery, to be built at a cost of $20,000.

Aurora, Ill.—Bids are wanted Sept. 3 for the construction of a $50,000 Carnegie Library.

Stillwater, Minn.—Bids are wanted Aug. 30 for the erection of the Carnegie Public Library. Archts., Patton & Miller, 115 Monroe St., Chicago, Ill. Rose E. Burke, Secy. Library Bd.

Ruston, La.—Bids are wanted Sept. 12 for the erection of a court house. J. L. Bond, Pres. Police Jury.

Rochester, N. Y.—It is stated that plans are about completed for a smallpox hospital to be erected on Elmwood Ave., to cost $35,000.

Lawrence, Kan.—The Co. Comrs. are stated to have selected the plans of J. G. Haskell, of Lawrence, and Fredk. C. Gunn, of Kansas City, for the new court house.

New Orleans, La.—The heirs of Simon Hernsheim have presented to this city $50,000 for a public library.

Brooklyn, N. Y.—The Municipal Art Comn. is stated to have approved the plans of Axel S. Hedman, 371 Fulton St., for a public bath to be erected on Hicks and Degraw Sts., to cost about $50,000.

Marinette, Wis.—J. E. Utke, of Marinette, is stated to have secured the contract for erecting the Stephenson Library, for $26,500.

Racine, Wis.—The plans of Mauran, Russell & Garden, Chemical Bldg., St. Louis, Mo., are stated to have been accepted for the Carnegie Library, to cost about $60,000.

Denver, Colo.—Gove & Walsh, McPhee Bldg., are stated to have completed plans for the erection of St. Vincent's Orphanage, to cost $75,000.

Beatrice, Neb.—The plans of G. A. Berlinghoff, of Beatrice, are stated to have been accepted for the public library, to cost about $18,000.

Pittsburg, Pa.—A permit has been issued to the Welsh Presbyterian Church for an edifice to be erected in McDevitt Place, 14th Ward, to cost $45,000.

Wellington, O.—Henry J. Spieker is stated to have secured the contract for erecting the $25,000 public library.

Columbus, Miss.—The Council is stated to have selected R. H. Hunt, of Chattanooga, Tenn., to prepare plans for a city hall.

Columbus, O.—The Co. Comrs. are stated to have adopted a resolution recommending the erection of a memorial hall, to cost $250,000.

Macleod, N. W. Ter.—Bids are wanted Sept. 4 for erecting a court house at Macleod. Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

Brooklyn, N. Y.—Bids are wanted Sept. 10 for furnishing material and making alterations and additions to the Kings Co. Hall of Records. Estimated cost, $500,000. J. Edw. Swanstrom, Boro. Pres.

Hazlehurst, Miss.—Bids are wanted Sept. 1 for erecting a jail and jailer's residence, to cost about $12,000.

Uniontown, Pa.—Bids are wanted Aug. 30 for the construction of the Uniontown Hospital. Jacob S. Hackney, M. D., Secy. Bd. of Trus., 36 W. Church St.

Cleveland, O.—See "Water."

New Brunswick, N. J.—Contracts for erecting the Carnegie Library are stated to have been awarded as follows: masonry, J. H. Prior & Son, Trenton, $24,000; carpenter work, Geo B. Rule, of New Brunswick, $15,476, and plumbing and gasfitting, H. M. Price's Sons, New Brunswick, $1,298.

Buffalo, N. Y.—Local press reports state that bids received for erecting the 65th Regt. Armory have been rejected, as all were in excess of the appropriation, which is $550,000. Brick of a buff or gray color is to be substituted for stone, and the 150-ft. tower is to be left off the building.

Vicksburg, Miss.—City Hall bonds amounting to $50,000 are stated to have been sold.

Elba, Ala.—It is reported that the Coffee Co. Comrs. will receive bids about Sept. 1 for the erection of a court house, to cost about $30,000.

Seattle, Wash.—In the estimates for 1903 filed with the Comptroller, Aug. 12, City Engr. Thomson includes $350,000 for the erection of a city hall, $120,000 for a jail and $17,000 for building electrical ducts, in connection with the municipal lighting plant.

Valley City, N. D.—The plans of W. C. Albrant, of Fargo, are stated to have been accepted for a Carnegie Library, to cost $15,000.

St. Louis, Mo.—The Little Sisters of the Poor have applied to the Bldg. Comr. for permission to erect a $65,000 building on their premises at Grand Ave. and Cherokee St. The foundation for the building has been in for about a year.

Columbus, O.—Bids will be received until Sept. 16 by the Bd. of Dirs. of the Columbus Work House for furnishing material and erecting a building and cell block, with the necessary connecting walls, etc., to the present structure, and additions and alterations in the present buildings at the Work House. J. S. Walters, Secy.

Hillsboro, Ill.—It is stated that bids are wanted Aug. 30 for erecting a brick church. Geo. R. Cooper, Chmn. Com.; S. A. Bullard, Archt., Springfield, Ill.

Hampton, Ia.—It is stated that bids are wanted Aug. 27 for erecting a brick library, 50x60 ft. Liebbe, Nourse & Rasmussen Archts., 724 Walnut St., Des Moines.

Beaumont, Tex.—Bids are wanted Sept. 12 for erecting a Catholic church. J. B. Brechin, Archt., Beaumont.

Mariposa, Cal.—It is stated that bids are wanted Sept. 2 for erecting a male ward at the Co. Hospital. J. H. Corcoran, Clk. Co. Hosp.

Brooklyn, N. Y.—Bids are wanted Sept. 4 for furnishing material and installing bath tubs, water closets, lavatories, etc. Thos. W. Hynes, Comr. Dept. of Correction, N. Y. City.

Santa Rosa, Cal.—It is stated plans will be received by the Library Trus. until Aug. 30 for a Carnegie Library.

Memphis, Tenn.—See "Bridges."

Williamsport, Pa.—Edgar V. Seeler, Real Estate Trust Bldg., Philadelphia, is stated to be preparing plans for a free library to cost $200,000, the gift of Jas. V. Brown, of Williamsport.

Watertown, N. Y.—Easton, Rising & Worden, of Hoosick Falls, are stated to have secured the contract for repairing and improving the State Armory, for about $25,000.

Darlington, Ind.—Bids are wanted Sept. 1 for erecting a 2-story city building, 25x44 ft. Address Town Clk.

BUSINESS BUILDINGS.

Crookston, Minn.—The officers of the Bank of Crookston are stated to have decided to erect a 3-story brick building 75x25 ft. on Bway. and 2d St.

Superior, Wis.—A. E Johnson, of Minneapolis, Minn., is stated to have decided to erect a brick block on Hammond Ave. and N. 4th St., to cost about $15,000.

Raleigh, N. C.—The Grand Lodge of Masons is stated to have decided to erect a 6-story temple on Fayetteville and Hargett Sts., to cost about $90,000.

Norwich, N. Y.—Mitchell & Stever, of Binghamton, are stated to have secured the contract for erecting 3 buildings for the Maydole Hammer Co., for about $90,000.

Racine, Wis.—The plans of Guilbert & Pugh are stated to have been accepted for a building for the Y. M. C. A., to cost about $40,000.

Des Moines, Ia.—The contract for the brick and carpenter work on the Brown-Hurley Hardware Co.'s warehouses at W. 1st St. and Court Ave. is stated to have been awarded to Chas. Weitz & Sons, 713 Mulberry St., for $56,000.

Syracuse, N. Y.—John Moore is reported to have selected Merrick & Randall, Sedgwick, Andrews & Kennedy Bldg., to prepare plans for a 50-room family hotel to be constructed on the site of the D. Edgar Crouse mansion at E. Fayette and State Sts.

Miami, Fla.—The Miami branch of the Fraternal Union of America is stated to have decided to erect a 3-story business block, 85x100 ft. on 11th St., between Aves. C and D, to cost about $17,000.

Pittsburg, Pa.—Chas. Bickel, 524 Penn Ave., is stated to be completing plans for an 8-story warehouse to be erected for Hartje Bros. at 2d Ave., near Wood St.

Brooklyn, N. Y.—The Brooklyn Amusement Co. has been incorporated to erect a theater at Willoughby and Pearl Sts., Brooklyn, with a seating capacity of 1,200, for vaudeville purposes. The theater will be built of fancy brick, iron and stone, and cost $150,000. It will be ready on Jan. 1. W. B. Watson, Pres.; Louis T. Horowitz, Secy.

Peoria, Ill.—J. J. Jobst, 223 S. Adams St., is stated to have secured the contract for erecting a round house on Junction St. and Monarch Ave. for the Peoria & Pekin Union Ry. Co., for about $60,000.

Dallas, Tex.—An 8-story building is to be erected here by the Texas-Moline Plow Co., a branch of the Moline Plow Co., Moline, Ill.; cost, $30,000.

Springfield, Mass.—Peter Burke has received the contract for building an addition to the Boston & Albany R. R. freight shops in W. Springfield, for about $40,000. The building to be of brick, 2 stories high, 155x230 ft.

Owensboro, Ky.—An addition is to be built to the Continental Tobacco House. Cost, $25,000.

Des Moines, Ia.—Chas. Weitz & Sons, Des Moines, have contracts for the $56,000 hardware warehouse to be built for Brown-Hurley Co. and for the $20,000 cold storage plant to be built for Schermerhorn Shotwell.

Ottumwa, Ia.—Ernst Koch, 31 Hoffman Blk., has prepared plans for a 2-story brick building 66x77 ft. for the Leisy Brewing Co., of Peoria, Ill., for office and cold storage in this city.

Binghamton, N. Y.—S. O. & H. R. Lacey, of Binghamton, are the architects for a fireproof store house 60x400 ft., and an office building 40x100, 5 stories, mill construction, to be built for Endicott & Johnson, Endicott.

Boston, Mass.—A permit to build has been granted to C. P. Bowditch and others, for a 3-story office building on Bowdoin Sq., Cambridge and Green Sts. Builders, C. A. Dodge & Co., 79 Milk St.; estimated cost, $75,000.

Plans have been prepared by Parker & Thomas, 1 Somerset St., for a 2-story fireproof tennis and racquet court and club house, to be located at Boylston and Hereford Sts., to cost $200,000.

Cleveland, O.—A stock company is being formed to erect a family hotel on Fairmount St., fronting on Wade Park, to cost, with site, about $500,000. A. N. Oviatt, 589 "The Arcade," is the architect. P. W. Ditto is reported interested.

A. A. Armstrong is stated to have purchased a site on Payne Ave. and Walnut St. for an 8-story store and apartment house, to cost about $100,000.

Portland, Me.—Bids will be received until Aug. 30 by F. H. & E. F. Fassett, Archts., 93 Exchange St., for making alterations and repairs to Preble House.

Palo Alto, Cal.—The Masonic Temple Assoc., of Palo Alto, has been incorporated, to erect a $20,000 temple on University Ave.

Fonda, N. Y.—The N. Y. Central & Hudson River R. R. Co. is stated to have adopted plans for a depot to be erected in Fonda, to cost, with other railroad improvements, about $110,000. W. J. Wilgus, Ch. Engr., New York City.

Buffalo, N. Y.—The Buffalo Realty Co. is reported interested in the erection of a department store on the site of the old Tifft House on Main St., to cost about $500,000.

Colorado Springs, Colo.—John C. Austin, of Los Angeles, Cal., is reported to be preparing plans for a 3-story frame and brick hotel, to contain 100 guest rooms, which Geo. W. Todd proposes to build at Colorado Springs.

Los Angeles, Cal.—Eisen & Wyman, of Los Angeles, are said to be preparing plans for a building to be erected at 4th St. and Central Ave., by the Ice & Cold Storage Co

Muncie, Ind.—It is stated that H. P. March contemplates erecting a $75,000 hotel at Jackson and Mulberry Sts.

DWELLINGS.

Philadelphia, Pa.—Newman, Woodman & Harris, Real Estate Trust Bldg., are stated to be preparing plans for a 4-story stone residence for Dr. J. Wilson, to be erected at 1509 Walnut St.

Kansas City, Mo.—C. A. Shepard is about to build a $10,000 brick dwelling at 2828 Forest St.

Danl. Houglan is about to build a $10,000 brick apartment house at 915 Paseo St.

Boston, Mass.—A building permit has been granted to Geo. W. Watson for 10 3-family houses on Brighton Ave. near Chester St.; estimated cost, $60,000; contract not awarded.

Plans have been filed for a 4-story brick single family dwelling on Audubon Road, Back Bay, by Archt. T. M. Clark, 22 Congress St.; estimated cost, $32,000; owner, Theo. M. Clark. Builder, Chas. King & Co., 170 Summer St.

SCHOOLS.

Lancaster, O.—Bids will be received by the Bd. of Trus. of the Boys' Industrial School until Aug. 30 for erecting an Employes' Building. C. P. Adams, Secy.

Danville, Ky.—The plans of Dittoe & Wisenall, Blymer Bldg., Cincinnati, O., are stated to have been accepted for the erection of a 3-story building for Caldwell College, to cost about $20,000.

Oakland, Ill.—Alex. Briggs, of Charleston, is stated to have secured the contract for erecting a school here for $22,480.

Bryn Mawr, Pa.—Cope & Stewardson, 320 Walnut St., Philadelphia, are stated to have completed plans for a dormitory for Bryn Mawr College, to cost $130,000. They are also reported to be preparing plans for a library to cost $250,000, and a main heating plant to cost $120,000.

Baltimore, Md.—Crook, Horner & Co., 303 N. Howard St., are stated to have secured the contract for ventilating and heating the school at Johnson and Heath Sts. for $6,300.

North Adams, Mass.—J. McA. Vance, of Pittsfield, is stated to have completed plans for the normal school dormitory. It will be 3 stories high and have a frontage of 156 ft.; the depth of the main building will be 44 ft., and there will be a wing at each end 56 ft. long and 40 ft. wide.

Denton, Tex.—Dennis Mahoney, of Waxahachie, is stated to have secured the contract for erecting the Girls' Industrial School at Denton, for $45,462.

Chicago, Ill.—A. F. Hughes, 437 W. 69th St., is stated to be preparing plans for a 2-story brick parochial school to be erected on 78th St. and Cheltenham Ave., to cost $35,000.

Columbus, O.—The Trus. of the Ohio State Univ. at a meeting Aug. 12 approved plans for the new Veterinary Building to cost $35,000; returned to the architect for revision the plans for the Physics Building, appropriation $130,000, and rejected bids received for the addition to the Chemical Hall, as all were in excess of the appropriation, which is $20,000. New bids will be received for the latter structure.

Marlin, Tex.—The plans of S. P. Herbert, of Waco, are stated to have been accepted for a brick school to cost $22,000.

Youngstown, O.—Bids are wanted Sept. 1 for the purchase of $28,000 school bonds. Edw. R. Thompson, Pres. Bd. of Educ.

Delray, Mich.—Malcomson & Higginbotham, Moffat Bldg., Detroit, are stated to be preparing plans for a school to be erected in the western part of the village, to cost $50,000.

Greeley, Colo.—J. A. Woodbury, of Greeley, is stated to have secured the contract for erecting the west wing of the Greeley High School for $28,991.

Pardeeville, Wis.—Local press reports state that bids will be received by the School Bd. until Sept. 4 for erecting a 6-room school.

Cincinnati, Ia.—It is stated that bids are wanted Sept. 15 for erecting a brick school. J. M. Sturdivant, Pres.

Passaic, N. J.—Swenson Bros., of Passaic, are stated to have secured the contract for erecting the 4th School for $52,000.

San Antonio, Tex.—It is stated that the Oblate Fathers, of this city, will erect on Laurel Heights, north of the city, a theological seminary, to cost about $75,000.

Bloomington, Ind.—Bids will be received until Sept. 3 by the Bd. of Trus. of the Indiana State Univ. for the following work in new Science Hall in said University: Furnishing material and installing plumbing and gas fitting, also separate bids for heating and for additional boilers and other connections, fittings, labor and material relating thereto. John W. Cravens, Secy.

Hastings, N. Y.—The lowest bid opened by the Bd. of Educ., Aug. 15, for erecting a brick school on Farragut Road, is stated to have been submitted by Robt. L. Stewart, for $42,975.

Fairfield, Ia.—The Parsons College is reported to have been destroyed by fire Aug. 19.

Buffalo, N. Y.—Bids are wanted Sept. 2 for ventilating and heating Lafayette High School, Francis G. Ward, Comr. of Pub. Wks.

New York, N. Y.—The following bids were opened Aug. 15 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., for the general construction on School 65, Boro. of Bronx: Thos. Dwyer, $188,000; Luke A. Burke, 401 W. 59th St., $181,750.

For general construction of School 110, Boro. of Manhattan: Patk. Sullivan, 389 Broome St., $226,000; Wm. & Thos. Lamb, $239,891.

For sanitary work, Morris High School, Boro. Bronx: Kirchhoff & Brown, 166 E. 82d St., $36,350; Jas. Fay, 205 E. 51st St., $35,545; Edw. J. Renehan, $36,000.

For sanitary work (contract No. 2), New High School of Commerce, Boro. of Manhattan: Kirchhoff & Brown, $29,735; Jas. Fay, $30,640; Edw. J. Renehan, $31,300.

For installing electric light wiring, etc., Morris High School: Fredk. Pearce, 18 Rose St., $28,886; Commercial Const. Co., $29,350; T. Fred. Jackson, $29,995.

For installing electric elevators, Wadleigh High School, Boro. of Manhattan: Otis Elevator Co., $10,850.

Brooklyn, N. Y.—The following bids were opened Aug. 15 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., New York City: Erecting new building, etc., School 91, Boro. of Brooklyn: Francis Sullivan, $58,900; Thos. Dwyer, $65,250; Peter Cleary, $66,000; George Hildebrand, $67,581; Rutan & Henningham, $61,667; Chris. J. Kenny, $63,800; Patk. Sullivan, $61,000.

For erecting school 130, Boro. Brooklyn: John H. Goetschius, $125,500; Patk. Sullivan, $132,000; Peter Cleary, $115,983; Rutan & Henningham, Manhattan Ave. near Conselyea St., $111,805; Wm. & Thos. Lamb, $121,413.

STREET CLEANING AND GARBAGE DISPOSAL.

North Adams, Mass.—Bids are wanted Sept. 10 for the collection and disposal of garbage for a period of 5 years from Nov. 1, 1902. J. Q. Irwin, Clk. Bd. of Health.

Homestead, Pa.—See "Water."

Oakland, Cal.—The Merchants' Exchange has adopted resolutions favorable to the erection of a garbage crematory.

Utica, N. Y.—Local papers state that the contract for the removal of ashes and rubbish and for the sweeping of paved streets in Utica expires in Oct., and that the City Engr. has prepared new specifications for both classes of work.

GOVERNMENT WORK.

Philadelphia, Pa.—Bids are wanted at the Bureau of Supplies & Accounts, Navy Dept., Washington, D. C., until Aug. 26 for furnishing at the League Island Navy Yard a quantity of boiler tubes, electrical supplies, pipe fittings, etc. A. S. Kenny, Paymaster Gen., U. S. N.

Duluth, Minn.—Bids are wanted Aug. 30 for connecting Presque Isle breakwater with the shore, Marquette Bay, Mich. Capt. D. D. Gaillard, Corps of Engrs., U. S. A.

Navajo Agency, New Mex.—Bids are wanted Sept. 11 at the Dept. of Interior, Office of Indian Affairs, Washington, D. C., for constructing a water system at the Navajo Agency school. W. A. Jones, Comr.

Chicago, Ill.—Bids are wanted Sept. 24 at the Treasury Dept., Washington, D. C., for the interior finish and completion of the Post Office at Chicago: Henry Ives Cobb, Archt., U. S. Gov. Bldg. at Chicago; Treasury Dept., Washington.

Newport, R. I.—Bids are wanted at the Bureau of Supplies & Accounts, Navy Dept., Washington, D. C., until Aug. 26 for furnishing, at Naval Training Station, labor and material for building auditorium, laying pavements, completing breakwater and extending sea wall. A. S. Kenny, Paymaster Gen., U. S. Navy.

Cleveland, O.—Bids were opened Aug. 15 by Maj. Dan C. Kingman, Corps of Engrs., U. S. A., for dredging in Cleveland Harbor, and the bid of L. P. & J. A. Smith Co., Cleveland (lowest bidders), which was as follows, was recommended for award: 18¾ cts. per cu. yd. for approximately 200,000 cu. yds. of work to be done; board of inspectors per day, per man, 50 cts.; total, $37,000.

Erie Harbor, Pa.—Maj. T. W. Symons, Corps of Engrs., U. S. A., Buffalo, N. Y., writes that the lowest bid received Aug. 15 for dredging and construction work at Erie Harbor, Pa., was from the Buffalo Dredging Co., Buffalo, at $147,726. The award of contract has not yet been approved by the Ch. of Engrs.

Ft. McKinley, Me.—Capt. A. W. Yates, Q. M., U. S. A., Portland, Me., writes that all bids received Aug. 4 for the construction of a sewer system at Ft. McKinley has been rejected, and that new bids will be asked.

Denver, Colo.—The only bid received Aug. 19 at the Treasury Dept., Washington, D. C., for safety vaults and vault doors at the U. S. Mint, Denver, was from the York Safe & Lock Co., York, Pa., at $88,660 and $93,660.

St. Louis, Mo.—Bids will be received by Capt. W. C. R. Colquhoun, Depot Q. M., until Sept. 20 for repairing the government roadway leading from Springfield, Mo., to the National Cemetery.

St. Louis, Mo.—Bids are wanted Sept. 10 for an iron fence, artificial stone sidewalks, etc., for the U. S. Marine Hospital at St. Louis. Specifications may be obtained from Jas. S. Gassaway, Surgeon, P. H. & M. H. S. (Custodian).

Boston, Mass.—Bids are wanted Aug. 30 for repairs to plumbing in the U. S. Marine Hospital at Boston. R. M. Woodward, Surgeon, P. H. & M. H. S., Custodian.

Charleston, S. C.—Bids will be received at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Oct. 11 for constructing a concrete and granite drydock, exclusive of pumping plant and caisson, at the Navy Yard, Charleston. Authorized cost of entire work, $1,250,000. Mordecai T. Endicott, Ch. of Bureau.

New York, N. Y.—Bids are wanted Sept. 8 for repairing dikes at Saugerties. Col. S. M. Mansfield, Corps Engrs., U. S. A.

New York, N. Y.—The following bids opened Aug. 14 by Col. S. M. Mansfield, Corps of Engrs., U. S. A., for dredging in Harlem River, have both been rejected: Morris & Cummings Dredging Co., N. Y. City, Section No. 1, 10,000 cu. yds. at 34.4 cts. per cu. yd.; Section No. 2, 250,000 cu. yds. at 30.4 cts.; R. G. Packard Co., N. Y. City, Section No. 2, at 32 cts.

Fergus Falls, Minn.—The following bids were opened Aug. 18 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Court House and Post Office at Fergus Falls: J. W. Miller, St. Paul, $61,886, $62,925 and $62,535; Lowenston Bros., Fergus Falls, $69,827; Congress Const. Co., Chicago, Ill., $67,542.

Denver, Colo.—The following bids were opened Aug. 12 at the Treasury Dept., Washington, D. C., for the completion (except certain steel vaults, plumbing, elevators, heating apparatus, electric wiring and conduits) of the U. S. Mint at Denver: A. B. Stannard, New York City, $217,622; J. A. McGonigle, Leavenworth, Kan., $213,432; Simpson & Toogood, Denver, $217,900; Congress Const. Co., Chicago, Ill., $227,326; P. N. Hennessy, St. Paul, Minn., $228,900.

Milwaukee, Wis.—Maj. J. G. Warren, Corps of Engrs., U. S. A., writes that the following bids were opened Aug. 15 for dredging Green Bay Harbor, Wis., 800,000 cu. yds.: A, Duluth Dredge & Dock Co., Duluth, Minn., 14 cts. per cu. yd.; B, Lydon & Drews Co., Chicago, Ill., 15 cts.; C, Saml. O. Dixon, Milwaukee, Wis., 12 cts.; D, Buffalo Dredging Co., Buffalo, N. Y., 17 cts.; E, FitzSimons & Connell Co., Chicago, Ill., 15 cts.

Bids opened at the same time for dredging Menominee Harbor and River in Mich. and Wis. were as follows: *a*, price per cu. yd. for 200,000 cu. yds. sand, clay, mud, etc.; *b*, 20,000 cu. yds. boulders and hardpan: A, *a* 12.9 cts., *b* 48 cts.; B, *a* 15 cts., *b* 68 cts.; C, *a* 14½ cts., *b* 52 cts.; D, *a* 17 cts., *b* 70 cts.; E, *a* 16 cts., *b* 60 cts.

Cleveland, O.—The following bids were opened Aug. 14 by Maj. Dan C. Kingman, Corps of Engrs., U. S. A., for improving Sandusky Harbor, O., by dredging: *a*, Outer bar, 120,000 cu. yds.; *b*, Straight channel, 200,000 cu. yds.; *c*, Main dock, 50,000 cu. yds.; *d*, West dock, 40,000 cu. yds.; *e*, Dock channel rock, 5,000 cu. yds.; *f*, Board of inspector, per day; *g*, total: W. A. McGillis & Co., Cleveland, *a* 25 cts., *b* 14 cts., *c* 16 cts., *d* 28 cts., *e* $6.15, *f* 48 cts., *g* $107,950; Lydon & Drews Co., Chicago, Ill., *a* 24 cts., *b* 16 cts., *c* 20 cts., *d* 20 cts., *e* $7.50, *f* 50 cts., *g* $116,300; Daly & Hannan Dredging Co., Ogdensburg, N. Y., *a* 23 cts., *b* 14 cts., *c* 16 cts., *d* 36 cts., *e* $6.25, *f* $1, *g* $109,250; Jas. Pryor, Houghton, Mich., *a* 23 cts., *b* 13 cts., *c* 23 cts., *d* 40 cts., *e* $6.75, *f* 50 cts., *g* $114,850; Buffalo Dredging Co., Buffalo, N. Y., *a* 20 cts., *b* 20 cts., *c* 20 cts., *d* 20 cts., *e* $8, *f* 50 cts., *g* $122,000; G. H. Breymann & Bros., Toledo, O., *a* 24 cts., *b* 12¾ cts., *c* 18 cts., *d* 30 cts., *e* $6, *f* 50 cts., *g* $105,550; FitzSimons & Connell Co., Chicago, Ill., *a* 23 cts., *b* 15½ cts., *c* 18 cts., *d* 40 cts., *e* $7.75, *f* 60 cts., *g* $122,350; L. P. & J. A. Smith Co., Cleveland, *a* 28 cts., *b* 14 cts., *c* 22 cts., *d* 40 cts., *e* $7.25, *f* 50 cts., *g* $124,850. All recommended for rejection owing to high prices.

MISCELLANEOUS.

Syracuse, N. Y.—Bids are wanted Sept. 2 for improving Onondaga Creek, in accordance with plans and specification on file in the office of City Engr. Frank J. Schnauber, which call for 43,500 cu. yds. of excavation, 800 cu. yds. of embankment, 1,000 cu. yds. of masonry, 250 cu. yds. of concrete, bailing and draining, and 2 acres of cleaning and grubbing. Wm. H. Jones, City Clk.

Philadelphia, Pa.—See "Electric Railways."

Orillia, Ont.—Bids are wanted Sept. 10 for constructing a wharf in the Park, in this city. Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa.

St. Peters, P. E. I.—Bids are wanted Sept. 8 for constructing a new block at outer end of breakwater at St. Peters. Fred. Gelinas, Secy. Bd. Pub. Wks., Ottawa, Ont.; J. B. Hegan, Res. Engr., Charlottetown, P. E. I.

Albany, N. Y.—Bids will be received by Chas. S. Boyd, State Supt. Pub. Wks., until Sept. 2 for dredging inlet to Cayuga Lake and repairing State pier at mouth of such inlet; for constructing retaining walls, sidewalks and curb at approach to bridge over Erie Canal, Watervliet, and for rebuilding vertical and slope walls, and excavating channel of Dry River, in said city; for repairing and improving Castorland dike, between main shore near Castorland depot, and bridge crossing Black River in Denmark, Lewis Co.; for repairing dikes and banks of Chemung River in Elmira; for providing drainage for purpose of conducting waters of Washington and Cemetery creeks in Geneva, from a point beyond termini of said creeks, through towing paths extended of Cayuga and Seneca Canal; for the extension of the towing path of Cayuga and Seneca Canal from its former terminus, southerly along the west shore of Geneva harbor.

Richmond, Va.—The Street Com. has passed favorably upon the plans of the City Engr. for the proposed straightening of Shockoe Creek at the foot of 2d St. Estimated cost, $25,000.

Galveston, Tex.—Local press reports state that the following bids were opened by the County Comrs. on Aug. 11 for the construction of a sea wall: I. Heffron, Galveston, $1,068,066; Parker-Washington Co., San Antonio, Tex., $1,124,022; John W. O'Rourke, Denver, Colo., $1,258,425; B. Lantry Sons, Strong City, Kan., $1,260,937; J. W. Thompson, St. Louis, Mo., $1,269,054; Geo. W. Catt, New York, $1,305,819; R. S. Van Sant, St. Louis, Mo., $1,350,771.

Baltimore, Md.—The Baltimore & Ohio R. R. has made application to the Harbor Bd. for permission to build a pier, 860x160 ft., which is to be used by the North German Lloyd Steamship Co.

New Orleans, La.—Bids will be received by H. B. Speed, Secy. Bd. of State Engrs., until Aug. 28, for about 200,000 cu. yds. of levee work on Fulton Lake levee, in Desha County, Ark.

New Orleans, La.—The Bd. of Port Comrs. has instructed its Engr. to prepare plans and specifications for the erection of steel sheds along the river front at Market and Orange Sts., Picayune tier and Clonet St.

NEW INDUSTRIAL PLANTS.

E. Rothrock, Wellington, Kans., is secretary of a company which will put up a 400-bbl. flour mill for which a 225-H.-P. engine and two 6x16-ft. boilers are needed.

Parke, Davis & Co., Detroit, are making large additions to their electrical and steam plant under the direction of Geo. W. Scott, consulting engineer, The Rookery, Chicago.

Chief Engr. W. J. Harahan, of the Illinois Central R. R., states that the capacity of the power plant for the Memphis, Tenn., shops has not been determined. The plan of the shops shows a 104x243-ft. car repair shop, a 104x155-ft. mill and carpenter shop, a 104x101-ft. blacksmith and tank shop and a 104x152-ft. machine shop.

Pres. W. L. Durst, of the Greenwood, S. C., Cotton Mill, states that it is proposed to erect a second mill with 10,000 spindles.

The Missouri Furniture Co., 1427 Sarsfield Place, St. Louis, will put up a 6-story 60x127½-ft. woodworking shop with a 150-H.-P. power plant. Gerhart Becker, architect.

Margolius & Co., Norfolk, Va., will put up a 75x175-ft. plant, for which a 75-H.-P. engine and 100-H.-P. boiler will be required.

Pres. J. H. Sale, of the Louisville & Portsmouth Fire Brick Co., Louisville, Ky., states that the power plant for its 30,000-brick plant has not been ordered yet.

The Detroit, Mich., Shipbuilding Co. will put up a 75x151-ft. foundry with two 20-ton cupolas and a 40-ton and a 15-ton traveling electric crane.

A. H. Miller, Lewiston, N. Y., is erecting a two-story 40x125-ft. concrete cold-storage building, for which the power plant has not been ordered.

The West Coast Mfg. & Inv. Co., Ballard, Wash., will rebuild its burned plant; capacity, 75,000 ft. lumber and 250,000 shingles.

The Indianapolis, Ind., Abattoir Co. will build an addition to its packing house next fall or spring, but plans are not yet completed.

The Crescent City Stock Yard & Slaughter House Co., New Orleans, contemplates adding to its plant, but the plans are still incomplete.

E. P. Simpson, The Haddock Inn, Toccoa Falls, Ga., will buy a 10-ton ice plant for the Farmers' Cotton Oil & Fertilizer Co., Toccoa Falls; electric power from a local plant will be used.

Otto C. Wolf, 1025 Arch St., Philadelphia, is designing for the Rosenegk Brewing Co., Baltimore, a 3-story 45x90-ft. stock house, a 2-story 40x60-ft. bottling house and a 2-story 20x30-ft. office; a 100-ton refrigerating machine will be installed.

The Wray-Austin Machinery Co., Detroit, is erecting a temporary 45x150-ft. shop for which a 50-H.-P. power plant will be installed.

Frank S. Betz & Co., Chicago, are putting up a building with 58,000 sq. ft. of floor space for manufacturing surgical instruments and will use small electric motors for power.

The Crown Paper Co., San Francisco, Cal., will build a new wood pulp plant, for which about 1,000 H.-P. will be required; the plans are still unfinished.

The Coldwater, Mo., Milling Co. will put up a 40-bbl. mill next month, for which machinery has not yet been ordered.

BUSINESS NOTES.

The Otis Elevator Co. reported on Aug. 15 that it closed orders for 40 hydraulic passenger elevators for New York office buildings during the past week, and for 51 electric elevators for the same city.

C. W. Mouch, of the Indiana Rolling Mill Co., New Castle, Ind., states that its main building is to be 70x200 ft. Two 500-H.-P. Allis engines with boilers have been ordered, and the rolls will be made by the Lewis Foundry & Machine Co., Pittsburg.

Recent sales of Westinghouse gas engines include the following large orders. Philadelphia Bureau of Water, eight 280-H.-P. and two 125-H.-P., to be direct connected to pumps for the high-service fire mains described in this paper on June 14; Logan Natural Gas Co., Lancaster, O., a 650-H.-P. driving a gas compressor; Riter-Conley Mfg. Co., Leetsdale, Pa., two 300-H.-P.; Winchester Repeating Arms Co., New Haven, Conn., two 150-H.-P. and one 165-H.-P. using producer gas; Bradford, Pa., Electric Light & Power Co., a 250-H.-P., being a repeat order; Penn American Glass Co., Alexandria, Ind., a 175-H.-P. direct connected to generator; Lippincott Glass Co., Alexandria, Ind., an 85-H.-P. Pittsburg Plate Glass Co., Ford City, Pa., five of 85 H.-P.

The Steam Boiler Equipment Co., 20 West Houston St., New York, states that since the beginning of the present difficulty in obtaining anthracite coal, it has installed its hydro-carbon system of regulating soft-coal furnaces in hotels, factories and office buildings in cities where smoke inspection is rigid, with satisfactory results in all cases.

The American Bridge & Scraper Co. has been organized by George Nichol and associates of Anderson, Ind., who have bought the plant of the Northwestern Scraper Co., in that city.

The Saginaw, Mich., Sugar Co., the Alma, Mich., Sugar Co., the Lansing, Mich., Sugar Co. and the Naomi Coal Co., McKeesport, Pa., are to install electric power plants for which engines have been ordered from the Ball Engine Co., Erie, Pa. Ball engines for lighting purposes have been sold to Col. W. H. Dewey, Mampa, Idaho, and to the Williams Bros. Co., Detroit.

The West German Portland Cement Co. has been incorporated, with $1,000,000 capital stock, to build works in Lima township, Washtenaw County, Mich. Linus S. Learch and Howard C. Miller, of Detroit, are leading stockholders.

The steam loop and Holly gravity return system is being installed in a large number of power plants at present, some recent orders placed with Westinghouse, Church, Kerr & Co., coming from the Meriden, Conn., Electric Light Co.; the Worcester, Mass., Consolidated Street Ry.; the Columbus, Buckeye Lake & Newark Ry., Hebron; the Boston & Northern St. Ry., Lowell; Boston & Worcester St. Ry., South Framingham, Mass.; Rhode Island & Suburban Ry., Providence; Berkshire St. Ry., Pittsfield; Philadelphia & Reading Ry., Reading; Rockingham Light & Power Co., Portsmouth, N. H.; Michigan Central Ry., Jackson, Mich.; American Smelting & Refining Co., Mexico; Chicago Edison Co., Chicago; Armour & Co., Chicago; American Smelting & Refining Co., Leadville; Atchison, Topeka & Santa Fe Ry., Topeka; American Cigar Co., Richmond; J. B. Stetson, Philadelphia; and the Lake Shore & Michigan Southern R. R., Collinswood, O.

The Alberger Condenser Co., 95 Liberty St., New York, has contracted to furnish the Commonwealth Electric Co., Chicago, a condensing plant to operate with a 7,500-H.-P. turbine-generator. It will be of the high-vacuum type, with 20,000 sq. ft. of cooling surface, and will require a pumping plant embracing a dry vacuum pump with Corliss valves, a centrifugal circulating pump, a hot well with a pump driven by a Corliss engine, and two vertical boiler feed pumps.

The Allis-Chalmers Co. reports the following sales of Reynolds-Corliss engines during July: L. T. Williams & Sons, New York, a 22x42-in.; G. A. Bergland, Milwaukee, a 20x42-in.; Rock Plaster Co., New York, a 22x42-in.; Madero & Rincon Gallardo, Lagos, Mex., a 14x36 in.; John M. Stone Cotton Mills, Starkville, Miss., an 18x48-in.; Combination Rubber & Belting Co., Bloomfield, N. J., a 20x42-in.; Springville Mfg. Co., Rockville, Conn., a 14x36-in.; Lidgerwood Mfg. Co., New York, an 18x36-in.; Brunswick-Balke-Collender Co., Chicago, a 26x48-in.; C. A. McDonald, Chicago, two tandem compounds 14 and 26x42-in.; Keye Bros., Argyle, Minn., a 10x30-in.; Barnet & Record Co., Minneapolis, a 20x42-in.; Cashier Mining & Milling Co., Breckenridge, Colo., an 18x36-in.; McCormick Harvesting Machine Co., Chicago, a 15 and 32x36-in. vertical compound; Griffin Wheel Co., Chicago, a 16x42-in.; International Paper Co., New York, a 22x36-in.; New Orleans Ry., two 38 and 80x60-in. vertical compounds. The month's sales also included several large blowing engines, two large pumping engines and a pair of 438-H.-P. Sederholm boilers for a working pressure of 150 lbs.

The Pittsburgh Gage & Supply Co., Pittsburg, Pa., is overhauling the power plant of the Cadiz, O., Electric Light & Power Co. and installing two 125-H.-P. boilers. The company is also installing a complete oil-filtering system for the Sleepy Eye, Minn., Milling Co.

The New York Continental Jewell Filtration Co. has finished installing a filter plant in the new building of the New York Stock Exchange, one at St. Andrew's Academy, Poughkeepsie, N. Y., and one for the Beaver Valley Water Co., Beaver Falls, Pa. A contract has been just closed for a plant for the new Y. M. C. A. building in New York.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Aug. 28. New London, Wis. .... Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 28. Danville, Ill. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 29. Redfield, S. D. .... Aug. 9
Sept. 1. Pipe, Mt. Sterling, Ill. .... Aug. 23
Sept. 1. Hawkesbury, Ont. .... Aug. 23
Sept. 1. Engine, Kansas City, Mo. .... Aug. 16
Sept. 1. Mendota, Ill. .... Aug. 16
Sept. 1. Dam, Ithaca, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 2. Portsmouth, O. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 4. New York, N. Y. .... Aug. 23
Sept. 4. Farmington, Mo. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 5. Engine and boiler, Milwaukee, Wis. .... July 19
Sept. 6. Pipes, Washington, D. C. .... Aug. 9
Adv., Eng. Record, Aug. 9.
Sept. 6. Gates, valves, Washington, D. C. .... Aug. 2
Adv., Eng. Record, Aug. 2.
Sept. 8. Los Angeles, Cal. .... Aug. 16
Sept. 9. Houma, La. .... Aug. 9
Adv., Eng. Record, Aug. 23.
Sept. 10. Reservoir dike, Paterson, N. J. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 11. Navajo Agency, New Mex. .... Aug. 23
Dec 1. Pumps, Seguin, Tex. .... July 26

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 26. Hammond, Ind. .... Aug. 23
Aug. 27. Brooklyn, N. Y. .... Aug. 23
Aug. 28. Guthrie, Okla. Ter. .... Aug. 23
Aug. 28. Mobile, Ala. .... Aug. 16
Adv., Eng. Record, Aug. 16.
Aug. 29. Geneva, O. .... Aug. 2
Aug. 30. Pittsburg, Pa. .... Aug. 23
Aug. 30. Dallas City, Ore. .... Aug. 23
Aug. 30. Monmouth, Ill. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Aug. 30. West Carthage, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Aug. 30. Washington, D. C. .... Aug. 9
Adv., Eng. Record, Aug. 9.
Sept. 1. White Plains, N. Y. .... Aug. 23
Sept. 2. South Bend, Ind. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 2. Plainfield, N. J. .... Aug. 9
Sept. 3. Harrisburg, Pa. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 3. Athol, Mass. .... Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 6. Champaign, Ill. .... Aug. 23
Sept. 6. Lakewood, O. .... Aug. 16
Sept. 9. Oshkosh, Wis. .... Aug. 23
Sept. 10. Salem, O. .... Aug. 23
Sept. 10. Alliance, O. .... Aug. 23
Sept. 13. Washington, D. C. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 16. St. Louis, Mo. .... Aug. 23
Sept. 16. Irvington, N. J. .... Aug. 23
Oct. 10. Ridley Park, Pa. .... Aug. 16
Adv., Eng. Record, Aug. 16.
——— Progreso, Mex. .... Aug. 23

BRIDGES.

Aug. 27. Boston, Mass. .... Aug. 23
Aug. 28. Marshall, Ill. .... Aug. 23
Aug. 29. Indianapolis, Ind. .... Aug. 9
Aug. 30. Portland, Ore. .... Aug. 23
Aug. 30. Three Rivers, Mich. .... Aug. 23
Sept. 1. Linneus, Mo. .... Aug. 23
Sept. 1. Delphi, Ind. .... Aug. 23
Sept. 1. Armour, S. D. .... Aug. 9
Sept. 2. Flandreau, S. D. .... Aug. 23
Sept. 2. South Valley, N. Y. .... Aug. 23
Sept. 2. San Jose, Cal. .... Aug. 16
Sept. 3. Alexandria, S. D. .... Aug. 23
Sept. 3. New Brunswick, N. J. .... Aug. 23
Sept. 3. Appleton, Wis. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 3. Fowler, Ind. .... Aug. 23
Sept. 3. Parker, S. D. .... Aug. 9
Sept. 3. Substructure, Chicago, Ill. .... July 19
Adv., Eng. Record, July 19.
Sept. 3. Superstructure, Chicago, Ill. .... July 19
Adv., Eng. Record, July 19.
Sept. 5. Milwaukee, Wis. .... July 19
Sept. 8. Belleville, Ont. .... Aug. 23
Sept. 9. Bloomington, Neb. .... Aug. 23
Sept. 9. Caldwell, Idaho .... July 12
Sept. 10. Catlettsburg, Ky. .... Aug. 23
Sept. 13. Mansfield, O. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Oct. 1. Castroville, Tex. .... Aug. 23

PAVING AND ROADMAKING.

Aug. 25. St. Clair, Mich. .... Aug. 23
Aug. 26. Windsor Locks, Conn. .... Aug. 23
Aug. 26. Marshalltown, Ia. .... Aug. 23
Aug. 26. Boston, Mass. .... Aug. 23
Aug. 27. Hoboken, N. J. .... Aug. 16
Aug. 27. Terre Haute, Ind. .... Aug. 16
Aug. 28. Wheeling, W. Va. .... Aug. 23
Aug. 28. Wheatland, Ia. .... Aug. 23
Aug. 28. Long Island City, N. Y. .... Aug. 23
Aug. 28. Mobile, Ala. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Aug. 28. New York, N. Y. .... Aug. 16
Aug. 28. Des Moines, Ia. .... Aug. 9
Aug. 29. Troy, N. Y. .... Aug. 23
Aug. 29. Clinton, Ia. .... Aug. 23
Aug. 29. Memphis, Tenn. .... Aug. 9
Aug. 29. Dayton, O. .... Aug. 9
Aug. 29. Jeffersonville, Ind. .... Aug. 9
Aug. 29. Waukesha, Wis. .... Aug. 9
Aug. 29. Cincinnati, O. .... Aug. 9
Aug. 29. Memphis, Tenn. .... Aug. 9
Aug. 30. Alliance, O. .... Aug. 23
Aug. 30. Pittsburg, Pa. .... Aug. 23
Aug. 30. Brooklyn, Conn. .... Aug. 23
Sept. 1. Council Bluffs, Ia. .... Aug. 23
Sept. 1. North Baltimore, Md. .... Aug. 16
Sept. 1. Paoli, Ind. .... Aug. 16
Sept. 1. Terre Haute, Ind. .... Aug. 16
Sept. 1. Niagara Falls, N. Y. .... Aug. 2
Sept. 2. South Bend, Ind. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 3. Brooklyn, N. Y. .... Aug. 23
Sept. 3. Chico, Cal. .... Aug. 23
Sept. 3. Leavenworth, Kan. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 3. Terre Haute, Ind. .... Aug. 16
Sept. 3. Toledo, O. .... Aug. 9
Sept. 4. Boston, Mass. .... Aug. 23
Sept. 5. Dayton, O. .... Aug. 16
Sept. 5. Williamsport, Pa. .... Aug. 16
Sept. 6. Hamilton, O. .... Aug. 23
Sept. 8. Chester, W. Va. .... Aug. 23
Sept. 8. Chariton, Ia. .... Aug. 16
Sept. 10. Massillon, O. .... Aug. 23
Sept. 15. Toledo, O. .... Aug. 23
Sept. 20. St. Louis, Mo. .... Aug. 23

POWER, GAS AND ELECTRICITY.

Aug. 25. Winterset, Ia. .... Aug. 23
Aug. 26. Washington, Ia. .... Aug. 9
Aug. 29. Detroit, Mich. .... July 26
Sept. 2. Baker City, Ore. .... Aug. 23
Sept. 3. Elmira, N. Y. .... Aug. 23
Sept. 5. Columbus, O. .... Aug. 23
Sept. 8. Amsterdam, Holland .... Aug. 2
Sept. 11. Memphis, Tenn. .... Aug. 23
Sept. 13. Akron, O. .... Aug. 23
Sept. 17. Cheviot, O. .... Aug. 23
Oct. 1. Weiser, Idaho .... Aug. 23
Oct. 15. Chicago, Ill. .... Aug. 23

GOVERNMENT WORK.

Aug. 25. Harbor work, Savannah, Ga. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 25. Ft. Des Moines, Ia. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 25. Post Office, Ellsworth, Me. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Aug. 25. Ft. Riley, Kan. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 25. Bulkhead, Philadelphia, Pa. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 26. Navy Yard supplies, Philadelphia, Pa. Aug. 23
Aug. 26. Newport, R. I. .... Aug. 23
Aug. 26. Supplies, Phoenix, Ariz. .... Aug. 9
Aug. 27. Metal lathing, etc., Washington, D. C. Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 27. Repair steamer, Pittsburg, Pa. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 28. Philadelphia, Pa. .... Aug. 2
Aug. 28. Harbor work, Cleveland, O. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 28. Breakwater, Cleveland, O. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 28. Vaults, Washington, D. C. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Aug. 28. Ft. Strong, Mass. .... Aug. 2
Aug. 28. Dredging, Wheeling, W. Va. .... Aug. 2
Adv., Eng. Record, Aug. 2 to 23.
Aug. 29. Light fixtures, St. Cloud, Minn. .... Aug. 9
Aug. 29. Light fixtures, Joliet, Ill. .... Aug. 9
Aug. 29. Light fixtures, Hot Springs, Ark. .... Aug. 9
Aug. 29. Light fixtures, Oskaloosa, Ia. .... Aug. 9
Aug. 29. Light fixtures, Abilene, Tex. .... Aug. 9
Aug. 30. Duluth, Minn. .... Aug. 23
Aug. 30. Boston, Mass. .... Aug. 23
Aug. 30. Rock Island, Ill. .... Aug. 9
Adv., Eng. Record, Aug. 9 to 23.
Sept. 2. Bldg., Johnson City, Tenn. .... Aug. 9
Adv., Eng. Record, Aug. 9 to 23.
Sept. 2. Rapid City, S. D. .... Aug. 9
Sept. 2. New Orleans, La. .... Aug. 9
Adv., Eng. Record, Aug. 9 to 23.
Sept. 3. Dredging, Annapolis, Md. .... Aug. 16
Sept. 3. Plumb'g lab'atory, Washington, D. C. Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 3. Wiring lab'atory, Washington, D. C. Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 3. Dredging, New York, N. Y. .... Aug. 9
Adv., Eng. Record, Aug. 16, 23.
Sept. 8. Dam, Charleston, S. C. .... Aug. 2
Adv., Eng. Record, Aug. 16, 23.
Sept. 4. Post Office, Lockport, N. Y. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 6. Louisville, Ky. .... Aug. 16
Sept. 6. Bremerton, Wash. .... Aug. 2
Sept. 8. Tompkinsville, N. Y. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 8. Htg. laboratory, Washington, D. C. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 8. New York, N. Y. .... Aug. 23
Sept. 8. New Orleans, La. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 9. Htg. P. O., Elmira, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 10. St. Louis, Mo. .... Aug. 23
Sept. 10. Brooklyn, N. Y. .... Aug. 16
Sept. 10. Post Office, Anniston, Ala. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 11. Water supply, Navajo Agency, N. M. Aug. 23
Sept. 11. Wilmington, Del. .... Aug. 16
Sept. 11. Dredging Baltimore Harbor, Md. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 11. Dredging Curtis Bay, Baltimore, Md. Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 11. Dredging, etc., New York, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 11. Wiring P. O., New Brunswick, N. J. .. Aug 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 11. Htg. P. O., New Brunswick, N. J. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 13. Boston, Mass. .... Aug. 16
Sept. 13. Dock, Norfolk, Va. .... July 26
Adv., Eng. Record, Aug. 2, 9.
Sept. 15. Riprap, etc., Philadelphia, Pa. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 15. Tampa, Fla. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 15. Htg. P. O., Abilene, Tex. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 16. Htg. P. O., Oakland, Cal. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 17. New York, N. Y. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 17. Wiring P. O., Abilene, Tex. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 18. Chicago, Ill. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 18. Wiring P. O., Oakland, Cal. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 20. St. Louis, Mo. .... Aug. 23
Sept. 22. Portland, Me. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 24. Chicago, Ill. .... Aug. 23
Sept. 30. Indianapolis, Ind. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Oct. 11. Dry dock, Charleston, S. C. .... Aug. 23

BUILDINGS.

Aug. 26. Fire Dept. bldg., New York, N. Y. .... Aug. 16
Aug. 26. Bank, Denton, Md. .... Aug. 16
Aug. 26. Quarantine station, Galveston, Tex. .. Aug. 2
Aug. 26. Pub. bldg., Trenton, N. J. .... Aug. 2
Aug. 27. Library, Hampton, Ia. .... Aug. 23
Aug. 27. City Hall, Muskegon Heights, Mich. .. Aug. 16
Aug. 28. Quarantine station, Hoffman Is., N. Y. Aug. 16
Aug. 28. Fire Dept. bldg., New York, N. Y. .... Aug. 16
Aug. 29. Armories, New York, N. Y. .... Aug. 23
Aug. 29. Hospital bldg., Monson, Mass. .... Aug. 16
Aug. 29. School, Cumberland, Wis. .... Aug. 16
Aug. 30. Library, Stillwater, Minn. .... Aug. 23
Aug. 30. School bldg., Lancaster, O. .... Aug. 23
Aug. 30. Hospital, Uniontown, Pa. .... Aug. 23
Aug. 30. Church, Hillsboro, Ill. .... Aug. 23
Aug. 30. Bus. bldg., Portland, Me. .... Aug. 23
Aug. 30. Library plans, Santa Rosa, Cal. .... Aug. 23
Aug. 30. Church, Scotch Ridge, O. .... Aug. 16
Aug. 30. Library, Boulder, Colo. .... Aug. 9
Aug. 30. School, Kingman, O. .... Aug. 9
Sept. 1. Jail, Hazlehurst, Miss. .... Aug. 23
Sept. 1. Library, Charlotte, Mich. .... Aug. 23
Sept. 1. Court House, Elba, Ala. .... Aug. 23
Sept. 1. Pub. bldg., Darlington, Ind. .... Aug. 23
Sept. 1. School, Manzanola, Colo. .... Aug. 16
Sept. 1. School plans, La Salle, Ill. .... Aug. 16
Sept. 1. School, Westfield, Mass. .... Aug. 9
Sept. 2. Pub. bldg., Mariposa, Cal. .... Aug. 23
Sept. 2. Htg. school, Buffalo, N. Y. .... Aug. 23
Sept. 2. Schools, Philadelphia, Pa. .... Aug. 16
Sept. 2. Court House, Kentland, Ind. .... Aug. 9
Sept. 3. Library, Aurora, Ill. .... Aug. 23
Sept. 3. Plumb. school, Bloomington, Ind. .... Aug. 23
Sept. 3. Bus. bldg., Columbus, Ga. .... Aug. 16
Sept. 3. School, Ruthven, Ia. .... Aug. 16
Sept. 4. Court House, Macleod, N. W. Ter. .. Aug. 23
Sept. 4. Pub. bldg., Brooklyn, N. Y. .... Aug. 23
Sept. 4. School, Pardeeville, Wis. .... Aug. 23
Sept. 6. Hospital, Cleveland, O. .... Aug. 16
Sept. 6. Capitol, Harrisburg, Pa. .... Aug. 9
Adv., Eng. Record, Aug. 16.
Sept. 6. Htg. school, Austin, Tex. .... Aug.
Sept. 10. Pub. bldg., Brooklyn, N. Y. .... Aug. 23
Sept. 10. Library, Sheboygan, Wis. .... Aug. 16
Sept. 12. Court House, Ruston, La. .... Aug. 23
Sept. 12. Church, Beaumont, Tex. .... Aug. 23
Sept. 15. School, Cincinnati, Ia. .... Aug. 23
Sept. 16. Pub. bldg., Columbus, O. .... Aug. 23
Oct. 6. City Hall plans, Houston, Tex. .... Aug. 9
Oct. 7. Court House, Miami, Fla. .... Aug. 16
Dec. 2. Capitol work, St. Paul, Minn. .... Aug. 16

MISCELLANEOUS.

Aug. 28. Levee, New Orleans, La. .... Aug. 23
Aug. 28. Stone wall, New York, N. Y. .... Aug. 16
Aug. 28. St. railway work, Cleveland, O. .... Aug. 9
Sept. 2. Creek improv., Syracuse, N. Y. .... Aug. 23
Sept. 2. Albany, N. Y. .... Aug. 23
Sept. 2. St. ry. franchise, Riverside, Cal. .... Aug. 9
Sept. 6. Washington, D. C. .... July 19
Adv., Eng. Record, July 19.
Sept. 8. St. Peters, P. E. I. .... Aug. 23
Sept. 8. El. ry. franchise, Los Angeles, Cal. .. Aug. 16
Sept. 9. El. ry. franchise, Pasadena, Cal. .... Aug. 23
Sept. 10. Garb. disposal, N. Adams, Mass. .... Aug. 23
Sept. 10. Wharf, Orillia, Ont. .... Aug. 23
Sept. 10. Garb. disposal, Atlanta, Ga. .... Aug. 16
Sept. 25. Portland, Ore. .... Aug. 16
Sept. 30. Harbor, Port Adelaide, S. A. .... July 5

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Volume XLVI., Number 9.

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Patents and Ethics.

From the time the American Society of Civil Engineers began its task of "advancing engineering knowledge and practice and maintaining a high professional standard among its members," it has found in the subject of ethics an inexhaustible field for discussion. Sometimes, to be sure, the word ethics does not appear, but the subject matter has the good old tone, just the same, that a thing of straw always emits when well punched. For instance, the number of times the members of this excellent if somewhat ponderous organization have landed solidly on the solar plexus of "patenting by engineers" cannot be enumerated. If memory does not fail, in the manuscript records of the Society's childhood days, when professional engineers were so few that a plain layman might well think the Golden Rule could cover their relations and have enough good cloth left to hang over the sides, there is an account of the first round of the still-unfinished controversy. The late William Jarvis McAlpine, one of the leading engineers of the time and a man of commanding personality, administered the castigation on this occasion. In those good old days, when personality counted for more than now, the mere fact that an engineer like McAlpine thought one way established that view as firmly as a law of nature in the opinion of the young fry who sat at the feet of the engineering Gamaliel.

But time changes all things and the views held by McAlpine, Jervis, Allen and Kirkwood were abandoned by many civil engineers, although others still held to the tenets of their fathers. Sometimes, to be sure, one of the old school experienced a change of heart: William E. Worthen, for example, as upright a professional man as ever made the word engineer a term of honorable significance, took out a number of patents in the latter part of his life. The increase in the custom has been steady, and has been the subject of repeated comment by members of the Society and others. So The Engineering Record is not surprised at the receipt of a thin pamphlet in which the latest discussion of this branch of ethics is embalmed. The Society, not being itself a professional engineer, does not need to regard the view of professional ethics that says nothing of an engineering nature should be protected by government-granted monopoly and it copyrights its publications. It makes the generous announcement, however, that "reprints from this publication, which is copyrighted, may be made on condition that the full title of Paper, name of Author, page reference, and date of presentation to the Society, are given." So we hastily mention that the paper is entitled, "Is it Unprofessional for an Engineer to Be a Patentee;" the author, Mr. Archibald R. Eldridge; the page, 314; the date of presentation, April 16, 1902. With this libation to the ethical opinions of the Society, it is doubtless safe to proceed.

The author makes this assumption: "Let it be supposed, and the supposition is within the bounds of both possibility and probability, that an eminent engineer, one of the leading lights of the profession, should, by chance, stumble upon a decided improvement in egg-beaters." This seems verging on levity in pages sacred to deep profundity, but much must be excused owing to the author's association with railroad men, whose regard for public opinion was summed up in Commodore Vanderbilt's famous remark. Arguing from his assumption, Mr. Eldridge asserts that the engineering world would not decry his patenting the invention, and then he asks why it should object to his taking out a patent on an improvement in rolling rails, or in a steam engine valve, or in a freight car. In this he touches the exposed nerves of this delicate subject, but, strange to say, in all the discussion of the question there is but one to defend the old position of the McAlpine school, that a patent of any kind is a thing forbidden the civil engineer.

Mr. Eldridge says: "Others may sell the products of their mills and factories; the engineer sells the products of his trained intellect. Wherefore should he then be debarred from selling those products to the best advantage to himself, provided always that they are sold openly and above board, and not sneaked into a piece of work or a contract?" That there is no "wherefore" is the burden of his subsequent remarks, and Messrs. Whinery and Hammatt endorse his statement. To these views there is only Mr. James Owen to lift up the standard of the conservative school. In his opinion, if an engineer in professional practice, as distinct from salaried or manufacturing work, "acquires a patent and uses it there is certainly no moral delinquency, but it lowers the dignity of the profession and lowers its appreciation by the public at large,"

Were it not the fag end of summer and therefore not the appropriate season for unnecessary discussion of such deep subjects, The Engineering Record would feel in duty bound to argue some of the statements by these gentlemen. At present, however, its duty is done in pointing out the facts above mentioned. This journal has spent a quarter century in recording the progress of engineering practice. In its early days patenting by engineers was warmly discussed; to-day, Mr. Whinery says it needs more discussion; a quarter century hence, the arguments will still furnish copy to the Society's printer. Mr. Eldridge feels "confident that the question is now settled, and that an engineer can patent any article he may invent," but he never in his life had a more mistaken belief. So long as human nature remains the same, this subject will be unsettled, for it is one of personal sensitiveness and not of right or wrong, just as some physicians use patented remedies and others will not. But this much may be safely asserted, that any one who makes a useful invention, and does not patent it, is neglecting a legitimate source of revenue. By patenting it, moreover, capital has an incentive to make its value known, and its field of usefulness is thereby increased. Any neglect to do this is simply to stifle the value of the invention, keep it unknown, and thus possibly enable a subsequent inventor to patent it.

Construction of the Lauchensee Dam.

The masonry dam in the upper valley of the Lauch is the fourth structure built by the German authorities in Alsace-Lorraine to increase the low-water flow in the streams of the Vosges Mountains. It proved to be the most difficult and expensive of the four to build, and an outline of the methods followed in the construction is therefore of interest as affording a basis of comparison with American work of a like nature. The following notes have accordingly been condensed from an elaborate article in the "Zeitschrift für Bauwesen," by Mr. H. Fecht.

The mass of the mountain range in the upper Lauch valley is a very dense, glassy graywacke or sandstone, which does not furnish on weathering a sand suitable for building purposes. At a number of points on the ridge of the mountains and also at points in the valley below the site of the dam there is a granite outcrop from which a building sand of quartz grains with a considerable admixture of feldspar can be obtained. The expense of its transportation to the site would bring the cost of such sand up to nearly $7 per cubic yard, which was prohibitory to its use.

The experience gained in the construction of the Vyrnwy dam in Wales, where the geological conditions are similar, showed that the ground sandstone furnished a sharp, durable sand rich in quartz. Surveys in the vicinity of the proposed dam showed that the 30 horse power needed to run the sand crushing plant could be obtained by utilizing the fall of the Lauch just below the scene of operations, where a turbine could be installed. It was estimated that such a plant could furnish a satisfactory sand at about $2.50 per cubic yard, and a hydraulic plant was accordingly installed. Since the valley at the site of the dam is 720 feet above the nearest highway, no work could be done until a road was built to it; this was about 1.85 miles long and its construction was a difficult task.

The dam rests everywhere on sound graywacke, with the seams and joints cleaned out and filled with rich concrete. The structure is curved in plan to a radius of 2,950 feet and its cross-section is shown in the accompanying illustrations. It was designed in the usual German manner, assuming the masonry to have a specific weight of 2.3. The line of pressure with both full and empty reservoir is within the middle third, and at the overflow section at each end the thickness was increased 20 inches. The observations of many years on the elastic behavior of the Vosges dams under water pressure and temperature changes indicated that the water pressure exerted a much smaller influence than the expansion due to warm weather. The fluctuation of temperature in these high valleys hemmed in by naked cliffs amounts to about 100 degrees Fahrenheit. Although it requires a long time for such a large body of masonry to acquire the temperature of the surrounding air, nevertheless the conditions in these valleys are very favorable for such an action. The dams so lie that for most of the day they are exposed to the sun, which also warms the rocky slopes of the vicinity and thus keeps the air at a high temperature. During the winter the downstream face is exposed to the icy east and northeast winds, which are particularly cool at such elevations. Direct observations reveal readily a movement of the masonry under these fluctuations, and such movements, although insignificant, are undesirable and should be reduced to a minimum. For this purpose the downstream face of the

Lauchensee dam has been covered by an earth fill to serve as a heat insulator. Its thickness was fixed by its purpose and by the need of acquiring a stable slope for the stone facing. This earth covering is not expected to prevent all temperature motion, but only a considerable portion of its amount. In the static analysis of the dam under water pressure, the effect of the earth was neglected, but it was considered in the analysis with the reservoir empty.

The reservoir has a capacity of 204,000,000 gallons at the usual flow line, 3.28 feet below the crest. The waste-weirs have been given unusually large dimensions, according to German ideas. Observations from January 1, 1892, to January, 1898, show that the mean annual precipitation at the reservoir is 61.7 inches, and the precipitation on the watershed, which averages 490 feet higher, is therefore assumed to be about 73.6 inches. The watershed has an area of 1,410 acres of which 60 per cent. is wooded. During the same period the annual rainfall at the Alfeld reservoir in the Vosges averaged 79.5 inches, and that on the tributary watershed 121.3 inches; in this case the catchment area is 1,020 acres, and 39 per cent. of it is wooded. The greatest measured runoff at the Alfeld basin was about 0.35 cubic foot per second per acre. If these figures are applied to the Lauchensee basin it is necessary to provide for a runoff of 495 cubic feet per second. It is also necessary to consider the most unfavorable condition which can arise; a warm rain following a protracted storm, with the ground frozen. The melted snow will then run down with the rain, and the ice on the reservoir will become broken up. Under these conditions the runoff may considerably exceed the amount mentioned above and may occur when the waste-weirs are partially choked by ice. In order to ensure full safety under such conditions, four weirs have been provided, two at each end, having a combined capacity of 1,400 cubic feet per second.

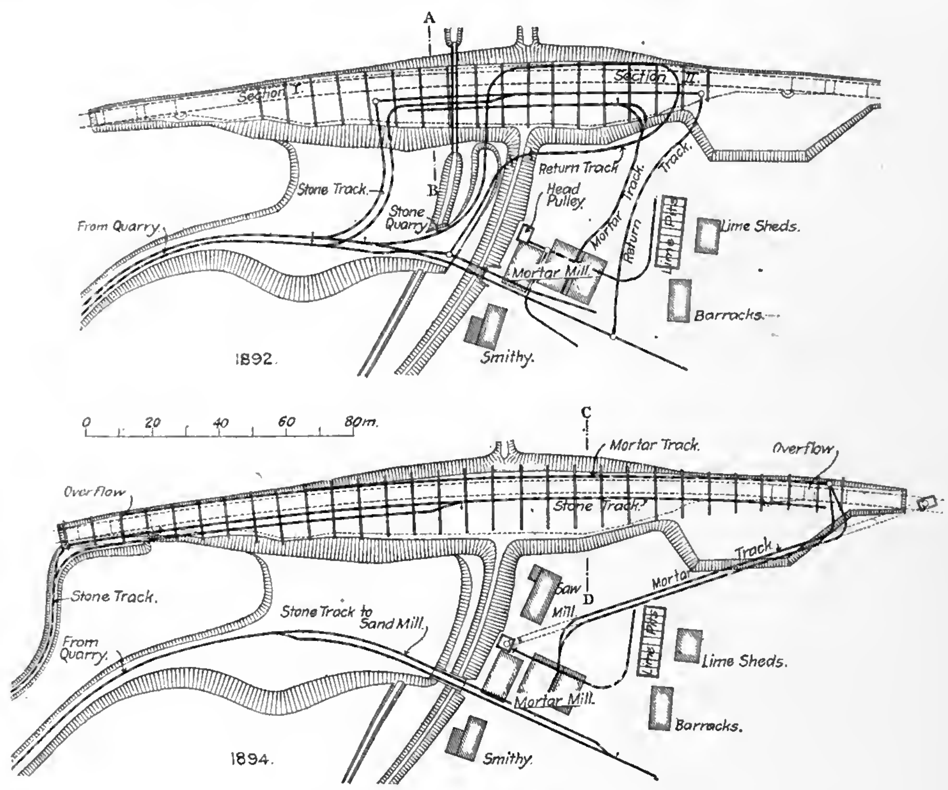
Since the only purpose of the reservoir is to supplement the natural low-water flow of the Lauch River, no special designs for drawing off the water are needed. The water is drawn through two openings into a culvert in the dam, which discharges into a paved channel leading to the river; the openings are fitted with sluice gates operated by standards on the upstream edge of the crest of the dam. The lower end of the culvert, outside the dam, is widened and crossed by heavy timbers so as to form a sort of stilling chamber where the velocity of the stream passing into the culvert under a high head is checked.

The only building stone available was the graywacke. While it is very hard and impermeable, it does not possess such an irregular surface when broken as granite. It can be hammered into course stone, but cannot be worked with other tools. The dam was, accordingly, built of cyclopean rubble, some of the stones running as large as ¾ cubic yard, although the most satisfactory size was from ⅓ to ½ cubic yard. Such dimension stone as was needed for the culvert trimmings was granite brought from some distant quarries. The coping, parapet and arches over the waste weirs are concrete mixed in the proportion of one part of Portland cement to eight parts of sand and broken stone.

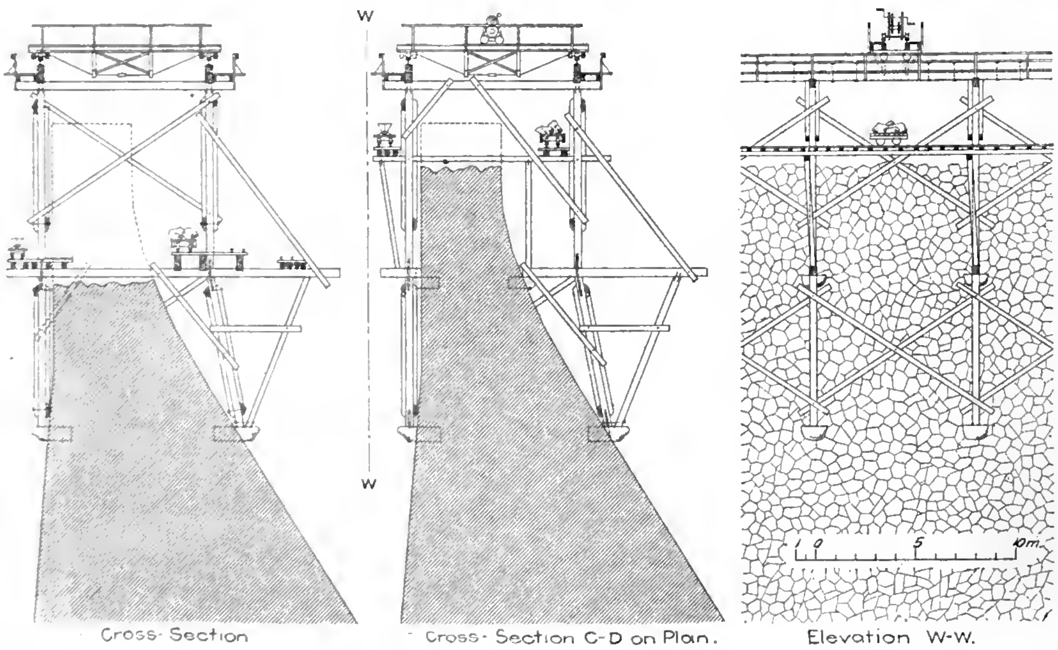
In order to determine the best mixture for the mortar for the work, tests were made with various brands of Portland cement, black lime, both in lumps and ground, white lime and trass, and with various amounts of sand. The decision was finally reduced to a choice between a mixture of 1 part cement, 1 part lime and 6 parts sand, and a mixture of 1 part lime, 1 part trass and 2½ parts of sand. The strength of these mortars was found to average about as stated in the accompanying tble.

Tensile Tests of Mortars for Dam.

Age.	Cement-lime.	Lime-trass.
1 month	......142 lbs. per sq. in.	107 lbs. per sq. in.
2 "	......202 " " "	147 " " "
3 "	......252 " " "	172 " " "
4 "	......275 " " "	191 " " "
5 "	......292 " " "	207 " " "
6 "	......307 " " "	220 " " "
7 "	......319 " " "	230 " " "
8 "	......330 " " "	243 " " "
9 "	......339 " " "	256 " " "
10 "	......346 " " "	266 " " "
11 "	......353 " " "	273 " " "
12 "	......356 " " "	285 " " "
18 "	......381 " " "	337 " " "
24 "	......397 " " "	384 " " "



PLAN OF PLANT IN DIFFERENT YEARS.



FRAMING USED IN BUILDING THE DAM.

As to the crushed sand it may be interesting to note that the composition of the materials obtained from the graywacke at Vyrnwy and that at Lauchensee is very nearly the same. The latter is somewhat better, if anything, for it has less magnesia. Both are stated to be rich in silicic acid in readily soluble form, which, on weathering, forms products that have hydraulic properties when combined with lime. The sand therefore acted as a strengthener of the trass, which could be used in consequence in the mortar in a relatively smaller proportion.

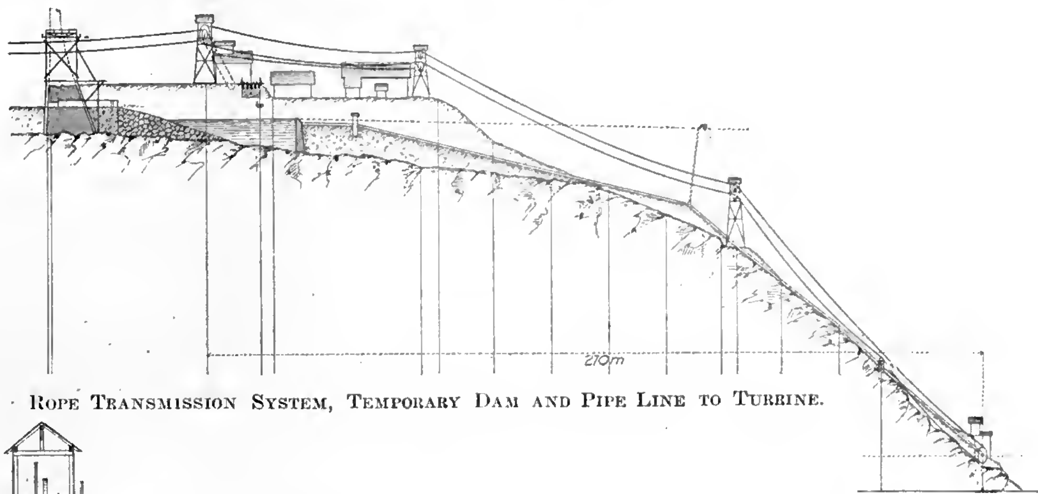
Both of the mixtures of mortar above mentioned seemed to be of equal technical value. The trass mortar could be made at a somewhat lower cost and could be used safely for a longer time after it was mixed. This was important at a place where sudden rainstorms might interrupt work many times. Trass mortar which had remained one to two days after mixing could be mixed up again with the addition of some of the binding materials without losing its value. Under similar conditions cement mortar was valueless. The trass-lime mortar was accordingly adopted. The trass was obtained in blocks in car-load lots from Andernach and crushed into sand and stones up to the size of an English walnut.

The experiments with different grades of black lime and white lime showed that the latter, employed in the proportions above mentioned with trass and the excellent sand, answered all requirements as well as the black lime. It also had the advantage that it could be slaked in an open pit and thus be free from danger of injurious subsequent swelling, while its continued usefulness after remaining wet for some time simplified the building operations without introducing any element of danger. The lumps of lime were received in sacks and were slaked in large open pans which were shoved alternately over nine pits.

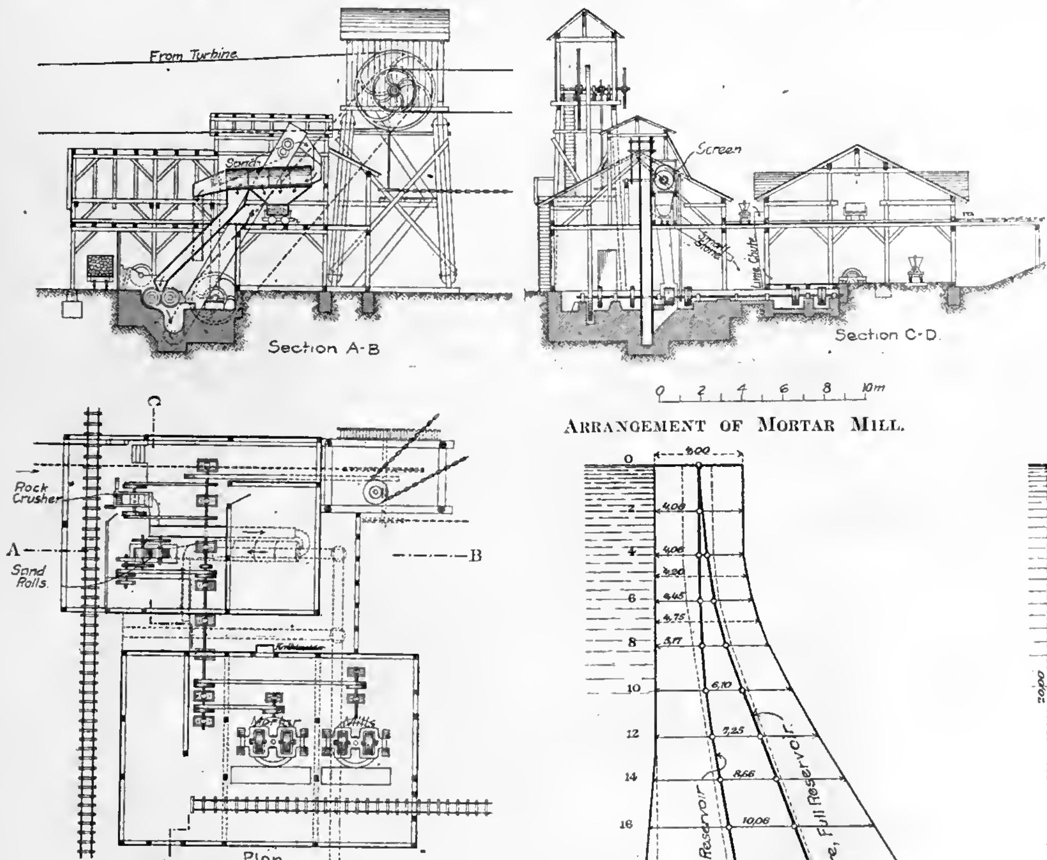
Examination showed that the rock of the southern side of the valley was much cleft where exposed, while that of the other side was a homogeneous mass. The quarry was accordingly located on this side, 650 to 1,300 feet from the dam so that the blasting would have no injurious effect on the masonry work, and high enough up the slope to allow the stone to be delivered by gravity to the highest part of the structure. In the autumn of 1889 the stripping of the quarry was begun and during the winter two small tunnels 160 feet apart were driven about 165 feet into the hillside. Small branches at the ends and centers brought the total amount of tunnel to 490 feet, and the work was done at a cost of $7.60 per foot. Eight chambers at the ends of the branch were blasted out and charged with 24,200 pounds of coarse black powder having 75 per cent. saltpeter. A dynamite exploder with detonator was placed in each charge and wired to a friction machine 650 feet distant. The chambers were then concreted and the charges fired. About 9,100 cubic yards of stone were dislodged by the shot.

A ditch was dug outside the catchment area on the north slope of the valley and the water of several springs and brooks was thus intercepted and conveyed to reservoir; the ditch is now used to add the runoff of a tract of 250 acres to the reservoir. From the reservoir a 2-inch pipe, with rubber joints for movability, was laid to the mortar mill, lime pits, smithy, the wells at the workmen's barracks and the dam itself. The quantity and pressure of the water were ample for washing the rock surfaces in the excavation for the foundations of the dam, for washing the separate stones used in the masonry, and for keeping the masonry damp so that the trass mortar would harden uniformly.

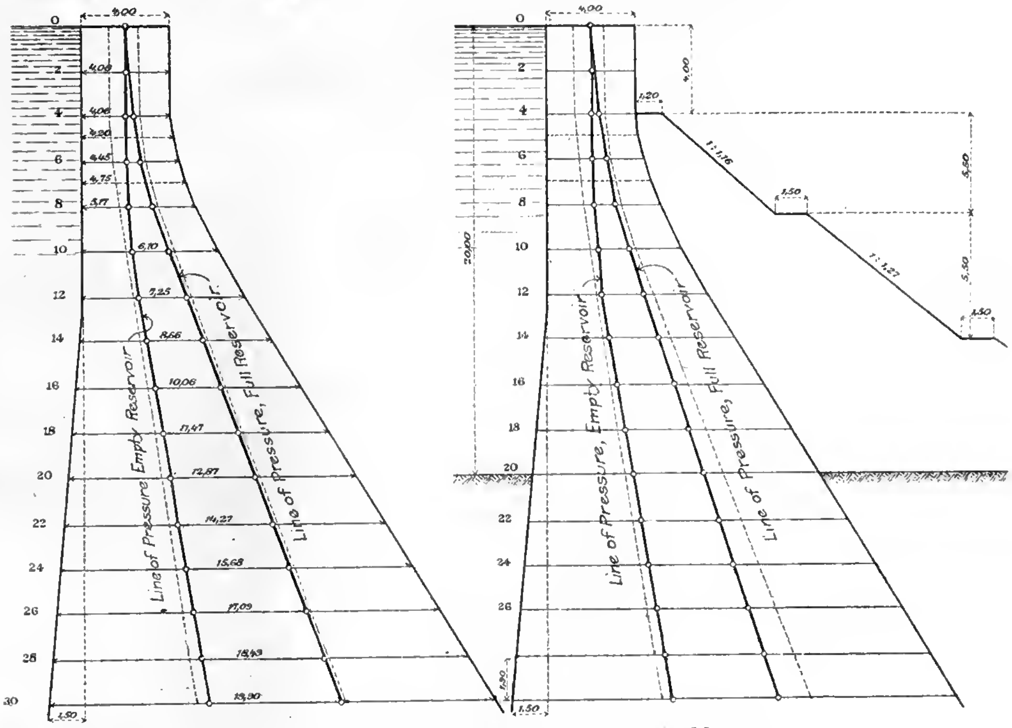
The sand mill was furnished in 1890 by Brink & Hübner of Mannheim. The main shaft for the sand and mortar machines was 4.8 inches in diameter and was designed to transmit 60 horse power at 120 revolutions per minute. The stone crusher was connected with the shaft by double belts and its flywheel made 200 revolutions per minute. From 12 to 15 horse power was needed by the crusher when working at its full capacity on stone of the usual size. It furnished under such conditions about 6½ cubic yards of broken stone per hour. The material fell into the boot of an elevator, which lifted it about 40 feet to an inclined cylindrical screen of perforated steel plate. The fine particles up to 0.16 inch in diameter fell into a dump car. The parts from 0.16 to 1.6 inches in size dropped into a chute which delivered them to rolls on the floor below, These



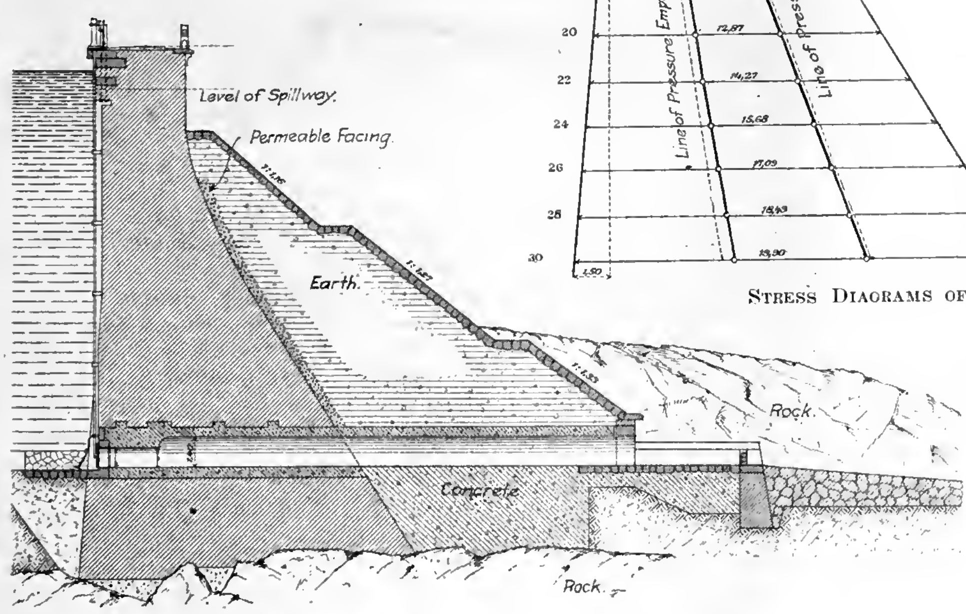
Rope Transmission System, Temporary Dam and Pipe Line to Turbine.



Arrangement of Mortar Mill.



Stress Diagrams of Dam, Dimensions in Meters.



Cross-Section of Dam through the Culvert.

rolls were 14.4 inches long and 34 inches in diameter, and made 22 revolutions per minute. They required from 12 to 15 horse power. The product fell into the boot of the elevator, which lifted it again to the screen. The stones in the screen over 1.6 inches in size were raked out and thrown by hand into the crusher. This plant furnished about 2 cubic yards of sand per hour. The rolls had chilled bands and could be easily changed, and the bands could be ground true when worn, without removing the rolls; this was done with an emery wheel making about 1,000 revolutions.

The mortar was prepared in two pug mills. Each was a cast-iron pan 7½ feet in diameter and 1.2 feet deep turning about a vertical axle in its center. This axle was held at the top by a frame, which also carried two rolls 3.5 feet in diameter, 1.2 feet wide and 3,300 pounds in weight. Small plows were attached to the framing so that the mortar would be turned over as the mill revolved. The wheels ground the lime and trass fine when water was added, mixed them well, and formed them with the sand into a very good, uniform mortar. Equal parts of broken trass-rock and lime paste were mixed with plenty of water for a few minutes and the sand then slowly shoveled into the mill. The entire process lasted about ten minutes and furnished nearly ⅓ cubic yard of stiff mortar, which, when cut vertically with a shovel, would retain the smooth surfaces of the cut.

So far as the progress of the work is concerned, the drawings of the framing used during construction and the plans of the plant in 1892 and 1894 furnish more information than a long description. There were eight of the traveling cranes shown on top of the framing, and all stone could be handled directly into place from the cars by them. The mortar was taken to the dam by cars running on an inclined plane having an endless cable driven by the turbine. The whole plant was designed to avoid any handling of material on the masonry itself.

Since the mortar was a purely hydraulic material it was desirable to expose the finished masonry to water as soon as possible. For this purpose, the reservoir level during the winters of 1892 and 1893 was always kept within a short distance of the top of the work. Under these conditions the mortar hardened excellently during the two years, as shown by investigations. Simultaneous experiments with model dams of the same materials, but not exposed to water, showed that the mortar had hardened less and irregularly, and even at the end of another year was not so good. Mr. Fecht considers these results warrant the belief that a new dam which stands several years without exposure to water suffers a detrimental superficial tightening if the mortar is a mixture of lime with cement or trass.

The embankment on the downstream face of the dam was not put in place until after the reservoir had remained filled for four years. In this way it was definitely settled that the masonry was without defects. The joints on the downstream face were then scraped out, a work which showed the mortar to be extraordinarily hard, and pointed with rich cement mortar. The earth embankment was then placed in horizontal layers and its surface covered with a stone pavement.

The dam contains 37,400 cubic yards of masonry, of which 65 per cent. is stone and 35 per cent. mortar. The working force when under full swing included 45 masons, 12 helpers, 27 laborers, 2 overseers and 2 foremen at the works, and 100 to 120 hands with a superintendent and a foreman at the quarry. The average daily task under these conditions was about 120 cubic yards; the greatest day's work was 196 cubic yards.

The cost of the masonry with all appurtenances, including the road, was $220,000, or $5.38 per cubic yard. The earth embankment cost $23,750, making the total cost of the reservoir $243,750. The land was government property. The work was carried out by day labor by the government under the direction of Mr. Bühler, Mr. Fecht being the chief engineer.

A 27 and 30-inch Concrete Sewer.

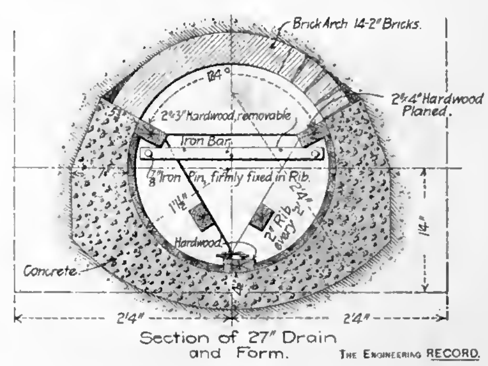
There has recently been completed at Truro, Nova Scotia, a storm-water sewer which differs in some respects from anything previously constructed. In all about 3,200 feet of 27-inch, 30-inch and 36-inch concrete sewer was built, including 6 inlets and 15 catch-basins, also of concrete. The manholes were of brickwork. The centering for the sewer was rather unusual because the concrete was laid in one monolithic mass to and above the center of the sewer, the brick arch for the crown occupying only 124 degrees and 130 degrees of the 27-inch and 30-inch sections respectively. The forms for the inlets and catch-basins were designed so that they might be easily taken apart and put together again. It may be stated that the main reason for using concrete was its cheapness under the given conditions as compared with brickwork.

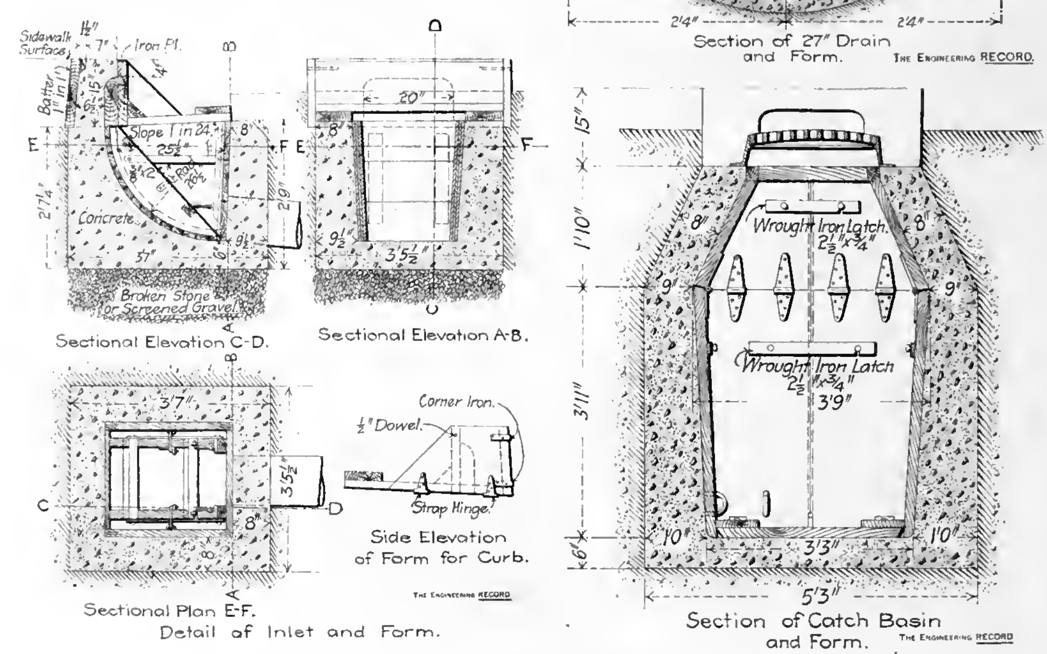
Messrs. Lea & Coffin, of Montreal and Boston, drew up the plans and specifications and were the engineers in charge of the work. In addition to laying this main storm drain, about 3.4 miles of vitrified pipe varying in size from 6 to 20 inches was laid. This was used partly in branches to the storm system, but the majority of it was a new house sewer.

The estimates for the entire work on which the contractors' bids were rated, and the prices paid for the work were as follows, it being understood that all pipes, casting, paving stones, cement and brick were furnished by the town, the contractor furnishing everything else: 19,550 cubic yards earth excavation, 0 to 8 feet deep, at 30 cents per cubic yard; 2,010 cubic yards earth excavation, 8 to 14 feet deep, at 57 cents per cubic yard; 100 cubic yards concrete masonry in trench and foundations, at $5.00 per cubic yard; 502 cubic yards concrete masonry in structures (including furnishing of forms) at $7.00 per cubic yard; 300 cubic yards brick masonry at $6.00 per cubic yard; 100 cubic yards screened gravel in place at $1.75 per cubic yard; 500 lineal feet spruce piles, driven and cut off, at $1.00 per lineal foot; and 5,000 feet, board measure, spruce lumber, placed and fitted as required, at $18.00 per 1,000 feet.

The concrete in the sewer proper and in the catch basins and inlets consisted of 1 part cement, 2½ parts sand, and about 4½ parts gravel passing a 2-inch screen and held on the sand screen. For the concrete in foundation the ratio was 1:3:5. These proportions were determined by experiment in order that the mortar might be slightly in excess of the voids in the gravel. The method of mixing is given in the following extract from the specifications:

"The gravel, which must be clean and free from dust and dirt, shall be spread upon a smooth, tight platform, in a movable frame. This frame shall be of the gauged dimensions for holding the proper amount of stone for a batch, according to the direction of the engineer. The gravel shall be leveled off with the top of the frame and thoroughly wetted. The cement and sand mixed dry upon an adjacent platform, as specified for mortar, shall be uniformly spread upon the top of the stone. The frame shall be lifted off and the material carefully and thoroughly mixed by being turned over with shovels, the men working systematically under the direction of the engineer. If additional water is required it shall be moderately sprinkled on the material from a sprinkler nozzle, care being taken not to wash out the cement or to put on at any time an excess of water."





Details of Construction, Truro Sewerage System.

The concrete was placed in horizontal layers about 6 inches in thickness, and lightly rammed. The usual precautions were taken in joining new work to that which had set, and the whole work was very carefully and systematically carried out.

The centering for the sewer was of 1-inch planed and matched pine boards nailed to ribs of 2-inch planking spaced every 2 feet apart. At the top, along each side of the centering, were placed two 2x4-inch hardwood stringers, between which at every second rib was a 2x3-inch removable hardwood brace held in place by a small hook at each end, which method of attachment was found to serve fully as well as the iron bar and pins originally designed and shown in the section. The centering was made in 10 and 12-foot lengths and in two halves longitudinally hooked together at the bottom and held in place at the top while in use by the hardwood braces. When the concrete had set, the braces were removed and the two halves were shut together, turning about the bottom connection as a hinge, and were lifted out without touching the concrete.

The method of laying the concrete was as follows: The alignment and grade of the invert were given in the usual way from a line stretched over batter-boards placed across the top of the trench. The latter was first excavated so as to leave about 8 inches on each side of the finished structure and to within a few inches of the required depth. Just before the forms were to be placed, the trench was bottomed out to the proper for mand correct depth by the use of a template fixed to the bottom of a rod graduated to feet and tenths. Planks were then laid on edge along each side of the trench as a mold for the outside of the concrete and held in place vertically by iron pins driven down into the ground.

Having prepared the bottom of the trench in this manner, the sections of the centering were then put together on the bank, brushed over with a soft soap solution and lowered onto short pieces of 4x4-inch wood placed across the bottom of the trench. They were thus easily set to line and grade obtained from the batters above. Eight lengths of the 27-inch forms were used, and these were placed end to end in the trench and drawn up tightly together by screw-bolts with hand nuts, making a continuous single form 96 feet long.

The concrete was first filled in up to the top of the vertical side planks, and then similar planks, laid in a sloping position, were placed on top of the vertical ones and held in place at the bottom by projecting strips of iron bearing against the inside of the vertical planks and at the top by small strips of wood nailed to the form. The remainder of the concrete was then put in place.

After allowing the concrete to set a day or two all the sections of the form except the forward one were unbolted, the wooden braces were taken out, and they were hoisted out by two hooks, one under each side stringer, thus causing the two halves to shut together and come out without disturbing the concrete on either side. Starting from the forward form, which, as stated, was left in place, the process of placing the others was repeated. It is stated that the workmen soon learned to perform the various operations with great readiness, and after a little practice the concrete was placed so as to leave a surface as smooth as the planed surface of the boards.

Wherever a good natural foundation could not be secured spruce piles were driven to hard bottom, cut off square, and either gravel or concrete laid on top of this, as the engineer directed. In some cases a simple cradle of planking was laid on the bottom of the trench for a foundation, or the trench was excavated deeper than usual and refilled with either concrete or gravel.

The Centering in Place.

The Completed Invert.

The forms for the inlets and catch-basins are shown in the illustrations, and are so simple in construction that little explanation is necessary. For the catch-basin the form is of 2-inch material. Each side consists of two leaves with beveled edges at the joint. They are held together by 2½x¾-inch wrought-iron latches. The top part of the form, overhanging the rest, is attached to it by means of hinges. The form for the inlet, like the other, is composed of a number of parts held together with hooks and latches. It can be readily understood from a little study of the drawings.

Whenever considered necessary, sub-drains were laid, the joints being filled with jute or wound with suitable cloth. The refilling around sub-drains was of clean screened gravel from ¼-inch to 1½ inches in diameter. In exceptional cases this refilling was covered with a continuous line of jute.

The contractors for the work were Alex. McKenzie and Edward Wilson of Truro. The information from which this article was prepared, including blue prints and photographs, was furnished by the engineers, Messrs. Lea & Coffin.

The New Covered Reservoir at Newton, Mass.

A covered reservoir recently constructed on Waban Hill, Newton, Mass., is 127x165 feet in size, with a depth of about 15 feet, and has a storage capacity of about 2,200,000 gallons. It is the second section of a series of four which have been planned to ultimately surround a central gate chamber. The first section was built in 1890, and is 125x174x15½ feet in size, with an arched brick covering. A full description of the system as laid out at that time was given in The Engineering Record for November 28 and December 12, 1891. The chief point of interest in the new reservoir is the covering, which is of flat concrete-steel construction, built by the Columbian Fireproofing Company, of Pittsburg.

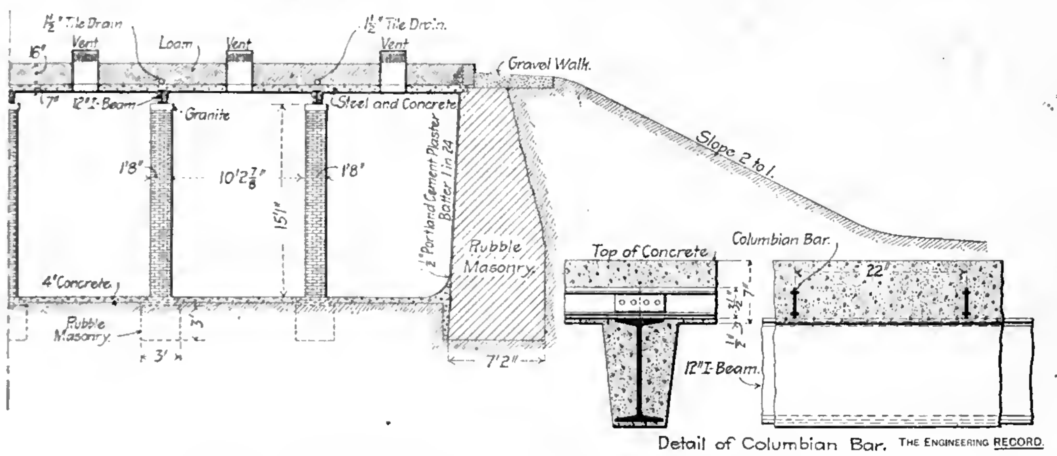
The work was done under two contracts, one for the construction of the reservoir, piers, etc., including all grading of the grounds, and the other for the steel and concrete covering. The specifications for the latter did not limit the bidders to any particular system, but allowed each to submit his own designs for a floor guaranteed to carry a load of 275 pounds per square foot with a factor of safety of 4. This was done in order to insure free competition among the various firms building concrete-steel floors. The contract for the reservoir proper was let to T. Stewart & Son Company for a total of $25,019.75, and the contract for the covering was let to W. H. Maguc, whose bid was on the Columbian system, at 29 cents per square foot, or a total of $6,206. This contract was afterward assigned to the Columbian Fireproofing Company. The foundation for the reservoir is a compact hard-pan and the walls and piers were carried down about 3 feet below the bottom of the reservoir. Only three walls had to be built, the fourth side being one of the walls of the other section, which had been constructed double-faced. Two of the new walls are of rubble masonry 7 feet 2 inches thick at the base and about 3½ feet thick at the top. They are battered 1 in 24 on the water face, which is plastered with a ½-inch coat of neat Portland cement. There is a 6-foot gravel walk around the reservoir, and from the edge of that the embankment has a slope of 2 to 1 until it meets the natural surface. The embankment is made of clayey material put on in layers, wet and well rolled, and afterwards loamed and sodded to correspond with the old sections. The third wall is also of rubble masonry, but faced on the outside above ground with ashlar. It is 8 feet 3 inches thick at the base and about 6½ feet thick at the top, and at some future time will probably serve as the southern wall of another section.

The piers to support the roof are of brick, and are 1 foot 8 inches square, resting on 3-foot rubble masonry bases and capped with blocks of granite. They are spaced north and south 11 feet 10⅞ inches apart, center to center, and 11 feet 8 inches apart east and west. The bottom of the reservoir is of concrete 4 inches thick. Inlet, outlet and drainage pipes are connected with the system in the central gate chamber built in 1890.

The largest items on which the bids for the reservoir proper were based, with the contract prices, are as follows: 5,700 cubic yards of earth excavation at 37 cents; 100 yards of American cement concrete, at $4.75; 250 yards of Portland cement concrete, at $6.50; 1,750 yards of rubble masonry, at $5.75; 190 yards of ashlar masonry, at $20; and 215 yards of brick masonry, at $13.50.

The covering of the reservoir may be briefly described as a monolithic floor of concrete, reinforced with ribbed steel bars, and supported on the tops of 12-inch I-beams, the latter also incased in concrete. The I-beams weigh 31½ pounds per foot and were cut long enough to span two of the 11-foot 8-inch spaces and leave ¼ inch for expansion. The specified loading of 275 pounds per square foot, plus the weight of the flooring, if applied to any large section of the reservoir at once would strain the I-beams considerably beyond a safe limit; and the reason for proportioning the parts in this seemingly unscientific manner was to take care of local loading. There was 150 pounds per square foot of loam placed on the reservoir, and it was estimated that 125 pounds per square foot would be equivalent to the maximum strain which might come on the concrete due to any moving load such as a crowd of people or teams passing over the reservoir. Such a load, however, would be extremely unlikely to occupy a large portion of the reservoir at any one time, so that it need only be used in determining the strength of the concrete-steel filling between the beams.

The flooring itself has a span of 11.9 feet, center to center of the I-beam supports. It consists of 7 inches of Portland cement concrete in which are imbedded 3½-inch Columbian bars spaced 22 inches apart and resting directly on the I-beams. The concrete called for in the specifications was a 1 : 2 : 5 American Portland mixture, but it is stated that as a result of a preliminary test of a section of the flooring 5 feet broad, it was decided to put in a better quality of concrete, and also to make the Columbian bars continuous by means of splice plates. The load applied in this test was not 1,100 pounds per square foot, the full limit required by the specifications, and on account of the time being limited, the test was made at the end of 25 days instead of 30 as specified. It was intended to make a final loading test on the floor when completed, but owing to the inconvenience of obtaining loading material and the lateness of the season, this test was abandoned, and the city engineer relied, in accepting the work, upon the preliminary tests, as well as upon the action of the floor under the heavy loading brought upon it by the teaming of cement gravel and loam during construction.



Details of the New Section of the Waban Hill Reservoir, Newton.

A single line of ventilators furnished by the city was built into the covering along the center of the reservoir. They are somewhat similar to those used on the old section, but of an improved form, admitting the air freely but excluding the light. Lines of 1½-inch horseshoe drainage tiles were laid on top of the concrete directly over each line of I-beams and connecting at the west side of the reservoir with a 4-inch tile drain, while over and around these drains loam to a depth of 16 inches was placed and seeded down. The plans and specifications for this work were prepared by the city engineer, Mr. Irving T. Farnham, and the foregoing description has been prepared from reports and information furnished by him, by the water commissioner, Mr. J. C. Whitney, and by the Columbian Fireproofing Company.

Notes Concerning Road Construction.

The improvement of the highways in the State of New York is under the control of the Boards of Supervisors, and for the last three years delegates from these Boards have met annually to discuss the methods of obtaining the best results from the money available for such improvements, as well as to plan and secure larger appropriations for this purpose. The last convention was attended by 110 supervisors and 50 highway commissioners, representing 40 counties out of the 61 in the State, and the main topic of discussion was the financial problem of improving the highways more rapidly than is now possible. In the four years up to January 1, 1902, during which the State aid laws were in force, 59 miles of road were completed, 109 miles not finished were under construction, 238 miles of road were waiting legislative appropriations as the counties in which they lay had raised their half of the total cost, and 1,250 miles had been more or less investigated by the State Engineer's department. The fact that 20 counties had raised $960,000 to pay their proportion of the cost of 238 miles of new roads, and only a legislative appropriation of an equal amount was necessary to put the work under contract, is a good indication of the appreciation of highway improvements now held in the rural counties of the State. The method employed in building these State aid roads was described substantially as follows at the convention by Mr. Edward A. Bond, the State Engineer and Surveyor, whose department is in charge of the work.

The first step in the preparation of plans for good roads is the survey, which, if properly done, will improve the grades from, at times, 10 to 20 per cent., changing the location of the road to reduce them to 5 or 6 per cent., or better. After the map and profile are once made the engineer carefully locates the grades of the road, so that as nearly as possible the excavation from rock and earth cuts will form the necessary embankment, always keeping in view the proper drainage of the road, allowing for ditches on either side of the finished road to be from 2 to 2½ feet below the crown, with plenty of culverts, either open culverts, box culverts, or cast-iron or vitrified pipe drains, sufficient for the water to quickly flow away in case of heavy rainfall or sudden winter thaw.

In laying the grades the engineer does not necessarily seek to find long continuous grades of a given percentage, but permits undulating grades, always bearing in mind, however, to make the percentage of the grade as low as is consistent with the surrounding conditions. The roads are graded for receiving the macadam surface, varying from 12 to 16 feet in width, and under unusual circumstances they are sometimes for short distances made 20 feet in width. The lower surface is graded to conform to the exact crown of the road when finished, and is graded so at all times to be an equal 6 inches below the macadam surface. After being properly graded, a 10-ton steam roller is placed upon it, and it is thoroughly rolled about five or six times, and if this rolling develops soft spots in the earth, this earth is to be removed and other earth put in its place, so that the whole earth surface is of one consistency throughout any given section of the road. At times very deep sand is met that requires a dressing of shale rock or clay to cover it, and also a similar material to provide wings on either side of the macadam to properly hold the macadam surface in place.

In laying the stone for these roads it is customary to select the best native stone in the immediate neighborhood for the lower course. These stones are drawn to an ordinary rotary or jaw stone crusher, and after being crushed are elevated to a rotary screen that separates the stone into three separate grades; one-half to 1 inch in one compartment, and 1 inch to 1½ inches in another, and 1½ inches to 3 inches in another; the screenings from dust to one-half inch in size being kept separate. In a section where there are ledges of rock and knolls of rock cutting to be excavated for easing the grades, often this rock is suitable to be used in the lower course.

When the State first began to build roads the stone from one-half inch to 1 inch was a waste product, but more recently this has been used for the bottom course on the sub-grade, simply stipulating that it should not in any case occupy more than one-third in thickness of the base course. The base course is made of screen stone 1½ to 3 inches in size, and, with the product of one-half to 1 inch, as above described, is put in a course 5¾ inches in thickness, loose. A 10-ton steam roller is then passed over this stone, beginning on either edge, and rolling toward the center of the road, rolling the whole of it about six times, thus knitting the stone together in one compact mass. After this, about one-half inch in thickness of the screenings, as above described, is placed on this stone. The roller is then passed over it five or six times. An ordinary road sprinkler is then used ahead of the roller, and the rolling and sprinkling continued with the addition of screenings or dust where required, until the whole lower course is filled to the surface with screenings, making one compact mass 4 inches in thickness when finished.

The top course is formed of stone from 1 to 2 inches in size. About 2¾ inches of this loose stone are put on the road and the roller passed over them as described in the first course some five or six times, and then screenings are added, as in the first case. Then follows the sprinkling and rolling until the top course is welded into the bottom course and the two are thoroughly filled with screenings, making a compact mass 6 inches in thickness when finished. At some points in the State this top surface has been made successfully of gravel instead of stone, as heretofore described.

The earth wings on the road are usually from

3 to 5 feet on either side, making a 12-foot road either 18 or 22 feet in width from one ditch to the other, as the case may be, and any other road the additional width of the macadam surface. In a dry season of the year, or when the road is first opened after traffic, it is customary to put an extra coat of stone dust or sand about one-half inch in thickness on top of the finished road. The most desirable stone for the top course for these roads is the Hudson River trap rock, and in all sections of the State which it is convenient to reach by canal this is generally specified, unless it is in exceptional cases, where a hard and durable granitic rock is found near the road to be constructed which will answer the purpose.

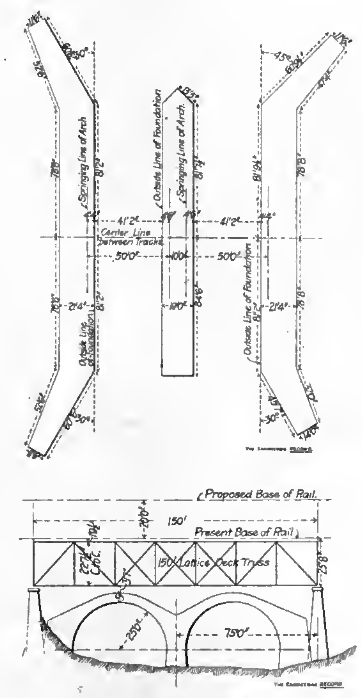
These roads have sustained the ordinary travel of a country district, leading to a populous city, for four years; some of them have been through a section of country having a sand subsoil for part of the way and another portion of the road on the side hill of a precipitous gully of brick clay. Some persons have questioned whether in northern New York roads of the character herein described would withstand the extreme cold weather on a clay soil without being ruined by the action of the frost. Experience has been that a road built as described, with proper care and provided with rapid and successful drainage, will withstand the climate and clay soils of any portion of the State.

The recent experience of the State roads of Massachusetts was summed up as follows by Mr. Charles W. Ross, street commissioner of Newton and formerly State highway commissioner: The style of the road that is being built in different sections at the present time is a very different type from that which was built ten or more years ago. For instance, in many places it has been found from practical experience that from 4 to 6 inches of macadam put on a good gravel foundation will give as good results as could possibly be obtained by putting on 8 or 10 inches, which was formerly the idea. It was evident that the large cost of building macadam roads could not be continued, and it was found by experience that something of a cheaper and yet a durable nature must be obtained. For instance, if a side street in a city has a good gravel foundation it can be covered with from 2 to 3 inches of crushed stone, put on in layers and thoroughly rolled, and give a good result. In many cases such a road is just as satisfactory as one covered with from 4 to 6 inches. When the amount annually appropriated by a city or town is small, it is a hard problem to solve—to know what to do to give the best results with the least amount of expenditure.

The heavy storms which come so often in New England do an immense amount of damage to our roads, and one heavy shower last summer damaged the streets of the city of Newton to such an extent that it would have cost at least $20,000 to put them in the condition that they were in before the storm. As these storms are so liable to occur, it has taught the authorities to look for something more durable that will stand the severe storms of the spring and summer. There have been a great many experiments made in regard to a new mixture of concrete or bituminous macadam, and roads of this material are being built in many parts of the country at the present time. Mr. Ross' experience leads him to believe that in a short time many streets will be covered with a coating of bituminous macadam, which will insure them against the action of the weather, and they will not be affected either by freezing or thawing. While the loss of fine material from the road after a shower is very great, there is also the additional expense of cleaning out the drains and catch basins that have been filled with this material, which is washed from the surface of the streets. It clogs the drains and goes from there into the small streams that lead to the river, and these must be kept cleaned at a great annual expense. If these roads could be surfaced with a less expensive material than asphalt, and yet give a smooth and lasting surface that would not be as slippery in the winter, or even in the summer when it is wet, and would insure it against the action of the high winds that sweep so much of the fine material away during certain seasons of the year, the experiment would be well worth trying.

Heavy Concrete Arches.

Some months ago an esteemed British contemporary, which will long be remembered by Americans as advising foreign engineers visiting the Chicago exposition to carry revolvers although Indians no longer infested that city, announced that a 200-foot concrete arch was under construction across the Vermilion River. This item had a considerable circulation and The Engineering Record has accordingly been to considerable correspondence to ascertain the facts concerning this remarkable structure. The report was finally traced to the Peoria & Eastern Railway Company, but not in its magnified form. As will be seen from the accompanying diagrams, the structure is simply a double 50-foot concrete arch bridge with no special feature about it except that it is under a 68-foot fill which requires a greater thickness of arch width than is ordinarily used with such a span. The arches replace a 150-foot lattice deck bridge carrying a track 20 feet below the proposed rail base of the reconstructed line. The engineer of the structure, Mr. M. A. Neville, sent The Engineering Record a copy of the specifications governing the work, from which the following notes have been taken.



HEAVY CONCRETE ARCHES.

It will be noticed in the diagrams that the arch is 5 feet thick at the crown and has a radius of 25 feet. The abutment at the springing line is 13 feet thick and the central pier is 10 feet thick. The concrete for the arch and spandrel walls is a mixture of 1 part of Portland cement, 2 of sand and 5 of stone broken to pass a $1\frac{1}{4}$-inch ring, while the mixture for piers abutments and wing walls is 1 part cement, 3 of sand and 6 of stone broken to pass a 2-inch ring.

"Hand-mixed concrete shall not be made in batches of more than one yard in each batch. The proper amount of the several kinds of material shall be measured in some way which is entirely satisfactory to the engineer or inspector in charge of the work, so that they may be satisfied that the requisite proportions of each kind of material are delivered for each batch of concrete. Satisfactory methods of measurement will be the use of headless or bottomless barrels for measuring sand and broken stone; the use of boxes into which the sand and stone may be cast and leveled off, (the boxes then being removed); or the use of square and uniform-size wheelbarrows, expressly designed for the purpose. The measurement of sand and broken stone in the ordinary shallow, round-bottom wheelbarrow will not be considered satisfactory, and shall not be permitted.

"The detail of mixing concrete by hand shall be generally as follows: The proper amount of sand shall be measured out and spread upon the concrete platform, and the proper amount of cement shall be delivered and spread upon the same, the sand and cement shall be turned over dry, either by means of shovels or hoes until they are evenly mixed. They shall then be wet and mixed into a rather thin mortar, and shall then again be spread into a uniform and thin layer upon the concrete platform. The proper amount of concrete stone (the same having been previously drenched with water) shall be spread upon the mortar, and the whole shall be turned over at least twice, either by shovels or hoes before it is loaded into the wheelbarrows; or in any other way taken to be placed into work. In wetting the mixture of sand and cement to make the mortar, and in wetting the subsequent mixture of stone, sand and cement (if necessary), a spray or sprinkler shall be used. The water must not be dashed upon the mass in buckets or large quantities, or by means of a jet. The inspector shall insist that the resultant mixture of sand, cement and stone, is as nearly as possible uniform in character, the mortar being equally distributed through the mass of stone. The inspector shall also see that the mixture is neither too wet nor too dry. It should be of such a consistency that when thoroughly rammed it will quake slightly, but it should not be thin enough to quake in the barrow, or before ramming.

"Machine mixed concrete shall be made of the same general consistency as the hand mixed concrete above specified. Proper precautions shall be taken to see that the requisite proportions of the different ingredients are used. If machines are used which are not provided with devices to deliver each of them, the process of making the concrete shall generally be as follows: The proper amount of sand, cement and stone for a batch not to exceed one yard of concrete shall be delivered on the platform, and roughly mixed together so that when the dry mass is cut down and delivered to the mixer by means of shovels, proper amounts of each of the ingredients are handled in each shovelful. It will not be regarded as a satisfactory process to deliver crushed stone, sand and cement at random to the mixer, without taking some special means as above described, to insure the delivery of the proper quantity of each ingredient as nearly as may be simultaneously.

"Concrete facing shall be composed of 1 part Portland cement and $2\frac{1}{2}$ parts sand, and shall have a thickness of at least 1 inch on all arch soffits, arch faces, abutments, piers, spandrels or other exposed surfaces. There must be no definite planes or surface of demarkation between the facing and concrete backing. The facing and backing must be deposited in the same layer, and be well rammed in place at the same time. No plastering will be allowed on the exposed faces of the work, but the inside faces of spandrel walls covered by the fill may be plastered with mortar having the same composition as specified for facing.

"The concrete for arches shall be started simultaneously from both ends of the arch, and be built in longitudinal sections wide enough to constitute a day's work. The concrete shall be deposited in layers not more than 6 inches thick, each layer being well rammed in place before the previously deposited layer has had time to set partially. The work shall proceed day and night, if necessary, to complete each longitudinal section. These sections while being built shall be held in place by substantial timber forms, normal to the centering and parallel to each other, and these forms shall be removed when the section has set sufficiently to admit of it. The sections shall be connected as specified above, and also, if in the opinion of the engineer it is deemed necessary, steel clamps or tie rods shall be built into the concrete."

Sinking and Testing an Iron Pile.

In Hoboken, N. J., at the foot of pier C in the North River, a cylindrical caisson was sunk last Spring to a depth of 97 feet below mean high tide. It was made of cast-iron sections 6 feet in external diameter, 2 inches thick and 6 feet high, with inside flanges bolted together with red-lead and rubber gaskets. Around the lower or cutting edge there was an inside horizontal ring of 1-inch pipe with 3/16-inch perforations ¾ inch apart on the under side. Three 1-inch vertical pipes were connected to the ring and through them water at 200 pounds pressure was pumped to scour the soil under the cutting edge. The caisson was lowered to bottom in 28 feet of water and sunk by its own weight some distance into the soft mud and silt. Then it was loaded with pig iron on a top platform and was gradually sunk with the scouring jets to a depth of 97 feet through blue clay. This was very soft to a depth of about 75 feet where shells were found, and then became a little harder, continuing with the same general characteristics to rock at a depth of 267 feet, as determined by test borings.

As the caisson sunk, sections were successively added to the top until it had a total length of about 108 feet and weighed about 80 tons. A total load of 60 tons of pig iron and the action of the hydraulic jets forced it down at a maximum rate of about 6 feet a day. After sinking was stopped the top was covered by a ribbed cast-iron diaphragm and pneumatic pressure was applied. Men enter the caisson and with a hydraulic jet loosened the core which was ejected in the form of mud by the wet blow-off through a 3-inch pipe contracted to 2 inches at the bottom to prevent the entrance of any objects large enough to cause obstruction. A maximum pressure of about 40 pounds sufficed to make the excavation to a depth of 80 feet where a horizontal bulkhead of two solid courses of crossed 4-inch planks was laid on the ground and braced down by vertical struts up against the under side of the next flange above.

A pair of heavy 12-inch horizontal I-beams were seated on the next flange and supported a platform to carry the pile while it was being assembled. The pile was made with cylindrical cast-iron sections 30 inches in diameter outside, 1½ inches thick and 8 feet high, with inside flanges faced and jointed with red lead and rubber gaskets and having twelve 1¼-inch bolts in each. The lower section terminated in a hollow conical steel casting 4½ feet long with a 6½ inch vertical hole through the 8-inch point. Around the outside of the cone were three turns of a helicoidal flange about 4 feet in diameter and 1¾ inches thick which acted like a gimlet thread to draw the pile down when revolved. There were 3x5-inch rectangular openings through the sides of the cone between the turns of the flange. Two inside vertical pipes 1¾ inches in diameter were formed by coring out the metal of the thickened wall on opposite side of the cone, and terminated near the point with downwardly inclined orifices ½ inch in diameter through the outer walls. These pipes were continuous with a similar pair integral with the walls of each upper section of the pile and formed two tubes reaching to the top of the pile, through which hydraulic jets could be forced if necessary.

The circular opening in the flanges between the point and the lower section of the pile was closed by a ribbed cast-iron horizontal diaphragm in two semi-circular halves which rested on the upper side of the flange. They were braced down against the flange by a pair of inclined pieces in the same vertical diametrical plane. Their feet were close together on opposite edges of the joint and their heads abutted against angle-blocks under the next flange above and were connected by a horizontal strut.

This was hinged on the under side of the middle in such a way as to make a toggle joint which could be broken by pulling up on a vertical rope attached to the middle of the strut and carried to the top of the pile. By operating this rope the braces could be removed and the two parts of the diaphragm hauled up without the necessity of descending in the pile to the bottom.

The pile was assembled, section by section, by a derrick on the pier through which the caisson had been sunk. The lower eight sections were rough castings finished on the flanges only, but the upper sections were turned outside and passed through two horizontal cast-iron guide rings at different heights, which were L-shaped in cross-section and were bored to a close fit. They were secured by triangular frames bolted to the caisson flanges and were eccentric with the caisson. The cylinder extended through packing rings in the horizontal diaphragms which closed the caisson and formed the top and bottom of its air lock and gave it solid bearings to align it and prevent springing and air leakage. The packing rings had been bored to 1/32 inch clearance, but as the pile sections were turned separately and did not match perfectly at joints there were slight offsets there which would not clear the rings and the latter were removed and reamed out ¼ inch larger.

When the pile had been built up above the top of the caisson it was lifted by a wrecking derrick, the platform on which it had been supported was removed, and it was allowed to sink into the mud, which it penetrated about 11 feet by its own weight only. Horizontal timbers were clamped across it just above the top of the caisson and pig iron was loaded on them, and the pile, being intermittently screwed down, sunk at a maximum rate of 6 feet a day which gradually diminished as it went deeper until at a penetration of 113 feet below mean high water three revolutions under a 30-ton load produced no penetration.

A cap bolted to the top flange of the upper section of the pile had a vertical axis with bearings in the horizontal top and bottom plates at the center of the horizontal reaction strut. This was rectangular in cross-section, made with four angles latticed, and was 17 feet long, 3 feet wide and 2 feet deep. The ends had on opposite sides double-flanged bearing plates on vertical guide beams which permitted it to move up or down with clearance, but would not allow it to revolve on the axis of the pile. The pile, cap and loading revolved freely on a common vertical axis. There was keyed to the cap, inside the strut, a wide thick horizontal ratchet wheel which was engaged by two pawls on opposite sides, pivoted to horizontal connecting rods from the pistons of two hydraulic cylinders about 1 foot in diameter and 2 feet long, which were mounted inside the horizontal strut and operated by a pump on the pier. The cylinders were a little inclined to the axis of the strut so that their axes were nearly tangent with the circumference of the ratchet wheel and the connecting rods and pawls were clamped to the ratchet wheel by top and bottom plates which engaged vertical flanges on the inner edge of the circumference of the wheel and slipped freely over it.

Above the upper bearing in the strut the pile cap had a horizontal flange about 3 feet in diamter, on which, after the pile had been driven 113 feet, there were supported two transverse I-beams carrying two spare sections of the caisson with their axes coincident with that of the pile. Their combined weight was about 17,000 pounds, and, being supplemented by pig iron piled inside on a floor laid on the lower flange, helped to sink the pile 10 feet farther when screwing was resumed. The hydraulic apparatus turned the pile at a speed of about one revolution in ten minutes. This caused a penetration of from ⅜ inch to 4 inches per turn and was maintained from half an hour to eight or ten hours at a time, careful observations being made and recorded. At first under the initial load of 10 tons, the pile descended as fast as 6 feet per day, but this rate rapidly decreased and the penetration was very slow and difficult at last, when it attained a final depth of 123 feet and the twisting ceased and experiments were continued on the bearing power of the pile. On August 16 the pile was stationary under a load of 37 tons. Then an increment of 5 tons was added and it immediately cominches to sink at the rate of from 0.01 to 0.02 inches in twenty minutes. In 36 hours it had sunk 11/32 inch and stopped. On August 18 another increment of 5 tons was added bringing the total load up to 47 tons and a settlement of 0.015 inch was observed in twenty minutes, and was continued for some time after at the same rate.

The tests are being made under direction of Mr. C. M. Jacobs, chief engineer for the western division of the proposed Hoboken-New York and Long Island tunnel of the Pennsylvania Railroad Company. Mr. J. Forgie is his principal assistant, Mr. A. D. Barrett is the superintendent and the caisson and pile were sunk by Mr. C. C. Lovejoy.

The American School of Correspondence, Boston, Mass., has recently completed an arrangement with the Armour Institute, of Chicago, whereby students of the former school are admitted to the classes of the latter without further examination, and their work counts towards a B. S. degree. This will enable such students to pursue at home part of the work required by the Armour Institute for a degree and will doubtless be of assistance to young engineers, draftsmen, and others in securing a technical education. The American School of Correspondence will soon remove its office and entire force of teachers to Chicago.

Tree Planting on the watershed of the Wachusett reservoir at Clinton, Mass., has been carried on recently under the direction of the Bureau of Forestry of the Agricultural Department, and it was recently announced that similar work will be undertaken on the watershed of the Woonsocket, R. I., storage reservoir.

The Pacific Portland Cement Company's Works.

By Watson Vredenburgh, Jr., C. E., 32 Broadway, New York.

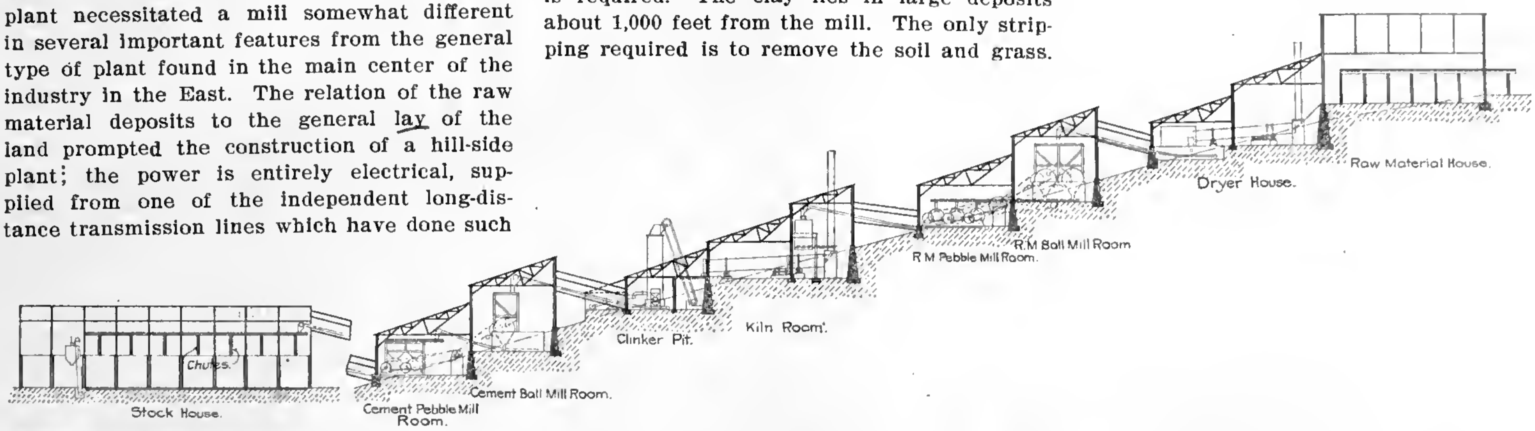
The extreme West has recently begun to take an active part in the development of the cement industry of the country and already a number of plants are projected and several in the course of construction. The plant of the Pacific Portland Cement Company, situated at Suisun, Solano County, Cal., has been under construction for the past year and commenced operation on August 1, 1902.

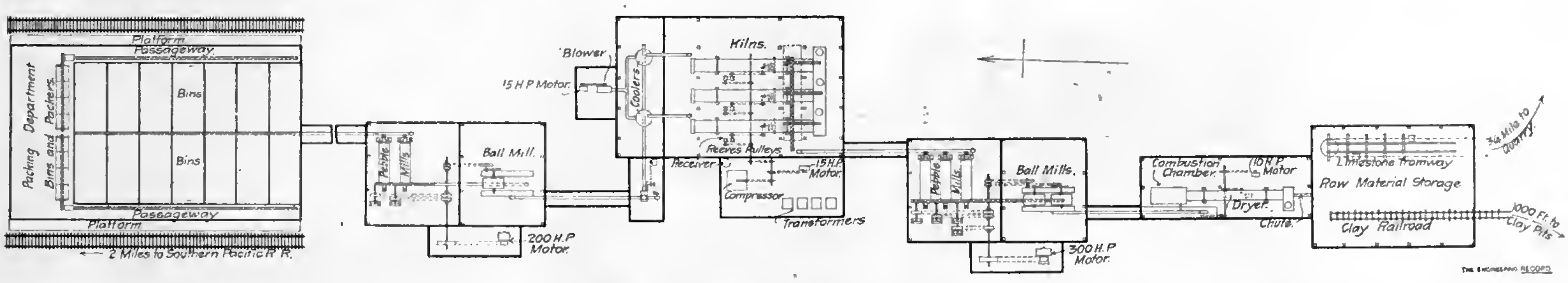
The local conditions surrounding the deposits of the raw materials at the site of this plant necessitated a mill somewhat different in several important features from the general type of plant found in the main center of the industry in the East. The relation of the raw material deposits to the general lay of the land prompted the construction of a hill-side plant; the power is entirely electrical, supplied from one of the independent long-distance transmission lines which have done such notable work on the Pacific Coast, and the fuel for the burning and driving is obtained from the California oil fields. These features make the plant unique in character and an endeavor will be made to describe it under the several most important essential features entering into the successful operation of such a plant and to describe its construction in general.

The company's property comprises approximately 800 acres of land, of which about 300 acres is limestone and the remainder being principally clay deposits. The mill is situated two miles from the Southern Pacific road, and by this route is about 50 miles from San Francisco and 40 miles from Sacramento.

In the selection of the immediate location of the mill the nature of the ground between the quarry and the railroad had to be considered, and, as constructed, the mill stands on the first of a series of foot hills which rise higher and higher to the north. These features have enabled a gravity layout to be made from the quarries through the several stages of manufacture to the stock house, with the two exceptions of the elevation of the clinker to coolers and the use of several elevators in the packing room of the stock house. The connecting railroad from the mill to the main line runs perfectly level for the entire two miles, excepting a very slight rise to the stock house situated at the foot of the slope.

The limestone quarry is situated at a distance of three-quarters of a mile from the mill and is worked from an open face in which the rock comes to the surface so that no stripping is required. The clay lies in large deposits about 1,000 feet from the mill. The only stripping required is to remove the soil and grass.





The Works of the Pacific Portland Cement Co., Suisun, Cal.

The character of the raw materials is shown from the following set of typical analysis, both from material dried at 212 degrees Fahrenheit.

Analysis of Limestone.

Ig. loss	43.74
Silica (SiO_2)	.41
Iron and Aluminum ($Fe_2O_3Al_2O_3$)	.56
Calcium (CaO)	54.86
Magnesium (MgO)	.21

Analysis of Clay.

Ig. loss	9.07	
Silica (SiO_2)	58.44	
Iron and Aluminum ($Fe_2O_3Al_2O_3$)	26.50	7.55 Fe_2O_3; 18.95 Al_2O_3
Calcium (CaO)	1.70	
Magnesium (MgO)	1.88	
Alkali (K_2ONa_2O)	1.56	

The finished cement showed the following analysis, physical and tensile strength tests:

Analysis of Cement.

Silica	22.51
Iron and Aluminum	11.13
Calcium	64.06
Magnesium (MgO)	.99
Sulphuric Anhydrite	1.01
Alkali	.54

Physical Test of Cement.

Initial set	2 hrs.
Set hard	6 hrs. 20 min.
Hot water	O. K.

Tensile Strength Neat Cement.

3 days	290 lbs.
7 "	645 "
28 "	795 "

The power for the entire plant, including the water and oil pumps is electrical; the crusher at the quarry also has its own motor and the ice plant used in connection with the company's boarding house has an independent motor. The power is furnished from the Bay Counties Power Company, which operates its lines of long-distance electrical transmission from Oakland to Colgate, a distance of 152 miles. This power is furnished at 60,000 volts and it is then transformed in the power house of the mill to voltage as required. The power company has two complete lines on independent poles so that the danger of a break down on the lines is reduced to a minimum. A great economy in the distribution of power is anticipated, due to the fact that when any individual machine is shut down its motor is also shut down, and as the power is a direct purchase this means a direct economy.

The power room of the plant is situated alongside the kiln building and directly connected with it. It contains the necessary transformers and switchboards from which the current is distributed to the various motors throughout the plant. In this room a 75-kilowatt motor drives a line shaft, which in turn drives an air compressor for supplying air to the kiln-burning apparatus and also the main shaft driving the kilns. Provision has also been made to install a 100-horse-power engine and boiler to be used as auxiliary power for driving the kiln shaft in the event of an accident to the electrical power. The motors for the plant were supplied by the General Electric Company and the compressor by the Compressed Air Machinery Company of San Francisco.

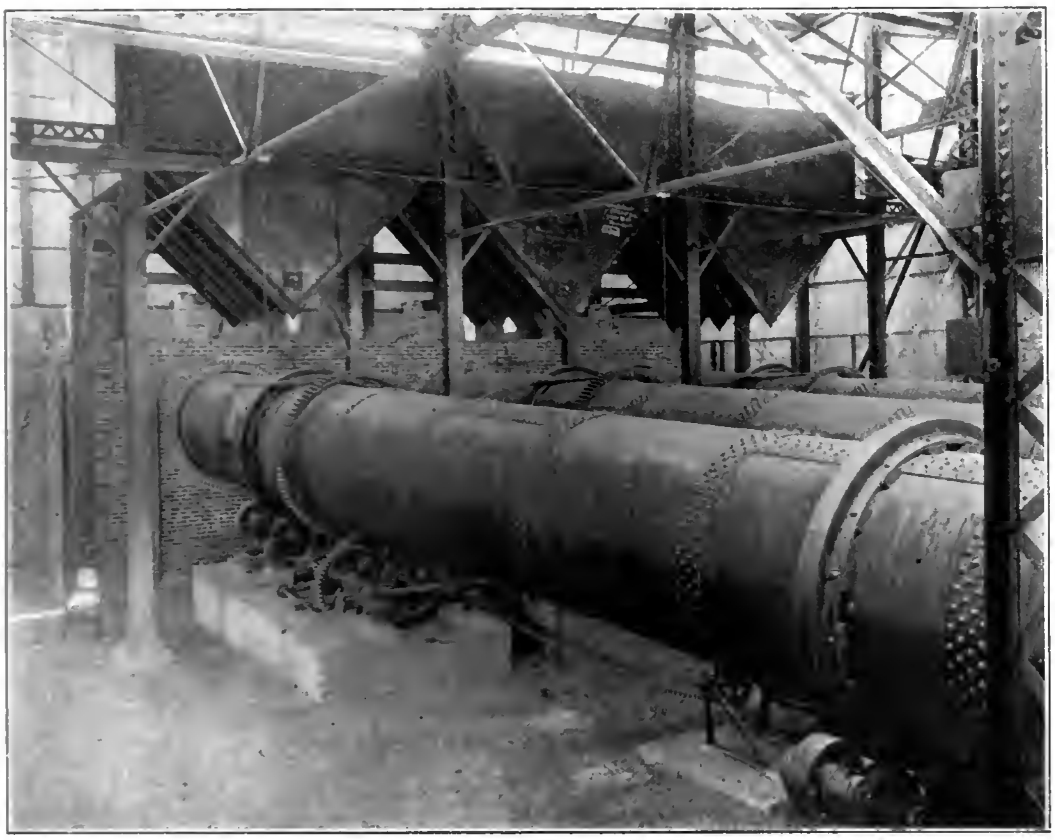
The fuel oil is delivered to the plant from the California oil fields in tank cars. An oil spur is so arranged that two cars can be unloaded at one time. The oil flows by gravity into a tank placed below the rails, and from there is pumped to the elevation of the floor of the raw material house, where storage is provided for 75,000 gallons. From these tanks the oil is fed to the kilns and dryer by gravity.

The accompanying diagram gives a general plan and elevation of the works, showing the relation of the various buildings with their machinery layout, which will be described in the order in which they are employed in the manufacturing processes.

The dimensions of the buildings comprising the plant are as follows: Raw material storage, 60 x 80 feet; dryer house, 30 x 85 feet; raw material ball mill room, 51 x 42 feet; tube mill room, 51 x 46 feet; kiln room, 71 x 69 feet; clinker pit, 41 x 69 feet; cement ball mill room, 42 x 51 feet; cement tube mill, 46 x 51 feet; stock house, 70 x 144 feet.

at present provides simply a bulk storage for the raw materials. It has been thought desirable to make the necessary proportionate mix of raw materials directly by hand in the raw material house during the preliminary experimental stages of manufacture, and, when the plant is in full operation and the materials thoroughly understood, to install a system of bins and conveyors to eliminate the manual labor. The proper mixture to give the desired composition is dumped directly from the floor of the raw material room into a rotary dryer 5 feet in diameter by 50 feet long, of the ordinary type furnished by the Vulcan Iron Works. The heat for the dryer is obtained from fuel oil and a special combustion chamber forming the end housing has been constructed to comply with the requirements of oil burning; grates, ash pits, etc., have also been provided so that coal or wood can be used. The dryer house also contains a 10-horse-power motor driving a counter-shaft from which the dryer is driven directly by belt.

The material passes directly from the dryer to a 16-inch belt conveyor which carries it to



View in the Kiln Room, Pacific Portland Cement Co.

The working floor of the limestone quarry is 200 feet above the base of the raw material storage house. The limestone is crushed to a 2-inch ring in a Gates crusher as it leaves the quarry, and on leaving the crusher drops into a bin, from which it is automatically loaded into buckets and carried to the mill, a distance of three-quarters of a mile, by means of an aerial bucket tramway furnished by the A. Leschen & Sons Rope Company of St. Louis. The buckets enter the raw material house at an elevation of 20 feet and are automatically dumped.

The clay lies in a large deposit about 1,000 feet from the mill, at a slight elevation above the raw material house. It is handled by means of plows and scrapers, and is loaded directly from scrapers into small dump cars. These cars run by gravity into the raw material house at an elevation of 18 feet and are dumped. The empties are made up into trains and are hauled back by horses.

The raw material house is a single room and

bins over two Krupp ball mills. From these mills the product of the first grinding is taken by a screw conveyor directly to a battery of three tube mills, in which the grinding of the raw material mixture is finished. These ball and tube mills, together with those used at the finishing end of the mill, were furnished by Thomas Prosser & Son, of New York. A 300-horse-power motor furnishes the power for this group of mills and drives a main shaft mounted on concrete piers 10 feet above the floor line of the tube mill room, from which the mills are driven directly.

The ground mixture is received directly from the tube mills on a 16-inch belt conveyor which conveys it to a screw conveyor, which in turn deposits it into the raw material tanks over the kilns. There are three rotary kilns 60 feet long and 6 feet in diameter, made by the Vulcan Iron Works, and mounted and turned in the usual manner. Each kiln is driven from the shaft mounted below the kilns and the speed for each controlled by a Reeves speed regulator. The raw material is stored in a large steel tank mounted above the feed end of the kilns and just in front of the housing. This tank is provided with partitions and a V-shaped hopper bottom for each kiln and was furnished by the Heilman Boiler Works, Allentown, Pa. The material is brought from the tanks by a screw conveyor which feeds it to the kiln through water-jacketed tubes. These conveyors are driven by gears and chain drives from the shaft of the kiln-driving gears and are provided with clutches, making the feeds independent of the kiln motion.

The burned material is discharged directly from the kilns in the form of clinker into the boots of elevators, from which it is elevated into clinker coolers. These coolers are 7 feet in diameter and 32 feet high and are provided with an artificial circulation of air through the center. They were made by W. F. Mosser & Sons, Allentown, Pa., and are of standard pattern as furnished by this company. The air blast is furnished by one 80-inch rolling mill blower made by the B. F. Sturtevant Company, the blower being driven by a 15-horse-power motor directly belted.

The cooled clinker is received from each cooler at its center directly on a 16-inch belt conveyor running through the center of the cooler foundation, and is discharged into a weighing hopper at the opposite end. This hopper weighs the clinker and discharges it upon another 16-inch belt conveyor, conveying it to bins over the finishing ball mill, which is fed from them. The arrangement of these ball and tube mills is exactly similar to that of the raw material rooms and the mills may be interchanged without affecting the layout. They are driven in a similar manner to those of the raw material end, a 200-horse-power motor furnishing the power for the main shaft.

The finished product from the cement mills is received on a 16-inch conveyor, which discharges it into a long screw conveyor at the top of the stock house. This conveyor distributes the cement into a series of bins for storage. Provision has been made for a system of conveyors running outside and directly in front of the bins, for bringing the cement to a packing department at the end of the building. In this department the cement will be elevated to bins, from which it will be packed in a series of bag and barrel packers.

The loading of the finished product for shipment can be made from either or both sides of the stock house, and the cars are hauled by the company's locomotives over their own road and delivered to the main line of the Southern Pacific Company, two miles from the works. This connecting road was built and is operated by the cement company.

The elevating and conveying machinery for the entire plant was furnished by the Webster Manufacturing Company, of Chicago; the main shafting, pulleys, clutches, etc., by the Hill Clutch Company, of Cleveland, Ohio, and the leather driving belts throughout by the Page Belting Company, of Concord, N. H.

All the buildings of the plant are of steel frame covered with corrugated iron, the structural steel work for which was furnished by Milliken Brothers, of New York. The slope of the hill-side necessitated the construction of a number of retaining walls, which are built of concrete, as well as all the machinery and building foundations. The entire works were erected by the company, none of the work being done by contract.

The layout of the buildings has been arranged with a view to extension, and an enlargement of the initial plant by the addition of a second unit will be begun as soon as the present works are in full operation.

The main office of the company is situated in San Francisco and its directorate is as follows: Mr. George Stone, president; Mr. Nathan L. Bell, secretary; Messrs. Jas. F. Kilby, Morris Kind and Samuel McMurtrie, directors. Mr. F. H. Lewis, M. Am. Soc. C. E., manager of the Virginia Portland Cement Works at Craigsville, Va., acted as consulting engineer in connection with the writer, who was designing engineer.

The Power Plant for the Pennsylvania Railroad Station, Pittsburg.

As supplementary to the description in The Engineering Record of August 23 of the train-shed for the new depot of the Pennsylvania Railroad at Pittsburg, advantage may be taken of the appearance of a paper by Mr. D. B. Kinch on the power plant for the station, in the July "Proceedings" of the Engineers' Society of Western Pennsylvania. The plant is a centralized, modern one, occupying an isolated building 55x420 feet in ground area, and located to serve both station and yards, the former being a consumer of perhaps 75 per cent. of the plant's output. The paper is reprinted herewith practically in full.

The heating and ventilation of the station, the elevators for both the offices and baggage service, the lighting of the building and yards, the filtering and refrigerating of the drinking water, the building service water, and pressure for fire mains, the entire telegraphic service, etc., are all provided for by the plant, which is duplicated as to the most vital points.

The engine and generator equipment comprises four Westinghouse compound engines, of the standard marine type design. The high pressure cylinder is 17 inches in diameter, the low pressure cylinder 27 inches, with a 24-inch stroke. They are equipped with a Rites governor and have a speed of 200 revolutions per minute. The high pressure cylinder is equipped with a piston valve, double ported, and the low pressure with a slide valve, double ported. The engines are direct connected to 350-kilowatt, 220-volt, two-phase, alternating current dynamos, of the Westinghouse standard type. One engine driven and one motor driven direct-current dynamo, each of 37½ kilowatt capacity, serve as exciters. These exciters also furnish direct current for a number of small motors, used at various points throughout the building on special apparatus for which alternating current motors are not, as yet, provided by the manufacturers in connection with their apparatus.

Current for the storage battery used in connection with the switch and signal installation is also provided from the exciters. These direct current machines also furnish the primary current for 14 Crocker-Wheeler dynamotors, used exclusively for the telegraphic service. The output of these numerous little machines varies from 8 volts on "locals" to 360 volts for duplex and quadruplex service. Battery current for telegraphic purposes is entirely supplanted by the installation of these small sets.

The switchboard panels are of blue Vermont marble, and the board is composed of 13 lower and 9 upper panels, each equipped with main and auxiliary bus bars. Stairways at either end of the board, give free access to the gallery around the upper panels. The lower panels are used for the generating and high tension work and the upper panels for the distribution. It is the intention to run the alternators in parallel, and to this end the synchronizing apparatus is one of the board features. Step-up transformers at a ratio of 10 to 1 are installed to furnish lighting and power circuits to outlying districts.

Ample circuits for series alternating-current arc lamps are provided, and for this work a combination jack and plug board is used. All transformers, as well as rheostats, are placed in the basement directly underneath the switchboard, thus clearing the back of switchboard to an unusual degree. The electrical equipment occupies the entire south side of the engine room, whilst along the north side are located the air compressors, hydraulic pumps, high pressure pumps, small air compressor for thermostatic heat control in the office building, a Scotch yoke air compressor, etc.

The main pumping engine for hydraulic elevators is of the Riedler type, fitted with mechanically operated valves. It has duplex single-acting outside packed plungers, 9½ inches in diameter and 24-inch stroke, steam cylinders 13 inches and 23 inches in diameter with 24-inch stroke. This pump, having a capacity of 1,400 U. S. gallons per minute, against a pressure of 200 pounds to the square inch, when running at about 96 revolutions per minute, with a steam pressure at throttle of 150 pounds. The main feature in the design of this pump was to cut down the floor space to the smallest possible area. For this reason the valve gear was put on the outside of the steam cylinders, in order to get the cylinders close together and do away with the necessity of a passage between the gears, which would have materially widened the engine. The engine frames were made of the double bearing type, with four-part adjustable boxes for all bearing. The entire water and steam end of pump is mounted on a substantial bed plate of box section, insuring alignment and in order to further economize the floor space, the pump end was made of the single acting type, as this would cut down the space required about one-half of that necessary for the double acting pump.

The distinctive feature of this pumping engine is the mechanically operated valves. As the pump is single acting, it was necessary to provide a by-pass so as to enable the pump to run without delivering water when the pressure had passed a certain point. The by-pass valve is operated by means of an air cylinder, which also operates an auxiliary throttle; the steam for running the pump being taken through a small by-pass on the side of this throttle, this by-pass having a valve in it, so that the amount of steam fed to the pump can be adjusted that the pump will not run more than 30 revolutions per minute when running on the by-pass.

The air cylinder for operating water by-pass valve and throttle is controlled by means of a pilot valve operated by an auxiliary governor, this governor only coming into effect when the speed of the engine has dropped to between 20 and 25 revolutions per minute. All of the working parts of governor are central, to eliminate friction; as auxiliary pumps for elevator service two simple direct acting Worthington pumps of 750 gallons each have been installed. These are also used for the night run. The elevator equipment comprises seven high-speed elevators, to travel from train floor to top floor, a distance of 190 ft., and eight direct lift elevators, used for baggage and express service.

For the furnishing of air to the signals and switches as well as for car testing and car cleaning purposes two cross compound vertical Reidler express type compressors are used. Sizes of air cylinders are 14 and 24 inches in diameter with 24-inch stroke driven by a vertical cross compound, non-condensing Corliss steam engine with cylinders 13 and 23 inches in diameter and 24-inch stroke. Each compressor having a capacity of 1,500 cubic feet of free air, net piston displacement, to a maximum pressure of 100 pounds, when running at a speed of 134 revolutions per minute. The air cylinders are mounted above the steam cylinders. Both air cylinders and heads are water jacketed. The air suction and delivery valves are placed in the heads; the suction valves being of the semi-rotative type operated by means of a wrist plate, driven from an eccentric in the same manner as the steam gear. An inter-cooler and an after cooler are provided, the inter-cooler having a volume of about six times the volume of the low pressure cylinder. After the air has been delivered from the high pressure cylinder it is passed through the after cooler so as to remove as far as possible all moisture. It is then delivered to storage tanks located in what is known as the air intake building. This is a separate building of small dimensions directly west of the engine room, and is equipped with storage tanks for air delivery to various points and also with appliances for thoroughly cleansing the air before it is delivered to the suction pipe. A 15-ton electric crane travels the entire length of the engine room, thus assuring valuable aid in case of need.

The boiler room is equipped with Babcock & Wilcox boilers. These boilers are of standard type and are all of forged steel construction, built to carry a working pressure of 200 pounds. The boilers as installed comprise six boilers in three batteries, each unit 300 horse-power, an aggregate of 1,800 horse-power, space being left for an additional battery for future increase. The boilers are equipped with Roney stokers and installed in the boiler room is a Hunt coal and ashes conveyor. Hoppers of 50,000 pounds coal capacity are located over each battery of boilers, and cams are arranged at convenient points along hoppers for dumping the buckets. The conveyor movement is made by a steam engine located in what is known as the annex. The conveyor extends along the top of coal hoppers and passing down the side of west battery runs along the basement floor, and at this point receives the ashes from the ash hoppers under each boiler, and the buckets of the conveyor receive these ashes through an automatic filler located directly under hoppers. The ashes are stored in a large hopper located in the second story of the annex from which chutes are arranged, and the ashes are dumped into cars, which but a few moments before contained the coal. A coal crusher is installed at the lower end of the coal hopper and only used when lump coal is delivered.

Two Cochrane feed water heaters each of 1,500 horse-power capacity are employed in boiler room, and feed water is delivered to the boilers at a temperature of 200 degrees Fahrenheit. All feed water piping to the boilers is of brass and in duplicate.

The chimney is located in the middle of the boiler room and south of the center line. The smoke flues enter chimney on basement level. Suitable dampers under automatic controllers are installed. The chimney is of the Custodis perforated radial brick, and the actual height without base, 240 feet with a base of 13 feet 6 inches high. The diameter of chimney is 9 feet. An 18-inch exhaust pipe extends the whole length of the chimney and extends above at top about 6 feet. This pipe will take care of all the steam exhausted during the warmer months. During the colder months the exhausted steam will be employed in heating the office building. The total weight of chimney, including the exhaust pipe, is about 2,600,000 pounds.

Special attention was devoted to the steam piping system, the view point always being that only partial shut down would result in the case of ordinary repairs or accidents. The piping is all extra heavy, with screwed flanged fittings. Two headers extend along the entire length of boiler room, along the rear of the boilers and about 8 feet above them. Into each one of these headers, is a main from each boiler. This practically duplicates the piping in the boiler room. At the partition wall between the boiler and engine rooms the mains drop to the basement and loop around the engine room. The main steam line runs in about a 4-foot space between the foundations of engines and the wall of building. At each point where a connection is made for engines, valves are placed on either side of this connection in the main line. Thus the connection to any engine can be cut off from the main steam line without interfering with the supply to other points. The exhaust line extends along the center of basement and connects to the exhaust line in the stack and also to a large distributing tank to which the building heating system is connected. A back pressure valve is located on exhaust line leading into the stack. At the west end of the engine room the exhaust line leads up to the roof, connected to exhaust heads. On this line, also, there are back pressure valves.

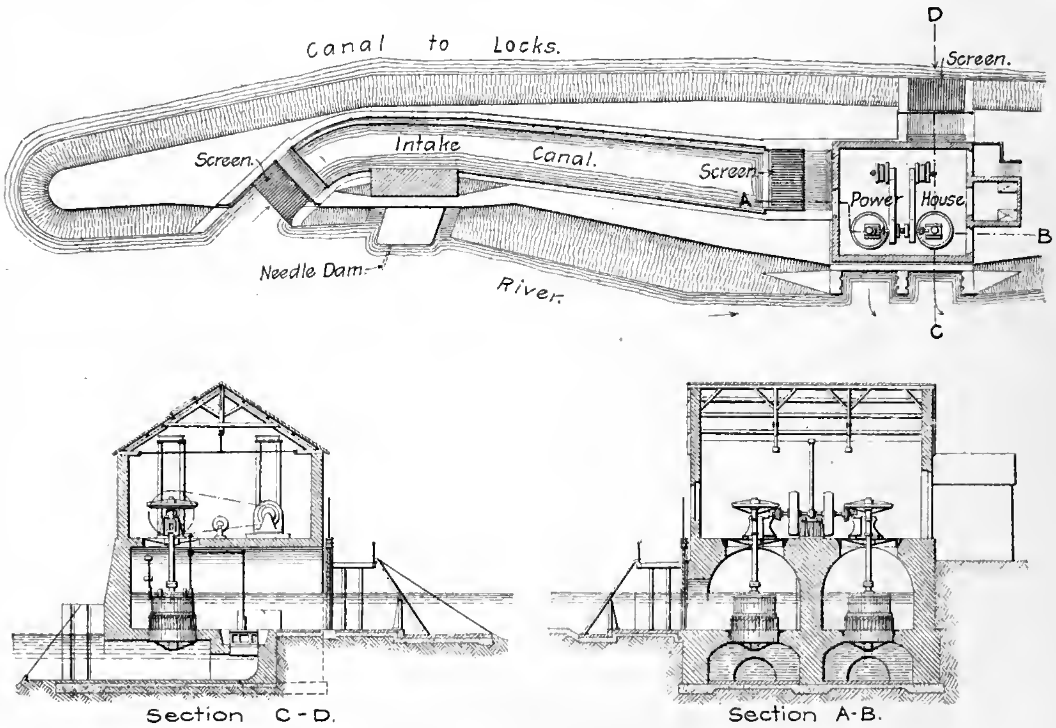
The refrigerating and drinking water plant is located at the partition wall between the engine and boiler rooms on the boiler room side, and is of Carbondale Machine Company's construction. The duty performed consists of refrigeration for two refrigerators for kitchen on top floor, containing approximately 1,000 cubic feet, also refrigerating for main restaurant boxes containing about 4,000 cubic feet, the connecting mains aggregating 1,200 feet. The filtering and cooling of the drinking water supply is for about 125 fountains, located in the offices and waiting rooms. The amount of water cooled is about 750 gallons per hour, with a range of 45 degrees Fahrenheit, from 80 degrees on the intake to 35 degrees to delivery mains. The delivery mains connect with sets of risers in the basement, from which lead the horizontal supply lines to each of the floors connecting to the office outlets, by means of an additional faucet at each washstand. The risers and mains aggregate about 11,000 lineal feet of pipe in supply and return mains. The temperature of the water at the drinking fountains is about 41 or 42 degrees. The method of circulation used ensures equal temperatures at all points, freedom from air in pipes and a continuous supply at all faucets. Stop or regulating cocks are placed at all fountain loops, to provide against excessive pressures due to the height of risers. The pressure at the water circulating pump in the basement of the power plant, a 9x5¼x12-inch duplex, is about 95 pounds. The steam required is about 32 pounds per ton refrigerating effect per hour. The refrigerating machine is of the standard Pontifex-Hendrick absorption pattern of 40 tons capacity, and consists of the generator, analyzer, exchanger, absorber, condenser and brine cooler, with duplicate direct acting single ammonia pumps and duplicate duplex brine circulating pumps. The refrigerant used is fused calcium chloride of 1.250 specific gravity. This substance is circulated through coils in refrigerators, and very low temperatures are possible. The location of refrigerating machinery in power house being essential, and the limited available space necessitated the placing of this apparatus in a space of about 8x30 feet and on three different levels. The machine proper standing on a platform of steel construction of 200 square feet, 12 feet above the power house floor. The cooling and brine storage tanks, with ammonia pump, on the main floor directly underneath, and the water circulating pump and filters below in the basement.

A Low-Head Water-Power Plant at Fumay, France.

A factory for the manufacture of cooking utensils, warming apparatus and general household articles, occupying about 6 acres at Fumay in the department of Ardennes, France, is now supplied with power from a low-head water-power plant supplemented when necessary by a steam plant and all connected on an electric system of distribution. The works were originally operated from a single steam engine with belt and shaft transmission, and as they grew in size, additional steam engines were added, until it was decided to rearrange the power facilities and the electric system of power transmission was adopted. Near the works, which are on the River Meuse, is located a dam required in connection with a lock for the transportation of boats around a fall in the river. Rights were obtained to utilize the flow of surplus water, which, being of low head, comprehended the control of a large discharge. During periods of high water or of stoppage from ice, the water power would prove insufficient for the needs of the works and an auxiliary steam engine driving an electric generator was accordingly installed.

The dam furnishes at low-water a discharge of 705 to 1,060 cubic feet per second under a fall of 7.87 feet. The water-power concession authorized the use of 424 cubic feet per second during dry periods and 636 cubic feet under normal conditions, that is 384 to 576 theoretical horse-power, according to the season. During the dry season, the head is at its maximum, which compensates in a certain measure for the diminution of volume. As shown in the accompanying illustrations, it was possible to establish the hydraulic plant against the dike built for the lock. It was not feasible to take all the water from the water-way to the lock, however, as too strong a current might be created for the management of boats, nor was there sufficient space for the construction of an independent intake between the river and the dike. It thus became necessary to provide two intakes, one from the lock waterway, limited to 212 cubic feet, and the other by the construction of a canal parallel to the dike and large enough to take the surplus water.

The power house is a small building, consisting of a generator room 35.4x42 feet in plan, with its floor 10.1 feet above the normal level of the head waters, and of two water chambers underneath, one corresponding to each waterway. In the floor of each chamber, at tail water level, is placed a vertical turbine, the two of equal power. To compensate for the difference of delivery in the two waterways of approach, a gate is provided between chambers to bring the two into communication, which allows each to receive the same quantity of water. In order not to hinder the service of navigation by too sudden variations of water level, resulting from stoppage or starting of the turbines, each chamber is provided, as shown in the cross-section of the plant, with a cylindrical bypass gate, the discharge of which is equal to that of the turbine. The gate is operated in conjunction with that of the turbine, in such a way that when the turbine gate is open, the bypass gate is closed and vice versa, and such that the discharge is practically constant whatever the degree of opening. Because of variations in the level of tail water the turbines are frequently under water and the so-called American type of turbine was chosen. They were built by Messrs. Teisset, Veuve Brault & Chapron, of Chartres. They have a rating of 200 horse-power each, under a head of 7.55 feet, and their speed is 41 turns per minute between the limits of 7.55 and 4.59 feet.



Water-Power Plant at Fumay, France.

Each of the wheels drives a pair of bevel gears which turn a horizontal shaft at 143 revolutions per minute, and from that by means of a belt the electric generators at 400 revolutions. The two horizontal shafts may be coupled together and each pinion and the pulley it commands can be disconnected from the turbine which ordinarily drives it, so that either one of the alternators can be driven from either one of the turbines, in case diagonally opposite machines should be for the time being out of use, and one alternator can be operated from two turbines, an arrangement which is advantageous when the head is reduced from high water and each turbine, for example, is only producing one-half of its power; the efficiency of a generator operating at full load is evidently better than that of two generators operating at half load.

The alternators, each of which carries its exciter on an extension of the shaft, furnishes three-phase current at 3,500 volts and a frequency of 40 periods per second. The current is carried in three copper wires a distance of about 5,250 feet, passing underground at a railroad bridge, crossing the dike at 59-feet above ground on wooden bents and through a built-up section with an insulated covering on the roofs of the houses. The high-tension line ends at two transformers, each of half the total power, in the central station of the works. The low-pressure winding of the transformers is of the star type, 115 volts per phase, allowing for 200 volts for general power work and 115 volts for lighting. The current from each transformer as well as from the steam driven generator is controlled from a switchboard in the central station.

For the steam unit, a Delaunay-Belleville high-speed vertical engine was adopted. It is double tandem compound machine rated at 220 horse-power at 400 turns per minute, and is provided with a jet condenser. The generator is directly connected to the engine and furnishes three-phase current, likewise at 200 and 115 volts. In connection with this generating set, a Belleville boiler, capable of generating 6,600 pounds of dry steam per hour at a pressure of 213 pounds per square inch, has been installed. From the boiler steam passes into an expansion chamber, which brings it to 127.8 pounds per square inch, then into a steam separator at the engine. Throughout the works there are about 30 motors taking an average of 150 horse-power and 900 incandescent lamps of 16 candle-power taking 60 horse-power; in addition electrical heating apparatus requires 5 horse-power. The works are described in a recent issue of "Le Genie Civil."

Lowering a Heavy Foundation Girder.

The large steel-cage twenty-story office building now being erected at the corner of William and Pine Streets, New York, has a grillage foundation to which the column loads are transmitted through unusually heavy distribution girders. Four of them, with triple solid-plate webs, are 38 feet long, 5½ feet deep and 32 inches wide over all and weigh about 30 tons each. They were brought to the site on special trucks drawn by eighteen horses and were unloaded by hydraulic jacks on cribbing in the street close to the edge of the cellar excavation. After the truck had been released, the girder was jacked down to skids at the street level. The skids reached to the edge of the excavation where they met the tops of four 12x12-inch timbers inclined about 30 degrees to the horizontal and supported at the bottom on the cellar floor, at the top on the tops of the sheet piles enclosing the excavation, and intermediately by 12x 12-inch caps of two transverse trestle bents which were X-braced in longitudinal and transverse vertical planes. Both inclined timbers and horizontal skids had loose flat steel bearing strips on top which were greased for the girder to slide upon.

The girders were unloaded with their webs in horizontal planes and the edges of their flanges bearing on the greased track plates on the horizontal skids. A heavy chain sling was passed around each end of the girder and another near the middle, with the rings on the side farthest from the excavation. The hoisting tackle from the boom of a large guyed derrick seated in the excavation was attached to the middle sling. To each of the other slings there was attached a six-part manila tackle, which was shackled to a chain around a parallel duplicate girder laid flatways on the curb to act as an anchor. A third tackle was attached to one of the end slings and was anchored through a coal hole in the sidewalk on the opposite side of the street.

The girder was jacked over to the top of the inclined skids, the opposite edge jacked up, and then started sliding down, being held back by the three preventer tackles and by the boom tackle which overhung the edge of the excavation and was operated by the hoisting engine. The lead lines from the other tackles were snubbed with several half turns around the shackles or links of the chains on the anchor girder, and three men on each paid them out as the girder descended. The girder was lowered smoothly and rapidly and reached the cellar bottom, about 18 feet below the street, in five minutes after it commenced to descend. It was landed on the greased flanges of I-beam skids and was turned 90 degrees and slid into place. About twenty men in all were required to handle and unload the girder. Mr. James B. Baker is the architect of the building, and the contractors are the Thompson Starrett Company, Mr. S. C. Weiskopf, engineer. The girders were built at the Pencoyd shops of the American Bridge Company.

The four-wheel truck on which the girders were brought to the site imposed so heavy a load on the pavement that near where the girders were unloaded one wheel broke through the pavement and the arched roof of the sidewalk vault, and made a large hole there. Another girder was delivered in the daytime and when the truck turned down Broadway to Wall Street it was necessary to unhitch the eighteen horses to turn the corner and hitch them on again in Wall Street. This carried the line of teams across both tracks of the Broadway electric cars and shut off all traffic so long that the street was blocked for many squares and more than fifty cars were stalled there.

This method of lowering a heavy weight on inclined skids elicited a description of some similar work done by the T. A. Gillespie Company in the construction of the pipe line of the Utica Electric Light & Power Company. A 7-foot steel pipe carries the water from the dam across the west branch of Canada Creek to the bottom of a very steep hill over 150 below, and there has a T and four 6-foot gate valves, the latter weighing 12 tons each. The T has three 7-foot openings and weighs 46,000 pounds. It was unloaded from the cars about a mile from the top of the hill and was transported there on a platform built on two low four-wheel car-trucks, which were moved over the rough ground on a narrow gauge track consisting of two sections of rails fastened together with bridles. The section in the rear of the trucks would be disconnected, taken up and brought around and connected on in advance, the trucks moved one length ahead, the other section of track moved around in front and so on. The road was fortunately down-hill and the trucks moved easily and had to held back by preventer tackles.

The pipe trench had been dug from the foot of the dam to the bottom of the hill and in it skid rails were laid at an angle of about 15 degrees with the vertical and the 23-ton casting was slid down on them. It was lowered with two preventer tackles and the hoisting tackle of a guyed derrick on top of the hill. The derrick had a mast 24 inches in diameter and a 60-foot boom 20 inches in diameter, and was rigged with ¾-inch steel plough rope and six very flat guy lines. Before lifting the T, the derrick was tested with one of the 12-ton gate valves, which it lifted over a large sand pile, with its boom in a flat position; the line was then slacked off a few inches and suddenly stopped so as to cause a very heavy impact, which, however, did no injury.

METHOD OF LOWERING A HEAVY FOUNDATION GIRDER.

It required about 15 minutes to lower the T down the skids, two men riding down on it with bars ready to free it from any obstruction.

The pipe line was 4,000 feet long and included 3,000 feet of 7-foot wood stave pipe and 1,000 feet of 7-foot riveted steel pipe up to ⅝-inch thick, which was delivered in sections 30 feet long and riveted and calked with pneumatic tools. It had a 7-foot riveted steel standpipe 180 feet high, the lower 60 feet of which was assembled and riveted together horizontally on the ground. The special connection to the horizontal line was riveted into it, and the pipe was lifted bodily by tackles suspended from large trees which were utilized for derricks and revolved into a vertical position. It was then guyed and completed by building on the upper part with inside and outside scaffolds and a light inside revolving T-derrick which carried the yoke riveting machine and hoisted the plates.

The Mechanical Plant in a Newark, N. J., Department Store.

A new building containing an interesting mechanical plant was completed early in the year for the department store of Hahne Brothers, of Newark, N. J. A complete steam plant was installed for the warming of the building and to operate four electric generating sets, several pumps and other steam apparatus. On the lighting circuits there are 12,000 incandescent lamps, and 550 enclosed arc lights. A fire sprinkler system is provided, an ice plant furnishes refrigeration for a restaurant, a grocery and ice cream boxes, for cold drinking water, for a soda-water establishment and for a fur storage room. The mechanical equipment includes 15 electric sewing machines, two electric package carriers, a merry-go-round and two exhausters for a cash carrier system. The plant is located in the basement and occupies a wing of the building, one end being separated from the remainder of this floor by a glass partition affording a view of the machinery to visitors.

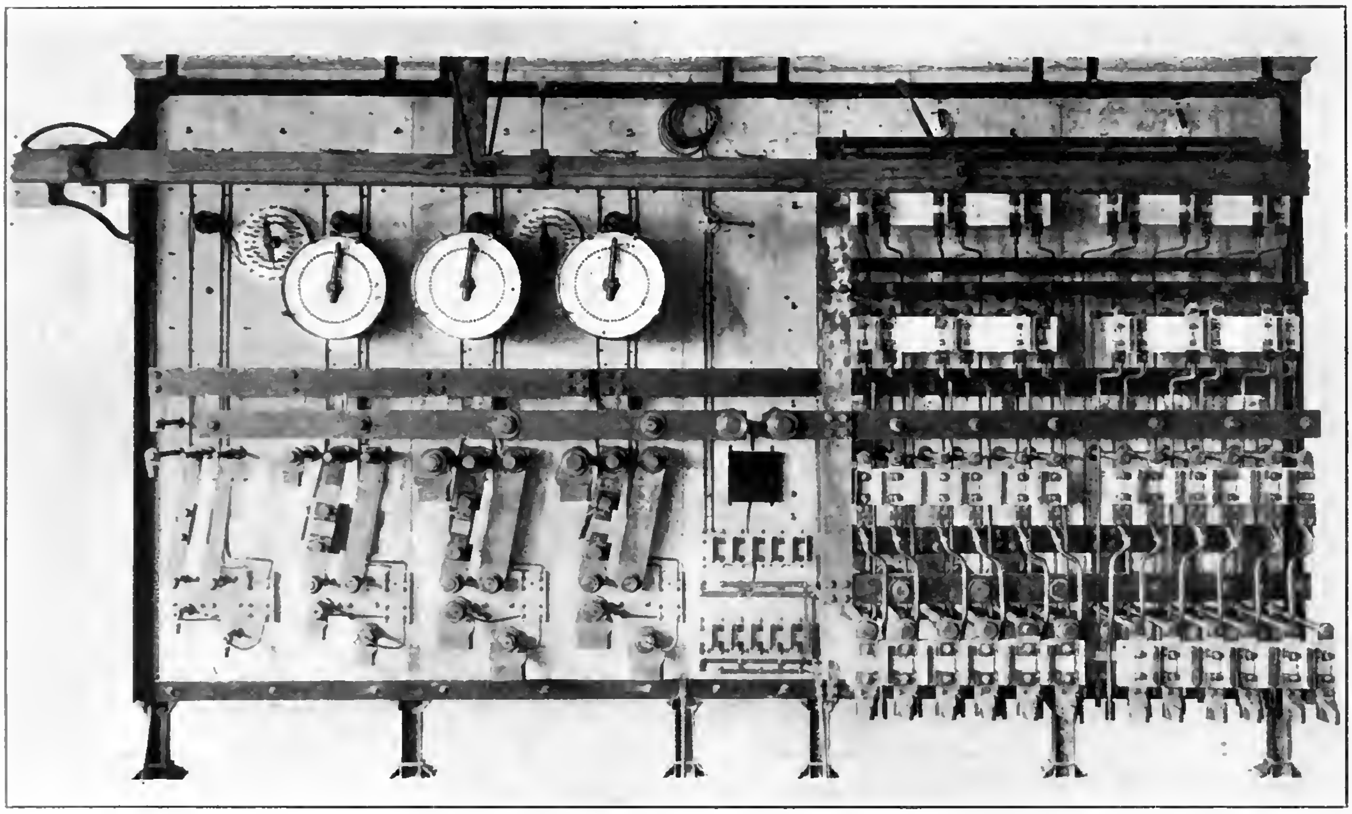
The main entrance to the building is on Broad Street, where there is a frontage of 240 feet, and the building extends along Neu Street for 255 feet to Halsey Street, there having a 100-foot front. This rear wing of the building is 140x100 feet in plan, where, in the basement, the mechanical plant is situated. The main body of the structure is lighted by two wells or rotundas located on each side of the center and extending to the roof. It is four stories high, exclusive of the basement.

The steam plant includes four Cahall water-tube boilers, each of 250 horse-power, and arranged in two batteries of two boilers apiece. They are individually connected to a four-piece steel smoke breeching 5 feet in diameter, which runs in front of the boilers overhead to a steel smokestack 6 feet in diameter and 100 feet high. Coal is taken from a vault of 90 tons capacity at the rear of the boilers and carried on a trolley to the firing pits. The fire boxes are fitted with Adams shaking grates. From each of two steam drums on each boiler, which are 20 feet long by 3 feet in diameter, a 3-inch connection joins a 5-inch supply pipe. The latter in each instance is run to a 12-inch header. Brick settings support the boilers, with suitable provision for expansion and contraction of the shells.

In a pit nearby are situated the boiler-feed pumps, two in number, one of which is 7x4½x8 inches in size and the other, 10x6x10 inches. They are of the Worthington type, and are piped so as to take the returns from the heating system, as well as fresh water from the city mains and deliver to the boilers through a 1,000-horse-power Berryman feed water heater, located on the opposite side of the stack. The pumps operate in connection with a governor in the usual way. Two smaller pumps are situated in the same pit; one pump takes care of and empties into a receiver shown; the other is used to empty a sump and discharges into the same tank. A boiler blow-off tank is combined also in the latter.

Steam from the 12-inch header mentioned is conveyed by branch lines of several sizes to the generating sets, four in all. Two of them are of 200 kilowatts capacity, a third is a 100-kilowatt set and the fourth has a 50 kilowatt capacity. The large sets in each case consist of a 21x18-inch, horizontal high-speed engines of the piston valve, side crank type, manufactured by the Harrisburg Foundry & Machine Works, of Harrisburg, Pa., and a 120-volt direct-connected multipolar Crocker-Wheeler generator. One of the other two dynamos is also a Crocker-Wheeler direct coupled to a 16x16-inch Harrisburg engine of similar construction, with a speed of 250 revolutions under 125 pounds steam pressure per square inch. The fourth set is composed of a 50-kilowatt Siemens & Halske generator, driven by a 12x12-inch engine, made by the Ames Iron Works, of Oswego, N. Y.

These dynamos furnish current to a two-wire lighting and power system combined. The arc lights are operated on the same voltage as the incandescent lights, namely, 110 volts. They are of the Manhattan 1,200-candle-power enclosed type. On the first floor there are 18 points of distribution and nine risers lead upward to the floors above. A separate riser is provided for a sign directly over one of the wells on the roof and another is run to the soda water fountain on the second floor, there supplying a number of arc lights under a stained glass dome. From four to five incandescent lights are provided for each show case and incandescent lights are also placed installed on floor columns. In the latter instance brackets are introduced and clusters of lamps attached. The aisles in the building are lighted by the arc lamps, while the courts in the interior of the structure are illuminated by a bank of incandescent lamps at each story. On the Broad street and New street fronts the show windows are supplied with numerous incandescent lights, with Frink reflectors, placed at a distance of from 8 to 10 feet apart, and on the Halsey street windows the same illumination is provided for a distance of 60 feet. The Broad street entrance is furnished with crystal dish lights, and in the vestibule there is also a row of 118 incandescent lamps arranged to shine through rosettes. The music hall on the second floor is supplied with about 250 amperes for incandescent lighting and a separate riser has been installed for this system.



View of the Rear of the Switchboard.

The power apparatus consists of a 5-horse-power Crocker-Wheeler motor, which is employed to run the merry-go-round, and a 10-horse-power motor of the same make for the running of an escalator, which travels from the center of the main floor near the rear court to the second floor. Power is also taken for the operation of 15 sewing machines on the fourth floor, where a small motor drives a line of shafting to which they are belted. Two package carries are also run from an electric circuit.

The switchboard, a photograph of the back of which is reproduced, consists of five panels of white Italian marble, two of which are occupied by generator accessories, a central panel by a recording wattmeter, a clock and several switches, and the remaining pair of panels by the main distributing switches. Circuit breakers of the I. T. E. type manufactured by the Cutter Company, of Philadelphia, two of them being of 1,600 amperes capacity for the large machines, and 800-amperes for the 100-kilowatt generator and one of 400 amperes for the Siemens & Halske generator, are contained on the board. Four pilot lamps, four Weston ammeters and two Weston voltmeters are provided for the generator panels. The rear of the switchboard shows the positive and negative bus-bars, the reverse side of four rheostats and the arrangement of all switches. It will be noted that fuses are inserted in the feeder circuits mounted on panels on the rear of the board and that all cables are connected to the switchboard connections at the floor.

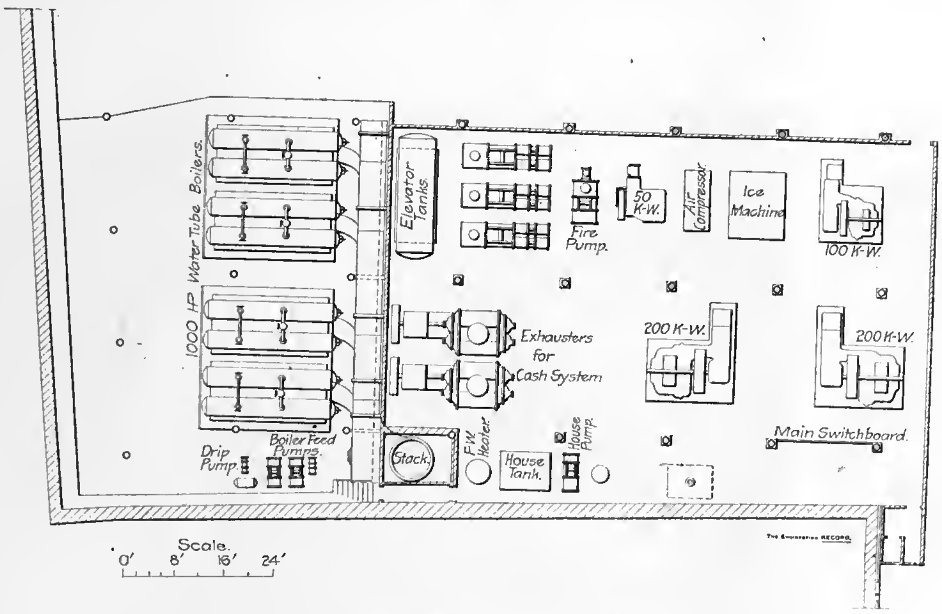
There are 13 hydraulic elevators in the building, which were furnished by the Plunger Elevator Company, of Worcester, Mass. Three compound Deane pumps, each 14x20x18 inches in size, a surge tank, and a pressure tank are installed in the engine room. The pumps receive water from the surge tank 6½ feet in diameter and 13 feet long, and discharge into a pressure tank, 18 feet long and 6 feet in diameter suspended above the former, by straps and wrought iron hangers; a pressure of about 150 pounds per square inch is maintained. The elevators travel at the rate of 400 feet per minute through a total lift of 60 feet, and have a carrying capacity of about two tons.

A complete fire system has been installed in the store, which comprises a sprinkler arrangement and the usual pumping outfit. In both cases artesian well water is used which is raised to the surface and discharged into a cistern beneath the basement floor by a Blake air compressor 10x12x12 inches in size. From this cistern the water is pumped to three tanks on the roof, each of which is capable of holding about 20,000 gallons. The pump in use for the latter purpose is 18x10x12 inches in size and was furnished by the Snow Steam Pump Works, of Buffalo, N. Y. A standpipe connects the tanks with the supply pipes of the sprinkler system, which was supplied by the General Fire Extinguisher Company, of New York. An additional fire underwriters' pump, located in the basement, connects with fire apparatus throughout the building.

Artesian well water is also used in the refrigerating plant for condensing purposes. This plant operates on the ammonia compression system, and a compressor made by the Remington Machine Works, of Wilmington, Del., is installed. A submerged condenser is used and one ton of ice is made per day. The various departments in which refrigeration is required have already been enumerated, the drinking water being circulated by a 1¾x2½x5-inch pump supplied by the same company and located near the other apparatus. The fur storage room is kept at a temperature of 25 degrees Fahrenheit, the ice boxes at 30 degrees and the drinking water at 45 degrees.

In addition to the general apparatus mentioned there is a cash carrier system and two Wilbraham Baker Blower Company's exhausters driven by vertical engines produce a suction in the carrier tubing to which they are connected of about 2 pounds below atmospheric pressure. A two-pipe steam heating layout serving about 10,000 square feet of direct radiation, warms the building in the winter months, and throughout the building Johnson thermostats are used for temperature regulation. Steam piping in all cases is insulated with magnesia covering made by the H. W. Johns-Manville Company, of New York.

The architect for the store was Mr. Goldwin Starrett, of the Thompson Starrett Company of New York. The mechanical plant was designed by Messrs. Osterberg & Sutton, of New York, and the electrical plant by Mr. H. D. Babbitt, of the Thompson Starrett Company, which was the contractor for the engines, dynamos, switchboard and electrical apparatus. Mr. Benjamin F. Pangborn is the chief engineer for Messrs. Hahne Brothers.



Plan of the Mechanical Plant.

A Complication of Water Rights.

In 1852, the first settlement of Herriman, Utah, was made at a place where a small stream, Butterfield Creek, afforded water for irrigation and domestic purposes. Later the water users incorporated the Herriman Irrigation Company to control the use and distribution of the water, all of which had been appropriated by them. The entire flow of the stream was thus used until 1894, when George W. Keel and his associates put in a headgate on the creek about two miles above the company's point of diversion, and diverted about half the water then passing down the channel. This appropriation has continued to the present time and has been the cause of prolonged litigation, which is of interest to all hydraulic engineers and managers of water-works. The appropriation of half the flow of the creek was based on the fact that Keel and other defendants in the suits had, prior to the diversion of any water by them, driven two mining tunnels on their own land, the Queen tunnel, about 2,900 feet long, and the Butterfield tunnel, about 8,200 feet. A large amount of water was encountered in these tunnels and allowed to flow into the creek, and it was only this water that the defendants appropriated, according to their claims. The company claimed that the water developed by the tunnels came from the sources feeding springs which yielded part of the flow in the creek, and that these springs had been dried up by the tunnels. On the other hand the owners of the tunnels pointed to various springs still flowing in the vicinity of those said to have existed prior to the driving of the tunnels, and asserted that if any springs had ceased to flow the cause was to be sought in the reduced annual rainfall and the destruction of forests. The evidence was held by the courts to show that the water comes from the Butterfield tunnel 5,500 feet and farther from its portal, and that there was no indication of any channel between the tunnel and the springs said to have been affected by it, one to one and a half miles distant. Such a state of affairs has all the elements of vigorous controversy as to both facts and law, and it is not surprising that it has produced prolonged litigation. The latest decision of the Utah Supreme Court, 90 Pac. Rep., 719, contains references to a number of legal points not particularly interesting to engineers, and these are omitted in the following condensation of the opinion, which was written by Judge Bartch.

The first technical point to be settled by the court of appeals was a question of fact, whether or not the tunnels caused the drying of springs that fed the creek. Judge Bartch was unable to find any proof to support a claim that the tunnel had such an effect. It was shown that the springs, which, it is claimed, have ceased to flow, are from a mile to a mile and a half from the tunnels. Butterfield canyon extends in a direction substantially east and west, and the tunnels are located on the north side of the canyon and extend into the mountain on that side. The timber and undergrowth which formerly retarded the melting of the snow and retained the moisture have been removed and destroyed. The country in that vicinity appears to be stratified, and there is evidence tending to show that the dip of the stratification is towards the north, and that consequently, on the north side of Butterfield canyon, the waters sink into the soil and rocks, and are carried by the stratification along the bedding planes in the opposite direction from Butterfield creek. Messrs. C. L. Stevenson and A. F. Doremus, after explaining the topography of the country in question, each testified in the trial court that in his opinion, after an examination of that section of country lasting for a period of 10 days, the springs were not affected by either tunnel, Mr. Stevenson stating that it was a physical impossibility for the springs to be dried by the tunnels. Mr. Doremus also stated that he "saw nothing to indicate springs had dried." Other testimony of like nature was presented, and the trial judge visited the tunnel and site where the springs were said to have existed and came away convinced that the opinions of Messrs. Stevenson and Doremus were correct. Hence, although conflicting testimony was given by the company's witnesses, Judge Bartch held that the trial court was justified in holding that the tunneling operations had not affected the springs.

If, however, notwithstanding the evidence in support of the finding, it were admitted that it was unwarranted, still such admission could not avail the appellant, the irrigation company, as will be observed upon further consideration of the facts and of the law applicable to them. This is so because the trial court further found: "That the waters that came into said tunnels during the prosecution of the work therein, and that have since and that now come into them, are waters percolating from the surface into the rocks, and through the cracks, fissures, and seams in said rocks, till they find an outlet into the tunnels through innumerable small spaces, through which the waters flow and drip into said tunnels. At no time before or during the making of said tunnels, or since, did any of the waters coming into said tunnels flow underground in streams that were known to exist, or that could be discovered, or that had well-defined channels with beds and banks; but said waters, before the making of said tunnels, were caused by rains or melting snows entering the surface of the ground and percolating through the rocks, where they either remained stationary, or moved in the rocks through the small cracks, fissures, and seams therein, and in courses and directions unknown and that were not then and are not now visible to observation; and their existence and course is only a matter of theory and speculation."

The evidence absolutely fails to show that any known and well-defined subterranean streams connected the springs with either of the tunnels. There is no evidence whatever showing that any one, before the driving of the tunnels, knew how the water existed in that mountain—whether it was percolating through soil and rocks, running in streams, or was motionless. There were no surface indications of channels or streams, or of any body of water, where the tunnels were located. Not until the tunnels cut the water-bearing strata did any person, so far as shown in the evidence, pretend to know that the water existed there in streams, and that those streams supplied springs a mile and a half distant. Nor were the tunnels driven for the purpose of developing a stream of water, or with any malice toward the appropriators of the surface stream. They were driven as a mining venture in the hope of finding ore. This was a legitimate enterprise, in which the owner of the land had the right to engage, and the water which he found, in digging the tunnels, where no known or defined streams existed, belongs to him as much as does the land itself; and this, even if thus, unexpectedly, in the nature of things, he gains an advantage over his neighbor. Such water, so hidden in the bowels of the earth, belongs to the owner of the soil, and he has the right to dig for it upon his own land and appropriate it and use it if he chooses to do so; and if thereby a loss results to his neighbor, it is damnum absque injuria.

Such right exists in the owner because, by the general consent of mankind, which is inferred from the very nature of the right, every owner of land is entitled to the natural advantages belonging to it. Water standing in the land underneath the surface, or passing through it, or into it, by filtration, percolation, chemical attraction, or in undefined and unknown streams, is such an advantage, which the owner of the land is left to enjoy. The law of surface streams does not apply to such water. If it were otherwise, no man would be safe in operating a mine, or even in digging a well, upon his land, for, by so doing, he might interfere with percolation, or cut an undefined stream hidden from observation, and thereby diminish or stop the flow of his neighbor's spring, and render himself liable in damages, however innocently the work might have been performed. The sequence would be the hindrance or prevention of improvements and progress. Where streams of water appear upon the surface, or in well-defined and known subsurface channels having beds and banks, there the owners of the soil over or through which they pass are bound to take notice of the rights of all others to the water; but, as to water of the nature of that developed by the tunnels in question in this case, the law is well settled that it belongs to the owner of the land; and where, as here, springs appear to exist, which flow into a surface stream, and they are not shown to be supplied by known or defined streams, the presumption is that they are formed by ordinary percolation. Such appears to be the settled law both in England and in this country.

In Cooley, Torts (2d Ed.) pp. 689, 690, the author says: "If one by an excavation on his own land draws off the subterranean waters from the land of his neighbor to the prejudice of the latter, no action will lie for the consequent damage. This is fully settled in England by the leading case of Acton v. Blundell, 12 Mees. & W. 324, and in a later case it is decided that prescriptive rights cannot be gained, in subterraneous waters, which will preclude such excavations on adjoining grounds as may draw them off. These decisions have been generally followed in this country, and it may be considered settled law that, if the well dug by one man ruins the well or spring of his neighbor by drawing off its water, it is damnum absque injuria. Probably, if the subterraneous water were a stream flowing in a well-known course it would be different, and one through whose land it flowed would be protected against its being drawn away from him. But one claiming rights in such a stream would be under the necessity of proving its existence and tracing it—not an easy task in any case."

So, in Gould, Waters, Sec. 280, it is said: "Water percolating through the ground beneath the surface, either without a definite channel or in courses which are unknown and unascertainable, belongs to the realty in which it is found. The rule that a man may freely and absolutely use his property so long as he does not directly invade that of his neighbor, or consequently injure his clearly defined rights, is applicable to the interruption of subsurface supplies of water or of a stream; and the damage resulting therefrom is not the subject of legal redress. The landowner may, therefore, make a ditch to drain his land, or dig a well thereon, or open and work a quarry upon it, or otherwise change its natural condition, although by so doing he interrupts the underground sources of a spring or well on his neighbor's land." In Kin. Irr., Sec. 49, the author says: "Percolating waters are those which pass through the ground beneath the surface without definite channels, although the same rules of law govern those which have definite channels but the course of which is unknown and unascertainable. Where there is nothing to show that the waters of a spring or well are supplied by any defined flowing stream, the presumption will be that they have their source in the ordinary percolations of water through the soil. Percolating waters, and those whose sources are unknown, belong to the realty in which it is found."

The Utah Supreme Court, in Crescent Min. Co. v. Silver King Min. Co., 54 Pac. 244, where water was developed by driving a tunnel for mining purposes, and after flowing from the tunnel was claimed by the plaintiff, said: "The waters issuing from the artificial tunnel into the lake are found to be underground, percolating waters from the mining claim of the defendant, and not waters naturally flowing in a stream with a well-defined channel, banks, and course. Under such a state of facts, the law seems to be well settled that water percolating through the soil is not, and cannot be, distinguished from the soil itself. The owner of the soil is entitled to the waters percolating through it, and such water is not subject to appropriation. The ordinary rules of law applying to the appropriation of surface streams do not apply to percolating and subterranean streams with undefined and unknown courses and banks." So, in Irrigation Co. v. Michaelson, 60 Pac. 943, it was said: "Water commingling with the ground or flowing through it by filtration or percolation, or by chemical attraction, is but a component part of the earth, and has no characteristic of ownership distinct from the land itself. In the eye of the law, water so commingled and flowing, or motionless, underneath the surface, is not the subject of ownership apart and distinct from the soil. If, however, subsurface streams of water flow in clearly defined channels, it is otherwise; for then the rules of law applicable to surface streams and waters apply."

The Supreme Court of Pennsylvania, in Haldeman v. Bruckhardt, 45 Pa. 514, says: "A surface stream cannot be diverted without knowledge that the diversion will affect a lower proprietor. Not so with an unknown subterraneous percolation or stream. One can hardly have rights upon another's land which are imperceptible—of which neither himself nor that other can have any knowledge. No such right can be supposed to have been taken into consideration when either the upper or lower tract was purchased. The purchaser of lands on which there are unknown subsurface currents must buy in ignorance of any obstacle to the full enjoyment of his purchase indefinitely downwards, and the purchaser of lands on which a spring rises, ignorant whence and how the water comes, cannot bargain for any right to a secret flow of water in another's land. It would seem, therefore, most unreasonable that the latter should have a right to prevent his neighbor from enjoying his own land in the ordinary way either by digging wells, cellars, drains, or by quarrying and mining." Then, after reviewing authorities, the court further says: "There are known streams to which, if the lower proprietor has any rights, they are perceptible, and require no subsurface exploration before their course can be defined. We are not, however, to be understood as intimating that an owner may maliciously or negligently divert even an unknown subterranean stream to the damage of a lower proprietor. But in the enjoyment of his land he may cut drains or mine or quarry, though in so doing he interfere with the flowage of water in hidden, unknown, underground channels."

In Frazier v. Brown, 12 Ohio St. 294, it was observed: "The law cannot properly limit the ordinarily absolute dominion of the owner of the soil, in respect to things concealed and hidden in the bowels of the earth, nor recognize an adjoining proprietor as having claims upon, or rights in, a thing passing under the surface of his neighbor's land, the existence of which was first revealed by the very act which would constitute the subject-matter of his complaint."

So, in Ocean Grove Camp Meeting Ass'n v. Asbury Park Com'rs, 3 Atl. 168, it was said: "The courts all proceed upon the ground that waters thus used and diverted are waters which percolate through the earth, and are not distinguished by any certain and well-defined stream, and, consequently, are the absolute property of the owner of the fee as completely as are the ground, stones, minerals, or other matter, to any depth whatever beneath the surface. The one is just as much the subject of use, sale, or diversion as the other."

The irrigation company further contended that the respondents abandoned the water flowing from the tunnels, by turning or permitting it to flow into Butterfield creek, and that, therefore, it was subject to appropriation the same as unappropriated water of a surface stream. On this point, the trial court found that "in turning the waters of the Queen and Butterfield tunnels into Butterfield creek, the Butterfield Mining Company did not intend to abandon the same or the use thereof, but intended to take the waters from the creek at some point further down, and to apply and use the same, before reaching the creek, for the purpose of milling its ores, when needed for that purpose." Counsel for the appellant insisted that the evidence is insufficient to support this finding, but, from an examination of the testimony, Judge Bartch held the finding was justified. It is evident that there was no intention on the part of the owners to abandon the water, and no adverse title had been acquired under the statute of limitations or by prescription. The owners of the land were also the owners of the water, and they had the right to use it or dispose of it in any legitimate way they saw fit. For the purpose of applying it to some proper use, the owners had, under the circumstances appearing in evidence, the right to turn it into the natural channel of Butterfield creek, and, after permitting it to flow therein for some distance, had the right to divert it again from such channel, if by so doing they did not divert more water, after making due allowance for evaporation and seepage, then belonged to them and did not interfere with any rights of prior appropriators of the waters naturally flowing in the said channel.

There appears to be nothing in the record which would warrant the position that the respondents were diverting more water than belonged to them, or that they unlawfully interfered with the rights of any prior appropriator. The mere turning of the water in the natural stream was not an abandonment of it, nor did such act prevent the owner from again claiming it. The burden, however, is upon him who turns water into a natural stream to show that he has not taken more out of it than belonged to him. This, according to the findings, was shown.

This opinion is concurred in by the other judges, except in one particular, but that is the important one as to the effect of the tunnels on the springs which formerly supplied water to the creek. In this respect the majority of the judges overrule the findings of the trial court and the opinion of Judge Bartch. They hold that while considerable water flows in the tunnels which has no appreciable connection with any surface supply, nevertheless some of the tunnel water comes from sources which formerly supplied springs now entirely dry or of greatly diminished volume. In view of the testimony by Prof. James E. Talmage, Mr. E. S. Hinckley and other geological and engineering witnesses for the irrigating company, the majority opinion of the court is that the mining interests are entitled to take from the creek only one-half the water entering it from the tunnels less 8 per cent. allowance for evaporation and seepage. The other half of the discharge from the tunnels is held to be water which would have reached the creek had the tunnels not been driven. The case was accordingly remanded to the lower court to be decided on these lines, the costs to be equally divided between the two parties.

Trade Publications.

The electrical supplies now handled by the H. W. Johns-Manville Co., New York, are so varied that the new catalogue covering them is a book of over 100 pages. It describes various insulating devices for line work, car fittings and dynamos and motors; switches, fuses and cut-out equipments; car heaters, insulated tools and insulating materials, all carefully indexed.

A new catalogue of pressure and volume blowers has been issued in attractive form by the American Blower Co., Detroit. Fans of many types and sizes are described, and there are useful tables of the loss in pressure in pipes, the relative capacity of ducts of different sizes and the weights of materials used in ducts.

Bucket elevators for lifting water are described in a folder from the Jeffrey Mfg. Co., Columbus, O. They are used in wells, for drawing water from streams for irrigating, and in other situations where horses are available for operating the lifts.

Two forms of pile drivers mounted on a turntable on a heavy flat-car are described in a special catalogue issued by the Vulcan Iron Works, Chicago. One of the cars is self-propelling and the other is not; both can be used with either a drop or a steam hammer. A lighter wooden driver mounted on a car, but not revolving on a turntable is described, and various sundries are illustrated.

An album of views taken along the New York subway has been prepared by the Carson Trench Machine Co., Boston. Twenty-two Carson-Lidgerwood cableways are used on the work for excavating and handling materials, and the illustrations show forcibly how little obstruction these plants offered to the traffic on the streets.

The Copper Cliff Mining Co., 79 Dearborn Bldg., Chicago, has prepared a well-illustrated description of the process and plant employed in making "CC" graphite paint. Starting with a naturally silicated graphite and linseed oil, the company makes a product for boiler fronts, steel stacks, steelwork in bridges and buildings, piping in refrigerating plants and other situations where the conditions are particularly trying.

Two new bulletins of the Fort Wayne Electric Works are No. 1,026 on enclosed direct-current series arc lamps, and No. 1,033 on integrating switchboard ammeters for single-phase currents. They give fully illustrated descriptions of the details of the devices mentioned.

The patents on the Kansas City wheeled scraper were purchased some time ago by the Smith & Sons Mfg. Co., Kansas City, Mo., which has used those of proved value, along with many new improvements, in the design of the Royal scraper which it has lately placed on the market. This is made in three sizes fully described in an elaborate catalogue just issued, together with drag scrapers and contractors' plows.

The recent publications of the General Electric Co., Schenectady, N. Y., include the following new bulletins: No. 4287, single-phase alternating-current 125-cycle generators; No. 4290, electric railway apparatus; No. 4291, compensated revolving field alternators; No. 4292, CE generators; No. 4293, constant-current transformer panels; No. 4294, the GE-73 railway motor. In addition to these bulletins the company has issued a pamphlet on the advantages of using oil in transformers; a beautifully illustrated description of lightning arresters, with an introductory chapter by Prof. Elihu Thomson on atmospheric electricity and lightning protection, which has engravings from a number of photographs of lightning flashes; and a large book describing all types of pumping machinery which have been driven by General Electric motors.

The U. S. Electro-Galvanizing Co., 346 Broadway, New York, describes in a new pamphlet the advantages of a system of cold galvanizing which it controls. A number of letters from licensees are given, some containing reports of interesting tests of the system.

A ventilator or cowl for discharging air from buildings is well illustrated in a brochure prepared by the Buffalo Forge Co., Buffalo, N. Y. This is so designed that a wind from any direction will draw air from the building.

The advantages of warm water and steam heating systems are outlined with unusual clearness in a little pamphlet from the Herendeen Mfg. Co., Geneva, N. Y. The discussion is wholly untechnical and written for the general public, yet it presents the merits of the Furman heating apparatus in a skilful manner indicating its preparation by some well-trained writer.

A 48-page list of many varieties of twist drills with taper, straight and square shanks and adapted for all services between those of a jeweler and the drill-press of a machine shop, has been issued by the Standard Tool Co., Cleveland, O.

The new catalogue of steam specialties made by the Lunkenheimer Co., Cincinnati, is a book of 208 pages profusely illustrated and well indexed. The list embraces brass and iron valves, injectors, whistles, lubricators, oil and grease cups, and steam specialties, and the book is so comprehensive and clearly written as to be invaluable to designers and owners of any class of steam plant.

Personal and Obituary Notes.

Mr. John M. Bruce has resigned as secretary of the Engineering Review Co., to become treasurer of the Judson A. Goodrich Co., New York City.

Mr. Alexander J. Taylor has resigned his position as sewer engineer for the Street and Sewer Department of Wilmington, Del., to take charge of street and sewer work for Mr. T. Chalkley Hatton. Mr. Francis R. Price, third assistant in the city surveying department, has been appointed his successor.

Edmund Phillips Hannaford, M. Am. Soc. C. E., died suddenly at his home in Montreal, P. Q., August 18. He was born in Devonshire, Eng., in 1834, and entered railway service in 1851 as draftsman. Until 1855 was a member of the engineering corps of the South Devon Railway and in the following year came to Canada. From 1857 to 1866 he was assistant engineer of the Grand Trunk Railway and was then appointed chief engineer of the Western Division. In 1869 he became chief engineer of the company and resigned from active work in 1896. Many new lines were constructed during this period of perhaps the railway's greatest development. In 1869 he was appointed chief engineer of the International Bridge.

Augustus Torrey, chief engineer of the Michigan Central Railroad, died in Detroit, August 20, from the results of an accident while on an inspection tour the day before. He was born in Beverly, Mass., in 1850, was graduated from the University of Vermont in 1872 and was first engaged by the Burlington & Lamoille Railroad, of which he was division engineer. He resigned in 1876 to become superintendent of the Burlington, Vt., water-works. In 1880 he joined the Michigan Central as assistant engineer and became chief engineer in 1892. During his administration he was prominently identified in matters of roadway improvement, introducing among other things a ballast-loading machine and a form of rail joint. He was the author of "Switch Layouts and Curve Easements." Mr. W. S. Kinnear, formerly superintendent of the Canadian division of the Michigan Central Railroad and latterly assistant to the general superintendent, has been appointed chief engineer, succeeding Mr. Torrey.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Atlanta, Ga.—Supt. of Water Wks. Park Woodward writes that the proposition to increase the capacity of the filtration plant is under consideration, but the Council has not yet made the appropriation for said improvement.

Newmans Grove, Neb.—At the special election held Aug. 19 the proposition to issue bonds for water works carried almost unanimously. Arnold C. Koenig, C. E., Omaha, Neb., is preparing the plans.

Gentry, Ark.—This vilage has granted a franchise to P. E. Miller for water works, which are to be constructed at a probable cost of $3,500.

Port Arthur, Tex.—City Secy. Jno. Roberts writes that J. C. McDowell, of Port Arthur, has been granted a franchise for the construction of a system of water works.

Oakland, Ill.—The Council is said to have appointed a committee to secure the services of a civil engineer to make surveys for proposed water works.

New York, N. Y.—Bids will be received by Robt. Grier Monroe, Comr. Dept. of Water Supply, Gas & Electricity, until Sept. 18 for furnishing material and building an engine, coal and boiler house for high service works at Jerome Park reservoir.

Graham, Va.—Bids are wanted Sept. 17 for constructing a water works system. O. A. Metcalfe, Town Recorder.

Grinnell, Ia.—Engr. in Charge H. H. Robbins writes that the contract for constructing a dam for the Grinnell Water Co. has been awarded to Coulson & Daley, Mt. Pleasant, Ia., for $4,957.

Dickinson, N. D.—L. A. Simpson, of Dickinson, who with A. Hilliard has the contract for the construction of a system of water works, writes that bids for said work will probably be asked about Oct. 1. Probable cost, $20,000.

St. Boniface, Man.—This town is reported to have voted to raise $100,000 to install a system of water works, and $15,000 for an electric light plant.

Hannibal, Mo.—It is stated that the Hannibal Water Co. is to make extensive improvements to its pumping station.

Philadelphia, Pa.—Bids will be received by the Dept. of Pub. Wks., Bureau of Water, until Sept. 12 for 20-in. cast iron water pipe for high pressure fire service and for an engine house, traveling crane and intake pipe for high pressure fire service. Wm. C. Haddock, Dir.

Yazoo City, Miss.—Bids will be received Sept. 8 for $175,000 water works, sewer and electric light bonds. E. J. Poursine, City Clk. Kirkpatrick & Johnson, of Jackson, Miss., Engrs.

Biloxi, Miss.—Bids are wanted Sept. 9 for furnishing and laying about 7 miles of cast-iron pipe, with hydrants and valves; also for relaying about 2 miles of wrought-iron pipe. For specifications address Kirkpatrick & Johnson, Engrs., Jackson, Miss. T. J. Roseli, Chmn., Biloxi.

Millvale, Pa.—Boro. Clk. C. W. Dankmyer writes that on Aug. 17 it was voted to issue $75,000 bonds to be used in the purchase of the Bennett water works and for the payment to the Bennett Water Co. of the amount of a verdict the company received recently against the Boro.

Baldwins, L. I., N. Y.—Bids are wanted Sept. 11 (readvertisement) for furnishing, constructing and erecting a pumping plant, with all appliances complete, at the Millburn Pumping Engine House, Baldwins; also for furnishing, delivering, erecting and connecting 2 boilers at the Millburn Pumping Staton, Baldwins, as advertised in The Engineering Record.

Durant, Ind. Ter.—Burns & McDonnell, Kansas City, Mo., have been awarded the engineering work for plans, specifications and estimates for a complete system of water works for this city.

Boston, Mass.—The following bids were opened Aug. 23 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a concrete and steel conduit and laying a 16-in. cast-iron water main at the Navy Yard, Boston: Aberthaw Const. Co., Boston, Mass., $45,039; Simpson Bros. Corporation, Boston, $43,300.

Adams, Mass.—Bids are wanted Sept. 2 for the purchase of $30,000 Adams Fire Dist. Water bonds. F. W. Spalding, Treas. Adams Fire Dist.

Findlay, O.—Bids are wanted Sept. 15 for the purchase of $150,000 water supply bonds. Frank C. Ray, City Clk.

Golden, Colo.—Bids are wanted Sept. 2 for $100,000 gravity system water bonds.

Weldon, N. C.—G. H. Coleman, of Portsmouth, Va., writes that the company which he represents proposes to construct a $35,000 water works plant at Weldon.

Colby, Wis.—City Clk. John J. Grimes writes that on Aug. 16 it was voted to construct water works and an electric light plant.

Ardmore, Ind. Ter.—City Clk. G. H. Bruce writes that a vote will probably be taken next fall on the issue of $175,000 bonds for water works.

Vernal, Utah.—S. R. Bennion, Pres. of the Ashley Valley Irrigation & Reservoir Co. recently incorporated with a capital of $50,000, writes that said company proposes to construct reservoirs, but plans and estimates have not yet been prepared.

Cleveland, O.—The contract for building a brick chimney on foundations provided by the city, at the Kirkland St. pumping station, has been awarded to U. H. Fath & Son, for $13,905.

Wilmot, S. Dak.—Town Clk. A. Minder writes that on Aug. 11 it was voted to construct water works at a cost of $8,000.

Manning, Ia.—Engr. in Charge A. Marston, of Ames, Ia., writes that the contract for constructing a water tower consisting of a steel tank about 60,000 gals. capacity, on a steel tower 100 ft. high, has been awarded to the Chicago Bridge & Iron Co., Washington Heights, Chicago, for $7,750.

Avon, N. J.—Engrs. in Charge Halsey & Logan, 164 Market St., Newark, write in regard to proposed water works and sewerage system, that an election will have to be held to authorize the issue of $70,000 bonds for said improvements, and therefore it will be at least 2 months before bids will be received for construction.

Fairmont, W. Va.—Bids are wanted Sept. 15 for improving the water works system, as advertised in The Engineering Record.

Portland, Ore.—Clinton C. Hutchinson, Pres. of the Oregon Irrigation Co., writes that it is proposed to irrigate 200,000 acres of land from Deschutes River at an estimated cost of $2,000,000.

Trenton, Mo.—City Clk. Stephen M. Hill writes that the City Council has given the Water Co. notice to furnish better water. This is all that has been done in relation to the matter up to the present time.

Chicago, Ill.—It is stated that bids are wanted Sept. 4 for water mains in a number of streets. J. A. May, Secy. Bd. of Local Improv.

Winnipeg, Man.—City Engr. H. N. Ruttan has submitted a report to the City Council recommending a plan for the improvement of the present water supply, at a cost of $12,000, which provides for the sinking of a well 15 ft. in diameter, a well 10 ft. in diameter and a drift or horizontal conduit 6½x6½ ft. for a distance of 200 ft. from well.

Dallas, Ore.—David Calbreath, of Independence, Ore., has submitted a proposition to the city officials to put in a system of water works.

Lidgerwood, N. D.—John Nuding, City Aud., writes that on Aug. 25 it was voted to issue bonds for the construction of water works.

Scotia, N. Y.—Papers of incorporation of the Scotia Water Wks. Co. have been filed with the Secy. of State. The capitalization is $10,000. The Directors are: W. H. Sanger, of New Rochelle; G. H. Russell, W. J. Hillis, of Albany, and others.

Phillipsburg, N. J.—The Lopatcong Water Co., principal office at Phillipsburg, has been incorporated, with a capital of $100,000. Incorporators: Geo. P. Elder, Wm. Prellwitz, Sylvester C. Smith, A. L. Scott, Jr., and others.

Fredericksburg, Va.—The Com. on Water has submitted to the City Council a report recommending improvements to the water works system to cost $8,000.

Havre de Grace, Md.—A. R. T. Lackle has prepared plans for a new system of water works, the supply to be brought by gravity from the hills several miles distant. The proposition to issue $60,000 bonds for said work will probably be voted upon at a special election.

Rockville, Md.—At a recent citizens' meeting the Town Council was authorized to borrow money sufficient to install new pumping machinery for the water works.

El Paso, Tex.—Local press reports state that the City Council has decided to ask for bids for a city water plant to be located on the mesa.

Colorado City, Colo.—Taxpayers and property owners in this city are said to be agitating the building of a municipal water plant.

Norwich, Conn.—The Bd. of Water Comrs. has engaged Chandler & Palmer to secure measurements, etc., regarding proposed changes at Fairview reservoir.

Covington, Tenn.—The Bd. of Aldermen has employed J. A. Omberg, Jr., of Memphis, to draw up plans and specifications for a water works plant to cost about $17,000.

Weiser, Idaho.—At the recent election it was voted to bond the irrigation district for $60,000 for the purchase and repairing and enlarging of Galloway ditch.

Spanish Fork, Utah.—The City Council has made an appropriation for the preparation of plans for a pure water supply for the city.

Wonewoc, Wis.—Bids will be received until Sept. 8 by the Village Clk. for furnishing and laying 7,781 ft. of 4, 6 and 8-in. cast iron pipe, 17 hydrants, 2 8-in., 3 6-in. and 1 4-in. valves and boxes, 5,910 lbs. of special castings, and 1 50,000-gal. concrete reservoir. W. G. Kirchoffer, Engr., Baraboo, Wis.

South Atlantic, N. J.—Bids will be received by the City Clk. until Sept. 15 for furnishing material and completing a water works system, work to include furnishing and laying 9,048 ft. of 4, 6 and 8-in. cast iron pipe, including 11 double nozzle fire hydrants, special castings and gate valves, and grading of standpipe lot; for furnishing and erecting a standpipe 12x100 ft., brick pump house and standpipe foundations, 8-in. driven well to depth about 850 ft., including 6-in. strainer and all other needed material and labor; for 1 gasoline engine and triplex pump, erected and including all requisite pipe connections, etc.

Fargo, N. Dak.—The City Council has under consideration the question of installing meters and a filtration plant.

Lynchburg, Va.—The Council Com. on Water has authorized the City Engr. to make a complete survey of a route for a pipe line from here to Piney River, in Amherst Co., a distance of 25 miles.

Shenandoah, Pa.—D. G. Adelsberger, of Baltimore, has prepared plans for a system of water works, the supply to be brought from the hills 4½ miles distant.

Sterling, Colo.—Government surveyors are said to be making a preliminary survey for a ditch to carry water from Platte River to the Great Pawnee reservoir, which it is believed the government will build. Estimated cost of ditch, $1,000,000.

Aiken, S. C.—Bids are wanted Sept. 10 for constructing and drilling an artesian well. Bids to be on an 8, 10 and 12-in. well. F. W. Wessels, Chmn. Water Wks. & Street Com.

Honesdale, Pa.—An ordinance has been passed by the Town Council granting permission to the Consumers' Water Co. to construct and maintain a system of water works.

Chardon, O.—Press reports state that the B. & O. R. R. proposes to build a 15,000,000-gal. reservoir at this place. J. M. Graham, Ch. Engr., Baltimore, Md.

Baraboo, Wis.—City Engr. Kircheffer estimates the cost of building a municipal water works plant at about $85,000.

Toledo, O.—Local press reports state that the Bd. of Water Works Trus. have decided to engage G. H. Benzenberg, of Milwaukee, and Allen Hazen, of N. Y., to act on the engineers' commission and thoroughly investigate the various means of supplying the city with pure water.

Mineola, L. I., N. Y.—The Nassau County Bd. of Superv. has granted the application of the Nassau Water Co., of Manhattan, for a franchise to operate in the town of Oyster Bay.

Memphis, Tenn.—Local press reports state that the Artesian Water Co. has had plans prepared for the addition of $1,500,000 worth of new equipment for the local plant in event a new contract is made with the Co. by the city of Memphis. Plans include the installation of a duplicate main, the installation of an auxiliary system in South Memphis and 10 miles of new mains. T. T. Johnson, of Chicago, Ch. Engr.

Ithaca, N. Y.—City Clk. A. G. Marion writes that the contract for supplying the city with water by hydrants, for fire purposes, for a period of 10 years has been awarded to the Ithaca Water Works Co., Ithaca, N. Y., at $40 per hydrant, and a stipulation in contract that prices for private consumers shall be reduced per schedule to be prepared.

Cheyenne, Wyo.—City Clk. E. A. Abry writes that the following bids were opened Aug. 21 for constructing masonry dam on Middle Fork of Crow Creek: W. C. Bradbury & Co., Denver, Colo., $59,180; Olson & Toovey, Denver, Colo., $97,810; Lusk & Co., Lusk, Wyo., $58,535; Smith, Thorpe & Co., Denver, Colo., $62,495; McGarvey & Bradley, Cheyenne, $66,050; R. P. McDonald, Denver, Colo., $69,730; John Gaffy, Denver, Colo., $57,825 (awarded); J. M. O'Rourke & Co., Denver, Colo., 63,815.

Natick, Mass.—Contracts for changes and improvements in the present water works system have been awarded as follows: 3,000,000-gal. vertical, cross-compound pumping engine, to Barr Pumping Engine Co., for $20,000; 18-in. cast-iron pipe, to M. J. Drummond, at $29 per net ton; brick pumping station, to E. T. Wilson, Natick, for $11,958; collecting well, 30-ft. in diam. and 30-ft. deep, to McClellan & Hennessy, Grafton, Mass., for $9,500; covering 4,000,000-gal. open reservoir with concrete groined arch roof, to F. A. Snow, Brookline, Mass., $24,642; new 18-in. force main, about 14,000 ft. long, is being laid by day labor; whole amount to be expended, about $120,000. F. L. Fuller, Engr., Boston; Geo. W. Travis, Supt. of Water Works.

SEWERAGE AND SEWAGE DISPOSAL.

Glassport, Pa.—Bids will be received by the Sewer Com. until Sept. 2 for constructing a 4½-ft. 2-ring brick sewer on portions of Broadway and Vermont Ave., and a 12-in. terra cotta sewer on a portion of Vermont Ave., and a 24-in. terra cotta sewer on a portion of Broadway. P. S. McMullen, Boro. Engr., Glassport.

Two Rivers, Wis.—Bids will be received by the Bd. of Pub. Wks. until Sept. 17 for furnishing material and laying 20,985 ft. of 8 to 20-in. pipe sewers, 15 manholes, 29 manhole flush tanks, 18 manhole catch basins, 48 inlets and 2 outlets, 4 catch basins, including connections, etc. Eugene Allie, Chmn.

St. Paul, Minn.—Bids will be received by the Bd. of Pub. Wks. until Sept. 2 for constructing sewers in portions of several streets (Lexington Ave. sewer system), length 6,300 ft.; estimated cost, $12,000. Bids will also be received at the same time for constructing a sewer in a portion of Lafond St. John S. Grode, Pres.

The City Engr. has placed the estimated cost of Mendota St. sewer system at $7,200.

Grand Rapids, Mich.—Bids will be received by the Bd. of Pub. Wks. until Sept. 19 for constructing a public sewer, as advertised in The Engineering Record.

Waterbury, Conn.—Local press reports state that bids will be received by the City Engr. until Sept. 9 for constructing sewers in portions of 3 streets.

East Liverpool, O.—Bids are wanted Sept. 3 for the construction of 10-in. and a 6-in. sewer on West Market St.; also a 10-in. sewer on E. 7th St. and a 6-in. sewer on Green Lane, with necessary laterals, manholes and flush tanks. F. H. Croxall, Secy. Bd. of Sewer Comrs.

Cleveland, O.—Bids are wanted Sept. 17 for the construction of sewers in several streets. Chas. P. Salen, Dir. of Pub. Wks.

Terre Haute, Ind.—Bids are wanted Sept. 3 by the Bd. of Pub. Wks. for the proposed sewer on 8th St.

Trenton, N. J.—Bids are wanted Sept. 2 for the construction of sewer No. 199, through Clinton Ave., Olden Ave. and other streets. C. Edward Murray, City Clk.

Avon, N. J.—See "Water."

Hico, Tex.—This city is considering the installation of a sewerage system.

Norristown, Pa.—Boro. Engr. S. C. Corson writes that contracts for sanitary sewers in 6 streets, in all 6,300 ft. of 8-in. mains and 4,500 ft. of laterals, have been awarded to McCoy & Moore, of Bridgeport, Pa., at 78, 94, 79, 81, 73 and 58 cts. for mains, 44, 80, 54, 41 and 45 cts. for laterals, and $120 for flush tanks.

Yazoo City, Miss.—See "Water."

Denver, Colo.—B. M. Hughes, Jr., Secy. Bd. of Pub. Wks., writes that the contract for constructing sanitary sewers in South Side Sewer Dist. No. 3, has been awarded to J. M. O'Rourke, Denver, for $11,581. The contract calls for 13,490 ft. of 8-in. pipe, 47 manholes and 11 flush tanks.

Irvington, N. J.—Bids are wanted Sept. 16 for building a sewerage system, as advertised in The Engineering Record.

Lebanon, Pa.—An ordinance is said to be before the Council providing for the issue of $500,000 bonds for street and sewer improvements.

Ft. Worth, Tex.—City Engr. John B. Hawley writes that the work of constructing a sewerage system in the 5th, 6th, 7th and 8th Wards, at an estimated cost of $30,000, will be done under his supervision.

Shenandoah, Ia.—Sewers are projected in several streets. Arnold C. Koenig, N. Y. Life Bldg., Omaha, Neb., Engr. in Charge.

Boston, Mass.—Supt. of Streets Donovan has awarded the contract for furnishing and installing 6 boilers at the sewer division pumping station, Calf pasture, Boston harbor, to I. P. Morris Co., of Philadelphia, for $24,960. There were but two bids, the other being by the Atlantic Wks., E. Boston, $33,000.

Grand Junction, Colo.—Press reports state that the city sewerage system will be extended to the Teller Indian school; 10,000 ft. of 8-in. pipe will be required.

Boston, Mass.—Bids are wanted by the Boston Transit Comn. until Sept. 4 for constructing side walls and sewer in State St., as advertised in The Engineering Record.

Dunmore, Pa.—The following bids for sewer construction are stated to have been received recently by the City Council: Donohue & O'Boyle, $67,638; M. J. Gibbons, Scranton, $74,534.

Ft. Snelling, Minn.—The lowest bid received Aug. 20 by Col. Geo. E. Pond, Ch. Q. M., St Paul, for the construction of a sewer system at this post, is reported to have been from John Hankinson at $5,694, with $4 per cu. yd. extra for blasting.

Ardmore, Pa.—All bids submitted on Aug. 4 for constructing the proposed sewer system in Lower Merion have been rejected by the Township Comrs. Modified plans, which have been adopted, reduce the cost of the sewer system $16,000.

Newark, N. J.—The contract for constructing Section 3, First Division of the West Branch of the Joint Outlet Sewer (bids opened Aug. 7) has been awarded to Costa Construction Co., Orange, N. J., for $107,020.

Baker City, Ore.—The City Council has under consideration plans and estimates for a sewerage system.

Spokane, Wash.—City Engr. Gill has placed the estimated cost of a sewer system for the 2d Dist. of the 4th Ward at $69,435.

Bradley Beach, N. J.—The Boro. Council has instructed the Boro. Engr. to prepare plans, specifications and estimates of cost of constructing a municipal system of sewers.

San Francisco, Cal.—Local press reports state that bids will soon be wanted by the Bd. of Pub. Wks. for the reconstruction of sewers in the district bounded by 5th, 7th, Howard and Brannan Sts. Estimated cost, $50,000.

Richmond, Va.—The City Engr. is making surveys for the new outfall sewer which is to cost about $35,000.

Weehawken, N. J.—The Township Com. has directed Township Engr. Bond to prepare necessary data in relation to the proposed sewerage system for the relief of the lower section of the town.

Eaton, O.—The City Council is considering the construction of a sewerage system. A rough estimate places the cost at $45,000 per mile.

New York, N. Y.—Bids will be received by Jacob Cantor, Boro. Pres., until Sept. 9, for furnishing material and building an outlet sewer into Harlem River, between 92d and 93d Sts., with alterations and improvements to existing sewers in Ave. A, between 92d and 93d Sts. and in 92d St., between Ave. A and 2d Ave. Engr.'s estimate: 150 ft. of 4-ft. wooden barrel sewer, Class I; 5 lin. ft. of 4-ft. brick sewer, Class II; 1,050 ft. of 4-ft. brick sewer, Class III; 582 lin. ft. of 4-ft. brick sewer, Class IV; 13 lin. ft. of 3-ft. 6-in.x2 ft. 4-in. brick sewer, Class V; 200 lin. ft. of 3-ft. 6-in.x2-ft. 4-in. brick sewer, Class VI; 1,000 cu. yds. of rock to be excavated and removed, 50,000 ft. B. M. of timber and planking for bracing and sheet piling, etc. Bids will also be received at the same time for furnishing material and constructing a sewer in 184th St., between Bway. and Amsterdam Ave. Engr.'s estimate: 371 lin. ft. of 3-ft. 6-in.x 2-ft. 4-in. brick sewer, Class I; 100 lin. ft. of 3-ft. 6-in.x2-ft. 4-in. brick sewer, Class II; 692 lin. ft. of 12 and 15-in salt-glazed, vitrified stoneware pipe sewer; 2,050 cu. yds. of rock to be excavated and removed; 5,000 ft. B. M. of timber for bracing and sheet piling.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Sept. 3 for constructing sewers and drains in a portion of Innes Ave. Geo. F. Holmes, Clk.

McKeesport, Pa.—Bids will be received by R. A. Hitchens, City Comp., until Sept. 2 for constructing 12 and 15-in. terra cotta sewers in portions of several streets.

Youngstown, O.—Steps are about to be taken to give the residents in the northern and eastern portions of the city increased accommodation in the way of sewer connections.

Clifton Heights, Pa.—Governor Stone has granted a charter to Gideon Boericke, Robert W. Emorton and Louis L. Tafel, for a corporation to be known as the Delaware County Sewer Co., for the purpose of the construction and maintenance of sewers, culverts, etc., for surface and under-surface and sewage drainage in the Boroughs of Clifton Heights and Aldan and vicinity.

Rochester, N. Y.—Engr. Geo. W. Rafter has been asked by the mayor to prepare plans for a sewage disposal plant at the Elmwood Ave. contagion hospital.

Pasadena, Cal.—The City Engr. is said to be making surveys for the outfall sewer, which is to cost $35,000.

Middletown, Pa.—See "Railroads."

New Orleans, La.—Geo. G. Earl, Supt. of the Sewerage & Water Bd., has recommended that the bid of John Dowdle at $349,932 be accepted for Contract B, main sewer work, provided that he will agree to permit such pipe sewer work as the Bd. may determine, to be done under his contract as extra work under the terms of the contract and the direction of the engineer. Most of the other sewerage contracts for which bids were opened Aug. 12 have been recommended for rejection as too high; new bids recommended to be asked.

New Britain, Conn.—Engr. Wm. H. Cadwell writes that the following bids were opened Aug. 18 for constructing Section 1 of the New Britain proposed disposal system, which includes building 31 filter beds complete, requiring the removal or handling of approximately 130,000 cu. yds. of materials, the laying of about 7 miles of underdrains, one mile of 24-in. main trunk feed sewer, 95 cu. yds. of rubble mason work, 2 screen chambers complete, ½ mile of effluent ditches, 1,000 cu. yds. of screened gravel for driveways, 4,500 sq. yds. of turfing, 19 manholes, etc.: Jas. F. Gaffney, Waterbury, Ct., $31,250; Edward Balf Co., Hartford, Ct., $42,952; Robt. D. Maynard, Springfield, Mass., $41,437; Long & Little, Leominster, Mass., $36,012; Bruno, Solomone & Petits, East Boston, $54,752; C. B. & F. A. Cadwell, New Britain, $42,686; Seymour & Newell, Springfield, Mass., $40,909. Contract awarded to Jas. F. Gaffney.

Hartford, Conn.—The following bids were opened Aug. 13 for sewer construction, the work to include 12,000 ft. of 10 to 24-in. pipe sewer and 40 manholes; the trench to average 12 ft. in depth and be excavated in gravel and clay: A, Seymour & Newell, Springfield, Mass., $31,582; B, Michael O'Neil, Hartford, $31,366; C, Chas. H. Slocomb, Hartford, $34,081; D, Smith & Price, Hartford, $35,801; E, Hartford Paving & Const. Co., Hartford, $29,546 (awarded). For detail bids see accompanying table:

Bidders.	24-in. tile.	20-in. tile.	18-in. tile.	15-in. tile.	12-in. tile.	10-in. tile.	Manholes.
A....	$3.45	$2.25	$1.60	$1.50	$1.50	$1.00	$42
B....	3.11	2.47	1.59	1.36	1.64	.74	45
C....	4.20	2.70	1.50	1.30	1.50	.85	40
D....	3.89	2.83	1.76	1.45	1.45	.90	50
E....	3.48	1.78	1.36	1.20	1.28	.85	45

BRIDGES.

Salem, Mass.—The Co. Comrs. have been petitioned to widen and improve the bridge across Crane River.

Chisholm, Minn.—Jacob Zimmerman, of Duluth, is reported to have secured the contract to construct a bridge across Lonyear Lake in this city, for $9,849.

St. Paul, Minn.—The Bd. of Aldermen has been petitioned to have the engineering department prepare plans and specifications for extending 3d St. bridge to Maria Ave. There is $65,000 available for this work, and it is stated that the total cost will be about $125,000.

Pasadena, Cal.—City Engr. Allin estimates the cost of constructing the proposed boulevard bridge across Arroyo Seco, about 800 ft. south of Madeline driveway, as follows: For a 210-ft. steel highway bridge, with 6-ft. sidewalks and 20-ft. roadway, $10,000; with a 30-ft. roadway, $16,000, and with a 40-ft. roadway, $25,000.

Mifflinville, Pa.—The King Bridge Co. is reported to have secured from C. H. Reimard, of Bloomsburg, the sub-contract for the superstructure of the Mifflinville bridge for $56,660.

Renfrew, Ont.—Thos. McLachlin is reported to have secured the contract to construct a bridge across Bonnechere River, Renfrew Co., for $16,500.

Pittsburg, Pa.—Frank H. Schwartz, Supt. of the Bureau of Construction, reports that the Point Bridge across Monongahela River is in an unsafe condition and that it will require $150,000 to repair it.

New Britain, Conn.—The construction of 2 concrete bridges, 1 at Chapman St. and the other at Plainville road, is contemplated.

Milwaukee, Wis.—Plans are being prepared for a bascule bridge to be built at W. Water St.

Bridgeton, N. J.—The Bd. of Freeholders is considering replacing the West Creek bridge with a stationary or draw bridge.

Buffalo, N. Y.—Bids are wanted Sept. 4 for constructing abutments and wing walls for Sprenger Ave. bridge. Francis G. Ward, Comr. of Pub. Wks.

Knoxville, Tenn.—J. C. Monday & Co., of Knoxville, are reported to have received the contract to construct the stone work on the Clinch River bridge, on the Knoxville, LaFollette & Jellico R. R., for about $60,000.

Allegheny, Pa.—Bids are wanted Sept. 9 for the construction and erection of the superstructure of a bridge on Shady Ave. over Woods Run Valley; also for the construction of piers and abutments for same bridge; also for paving the roadway and sidewalks of said bridge. John R. Murphy, City Recorder.

Downieville, Cal.—Bids are wanted Sept. 15 by Henry E. Quigley, Clk. Bd. of Superv., for a combination bridge with 8 piers.

Washington, Ind.—Thos. Harris, Clk. Daviess Co. Court, writes that at the election held Aug. 19 it was voted to construct a bridge over White River between Knox and Daviess Counties.

Anadarko, Okla. Ter.—Co. Surveyor Chas. H. Jones writes that the contract for constructing 5 steel bridges (bids opened Aug. 18) has been awarded to the Wichita Bridge & Iron Co., Wichita, Kan., for $13,621.

Harrisburg, Pa.—Local press reports state that the State Bd. of Property has decided to ask for bids for constructing 21 county bridges, which will replace structures swept away by the floods of last winter. It is stated that the cost of the bridges will range from $5,000 to $15,000 each. The following are reported to have been appointed as engineers in charge of construction: Emil Swenson, of Pittsburg, 1 bridge in Juniata Co. and 2 bridges in Lycoming Co.; H. Laub, of Pittsburg, bridges in Forest, Clearfield and Jefferson Counties; R. Bowman, of Mahanoy City, 1 Berks Co. bridge; A. J. Whitney, of Rome, a bridge in Bradford Co.; Oscar E. Thompson, of Phoenixville, on the following bridges: 2 in Bradford Co., 2 in Wyoming Co., 5 in Wayne Co., 1 each in Carbon, Luzerne, Sullivan and Lackawanna Counties.

Philadelphia, Pa.—The City Bureau of Surveys is reported to be contemplating the construction of an approach from the highlands east of Ridge Ave. to connect the proposed upper deck of the Falls bridge and also an approach to connect the upper deck with the River Drive.

Doylestown, Pa.—Ch. Webster, of the Bureau of Surveys, and the Co. Comrs. are considering replacing present stone structure at Frankford Ave. with a steel bridge with stone piers and approaches, at a cost of about $20,000.

Boston, Mass.—City Engr. Jackson has awarded the contract for building the three remaining masonry and concrete piers for Broadway bridge (bids received Aug. 27) to Holbrook, Cabot & Rollins, of Boston, at $35,969. There were five other bidders: Lawler Bros., $36,465; Jones & Meehan, $39,197; W. L. Miller, $38,643; Wm. H. Ellis, $44,556; John T. Cavanagh, $45,000.

Wilmington, Del.—Bids will be received by John G. Armstrong, Co. Comr., until Sept. 2 for constructing the superstructure of a steel highway bridge to consist of 1 span 54 ft. long, across Christiana River, 1 mile from Newark station.

Hackettstown, N. J.—The Co. Bd. of Freeholders has decided to replace the line bridge between Warren and Morris Counties with an iron bridge, to have an 80-ft. span and 20-ft. roadway.

Cleveland, Ill.—The building of a wagon bridge across Rock River at Cleveland, connecting Henry and Rock Island Counties, is being considered.

Dyersville, Ia.—The Clinton Iron & Bridge Co., of Clinton, Ia., is reported to have secured the contract to construct a bridge at Dyersville for $5,090.

Connellsville, Pa.—The Glenwood Bridge Co. has applied to the Baltimore & Ohio R. R. Co. for permission to construct a bridge, 1 mile long, across the Co.'s yard at Connellsville.

Brenham, Tex.—Press reports state that a $3,000 iron bridge across New Year's Creek has been washed away by the freshets.

Williamsport, Md.—The citizens of Williamsport have petitioned the Co. Comrs. to construct a bridge across Potomac River, connecting Williamsport with Berkeley Co., W. Va. It is stated that if the Co. Comrs. do not make an appropriation for the construction of said bridge, the citizens will endeavor to form a stock company and build a bridge at a cost of about $30,000.

Oklahoma City, Okla. Ter.—It is stated that the Choctaw Northern R. R. Co. has decided to build this fall a $20,000 viaduct across its tracks at Walnut St. F. A. Molitor, Ch. Engr., North Little Rock, Ark.

Syracuse, N. Y.—An agreement has been reached between the city and the officials of the D., L. & W. R. R., whereby the company is to move a portion of its coal sheds at the foot of Butternut St. to permit the city to extend the street across the canal. The wooden structure now there will be replaced with a steel trestle with supports, and the city has agreed to pay $5,000 toward the cost of removing sheds and constructing trestle.

Oakland, Cal.—Cotton Bros. & Co., of Oakland, are reported to have received the contract to replace Bay Farm Island bridge, at $19,000.

Luray, Va.—Bids will be received by the Town Council until Sept. 15 for stone and concrete masonry for bridge over Hawksbill Creek; 1 span, 105 c. to c., end pins, 18-ft. roadway. T. R. Campbell, Mayor.

Culpeper, Va.—Bids will be received by the Co. Bd. of Superv. until Sept. 3 for erecting 2 iron bridges. Address W. E. Coons, Clk.

Terre Haute, Ind.—Bids will be received by the Co. Comrs. until Sept. 20 for constructing a 70-ft. span bridge at 7th St., Harrison Township; a 30-ft. span bridge and a masonry bridge, both in Linton Township; and a 60-ft. span bridge in Pierson Township. Jas. Soules, Co. Aud.

PAVING AND ROADMAKING.

Mt. Clemens, Mich.—Local press reports state that the Council has asked for bids for repaving Cass Ave., Walnut St. and several other streets.

Dallas, Tex.—Local press reports state that bids have been asked for paving with asphalt on Commerce St.

St. Joseph, Mo.—Two new paved thoroughfares in the resident district are among the important contracts which, it is stated, are to be let in the near future by City Engr. Floyd, in compliance with ordinances passed and signed.

Glassport, Pa.—Bids will be received by the Boro. Street Com. until Sept. 2 for paving, grading and curbing Broadway. W. F. Sparks, Chmn.; P. S. McMullen, Boro. Engr., Glassport.

New York, N. Y.—Bids are wanted Sept. 9 for repairing and maintaining asphalt pavements, on numerous streets on which the original maintenance guarantee has expired. Engr.'s estimate, 15,000 sq. yds. of asphalt block pavement and 5,000 cu. yds. of concrete, including mortar bed. Bids will also be received at the same time for regulating and repaving portions of numerous streets. Engr.'s estimate, 74,790 sq. yds. of asphalt pavement, including binder course, 73,770 sq. yds. of stone pavement, to be relaid as foundation, or in approaches, etc., 37,041 lin. ft. of new curbstone, etc. Jacob A. Cantor, Boro. Pres.

Camden, N. J.—Bids will be received by Chas. H. Ellis, Jr., Chmn. Com. on Streets & Highways, until Sept. 2 for paving with vitrified brick on a concrete foundation portions of several streets.

Terre Haute, Ind.—Robt. H. Sparks, City Engr., writes that bids will be received until Sept. 5 for repairing the asphalt pavement on 5th and 7th Sts.

Grossepointe, Mich.—Bids will be received until Sept. 6 by the Township Bd. and Highway Comr. for paving with macadam on a portion of Jefferson Ave. Chas. Poupard, Highway Comr.; Thos. Campau & Son, Engrs., Rm. 3, Campau Bldg., Detroit.

Lawrence, Kan.—Sam P. Moore, City Clk., writes that bids will be received until Sept. 2 for paving with macadam, 8-in. thick, approximately 10,000 sq. yds. on Ohio St.; 5-ton roller. Holland Wheeler, City Engr.

Toledo, O.—Bids are wanted Sept. 8 for block paving in Crane Lane. Chas. H. Nauts, City Clk.

Connersville, Ind.—City Engr. Karl L. Hanson writes that the contract for 65,000 sq. ft. of cement sidewalk has been awarded to Chas., Jr., and Roy Williams, of Connersville, at 9½ cts. per sq. yd.

Alton, Ill.—Petitions are being circulated for the paving of Liberty, Grove and Common Sts. with brick, in all about 1 mile long. Property owners in Bloomfield St. have petitioned for brick sidewalks about 1½ miles in length.

Lebanon, Pa.—See "Sewerage and Sewage Disposal."

Kenosha, Wis.—A movement is said to have been started for the construction of a boulevard paved with macadam or asphalt between Kenosha and Racine. Total length, 8 miles.

New York, N. Y.—Bids are wanted Sept. 4 for the completion of the construction of Riverside Park and Drive, between 95th and 99th Sts., in connection with the 96th St. viaduct. Wm. R. Willcox, Comr. of Parks.

Cincinnati, O.—Bids are wanted Sept. 18 for repairing a portion of Race St. with asphalt; also for improving Huron St. by paving with brick. Geo. F. Holmes, Clk. Bd. of Pub. Service.

Baltimore, Md.—Bids are wanted by the Bd. of Awards Sept. 3 for grading, paving with Belgian block and curbing Henry St. B. T. Fendall, City Engr.

Bradford, Pa.—City Clk. E. C. Charlton writes that the contract for paving Sanford, Petrolia and Pearl Sts. with brick, has been awarded to Sheehan & McGhaw, for $20,000.

South Bend, Ind.—City Engr. A. J. Hammond has been directed by the Bd. of Pub. Wks. to prepare plans for paving the alley along the new city hall with sheet asphalt, bituminous macadam or rock asphalt.

Cedar Rapids, Ia.—Bids are wanted Sept. 5 for paving with macadam on a portion of 16th Ave. West. W. L. Cherry, Chmn. Pub. Improv. Com.

Leavenworth, Kan.—Bids are wanted Sept. 3 for 8,650 lin. ft. of artificial stone curbing, cost not to exceed 52 cts. per lin. ft. Bids will also be received at the same time for regrading and paving 4th St., requiring 19,063 sq. yds. of paving and 6,615 cu. yds. of regrading, cost not to exceed $1.47 per sq. yd. and 30 cts. per cu. yd. respectively. M. A. Przybylowicz, City Clk.

New Haven, Conn.—City Engr. Kelly estimates the cost of repairing East Chapel St. pavement at $10,500.

Peru, Ind.—The City Council has ordered paved with brick the alleys one square east and west of Broadway. Estimated cost, $20,000.

Utica, N. Y.—The contract for paving the eastern end of Broad St. has been awarded to the Barber Asphalt Paving Co. for about $11,500.

Linden, Tex.—The Commissioners Court has authorized the issue of $10,000 bonds for the improvement of roads and bridges in Cass Co.

Frederick, Md.—The contract for paving East Church St. with brick has been awarded to J. U. Fritchey, of Lancaster, Pa., at his bid of $1.97 per sq. yd. for Mack block, $1.12 per ft. for dressed granite curbing, 20 cts. per ft. for old granite curbing and 10 cts. per sq. yd. for repairing with old rubble stone; total, about $20,000.

Grossepointe, Mich.—The Township Bd. has awarded the contract for macadamizing Mack Ave. to Gilbert Moran & Co. for about $34,000.

Lincoln, Neb.—The Council has awarded the contract for asphalt surfacing in repaving Districts Nos. 14, 18, 19, 20 and 24, to the Green River Rock Asphalt Co. at $1.51 per sq. yd., with 10-year guarantee.

Peoria, Ill.—The contract for paving S. Adams St., nearly one mile in length, has been awarded to Thompson & Case for $38,388.

St. Mary's, O.—Thos. McKinney & Son, of Toledo, are reported to have received the contract for paving Wayne St., nearly a mile long, at their bid, which amounted to about $43,000. Logan brick to be used.

Monmouth, Ill.—The Council has passed an ordinance for constructing 13 blocks of brick and cement sidewalks.

Athens, Tex.—Representatives of the people of several counties interested, at a meeting held recently in Athens, pledged $500,000 with which to build a road from Palestine to Greenville.

Mexico, Mo.—The Council is said to be taking steps to pave certain streets with brick.

Menominee, Mich.—According to press reports the citizens have decided to pave several streets with brick.

Erie, Pa.—The contract for paving a portion of 21st St. has been awarded to Mayer Bros. at $1.97 per sq. yd. for sheet asphalt; maintenance, $12.50 per 1,000 yds. for 10 years; landmarks, etc., $5; 6-in. pipe at 45 cts.

Washington, D. C.—The Dist. Comrs. have determined to resurface East Capitol St. and other public thoroughfares.

Indianapolis, Ind.—The Western Construction Co. has been awarded the contract for a flint rock macadam roadway and curb in Shelby St. at $3.28 per lin. ft.

Nashville, Tenn.—A bill before the Bd. of Pub. Wks. provides for the appropriation of $39,400 to pave with bituminous macadam Summer, Carroll, Mulberry, Center, College and Market Sts., as recommended by Mayor Head.

Appleton, Wis.—A plan is on foot to macadamize the thoroughfare between this city and Menasha.

Buffalo, N. Y.—See "Electric Railways."

Cincinnati, O.—The City Engr. has been directed to prepare specifications for the resurfacing of a portion of 4th St. with sheet asphalt.

Hendersonville, N. C.—Bids will be received at the office of the Mayor until Sept. 12 for grading, curbing and paving, as advertised in The Engineering Record.

Bedford, Ind.—At the special election held in this township Aug. 16 it was voted to construct at once 36 gravel roads.

Atchison, Kan.—The Council has passed a resolution to grade, curb and pave with brick a portion of Santa Fe St.; 2,533 sq. yds. paving and 1,360 lin. ft. cement curbing.

Bids are wanted Sept. 2 for grading, curbing and paving a portion of 10th St.; 3,900 sq. yds. brick paving and 2,460 lin. ft. cement curb 5½x20 in. Fred Giddings, City Engr.

The City Engr. has been instructed to prepare plans for repaving Commercial St. with vitrified brick on concrete foundation. There will be required 18,700 sq. yds. of paving and a large amount of new curb.

Covington, Ky.—The Council has passed an ordinance providing for the paving of a portion of Pike St. with brick.

Muskegon, Mich.—City Engr. C. S. Gamble writes that the contract for paving Muskegon Ave., length 3,925 ft., has been awarded to the Barber Asphalt Paving Co. at $1.49 per yd. for Trinidad pitch lake asphalt and macadam 8 in. thick; 46 cts. per ft. for 7,231 ft. of cement curb and gutter. Total, $19,200.

Oskaloosa, Ia.—It is stated that bids are wanted Sept. 3 for 21,000 sq. yds. of brick paving, 10,000 ft. of curbing, grading, etc. C. Leighton, City Clk.

Spokane, Wash.—It is stated that bids are wanted Sept. 8 for paving, curbing and guttering of Main St. R. E. Clark, Secy. Bd. Pub. Wks.

Eureka, Cal.—It is stated that bids will be received by the Bd. of Superv. until Sept. 8 for constructing the Auger Road.

Niles, O.—It is stated that bids are wanted Sept. 18 for 3,200 lin. ft. of sandstone curbing and 7,000 sq. yds. of asphalt block pavement. Wm. Wilson, City Engr.

North Bend, O.—It is stated that bids are wanted Sept. 15 for $10,000 street improvement bonds and $10,000 sidewalk bonds. W. D. McClurkin, Hamlet Clk.

Janesville, Wis.—Bids will be received by the Street Assessment Com. until Sept. 20 for grading to a subgrade and surfacing with macadam on portions of several streets. Victor P. Richardson, Chmn.

Decatur, Ind.—It is stated that bids are wanted Sept. 4 for constructing Brushwood macadam road. Estimated cost, $5,600. Abe Boch, Co. Aud.

Green Bay, Mich.—It is stated that bids are wanted by the Com. on Streets until Sept. 16 for grading, curbing and paving with asphalt on Cherry St., requiring about 3,182 sq. yds. of asphalt pavement and 1,380 lin. ft. of curb and gutter.

Schenectady, N. Y.—Local press reports state that bids will be received by the City Council until Sept. 9 for paving a portion of College St.

Newton, N. J.—The Bd. of Chosen Freeholders has appropriated $20,000 for building macadam roads with State aid.

St. Louis, Mo.—Pres. Phillips, of the Bd. of Pub. Improv., estimates that not less than 125 miles of streets will be reconstructed or newly paved during 1903.

Boston, Mass.—City Engr. Jackson will open bids on Sept. 10 for building a telford macadam roadway in Oakland St. in the Mattapan Dist.

St. Paul, Minn.—Bids will be received by the Bd. of Pub. Wks. until Sept. 2 for paving with brick on a portion of Robert St. Estimated cost, $22,790. Bids are also wanted Sept. 2 for paving Ramsey St. with asphalt. R. L. Gorman, Clk.

Local press reports state that the following bids were opened Aug. 20 for paving W. 7th St. from Ramsey St. to Tuscarora Ave., 39,258 sq. yds., with sandstone. The first amount in each bid is the city's portion, the second amount the street railway's portion: P. M. Hennessy, $96,875, $11,900; L. G. Washington, $98,875, $11,465; James Forrestal & Co., $97,360, $11,670; Fielding & Shepley (awarded), $92,600, $10,600.

Paris, Ill.—City Engr. W. C. Lemen writes that the following bids were opened Aug. 14 for 15,200 sq. yds. of brick paving on concrete foundation, 2,000 lin. ft. of stone curbing, 6,100 ft. of combined curb and gutter, for Wood St.: A, D. W. Norton, $26,750; B, Troy Porter, $28,054; C, Morrisey & Lynch, $25,778; D, Wolf, Maupin & Curdie, $25,493; E, Thompson & Case, $25,320; F, Capitol Paving & Const. Co., $26,125; G, Geo. R. Grimes, $27,497; Engineer's estimate, $29,172. For detail bids see accompanying table:

Items and Quantities.	A	B	C	D	E	F	G
Excav., 8,500 cu. yds.	$.20	$.25	$.20	$.18	$.20	$.20	$.17½
Curb	.40	.45	.43	.40	.42	.36	.42
Curb reset, 600 lin. ft.	.12	....	.05	.05	.06	.08	....
Com. curb and gutter	.45	.50	.47	.44	.45	.43	.45
Poston block, 1-5	1.28	1.29	1.19	....	1.15	1.22	1.29
Poston block, 1-2-4	1.28	1.29	1.20	1.21	1.17	1.23	1.32
Terre Haute, 1-5	1.27	1.29	....	....	1.16	....	1.25
Terre Haute, 1-2-4	1.27	1.29	....	1.23	1.18	....	1.27
Clinton, 1-5	1.27½	....	1.19	....	1.15	....	1.29
Clinton, 1-2-4	1.29	1.29	120	1.23	1.17	....	1.32
Filler	.06	.10	.08	.08	.09	.10	.09
Storm inlets: Corners, 15	15.00	15.00	17.50	10.00	12.00	15.00	7.50
Intermediate, 7	15.00	15.00	12.50	10.00	10.00	15.00	7.50
Storm drains: 8-in., 1,000 ft.	.25	.20	.20	.20	.20	.15	.20
10-in., 1,100 ft.	.29	.20	.20	.23	.20	.20	.32
12-in., 1,475 ft.	.35	.20	.20	.25	.28	.25	.37

Atchison, Kan.—City Engr. Fred. Giddings writes that the following bids were opened Aug. 7 for paving, grading, curbing and culverting Main St. from 5th Ave. to 15th St.: A, Rackliffe & Gibson, St. Joseph, Mo., $99,584; B, C. Crawford, Atchison, $98,379; C, Chapin & Greever, Leavenworth, $101,638; D, Owen E. Seip & Co., Atchison, $98,678; E, Hanley, McGuire & Wise, Topeka, $99,537; F, Thos. Beattie, Atchison (contract awarded), $96,311. For detail bids see accompanying table:

Items and Quantities.	A	B	C	D	E	F
Brick paving: On 6-in. concrete, 12,623 sq. yds.	$1.53	$1.49	$1.52½	$1.51	$1.52	$1.48
On old macadam, 21,821 sq. yds.	1.15	1.14	1.18	1.14	1.18	1.13
Cement curb, 10,055 ft.	.63	.61	.63	.60	.64	.59
Grading, 29,666 cu. yds.	.41	.41	.44	.42	.43	.39
Curb reset, 235 ft.	.15	.18	.18	.11	.18	.15
Catch basins: No. 1, 2	19.00	16.00	14.00	17.00	18.00	15.00
No. 2, 8	22.00	18.50	21.00	18.50	21.00	17.50
No. 4, 4	25.00	20.00	24.00	22.00	23.00	20.00
No. 5, 2	27.00	23.50	26.00	24.00	25.00	22.50
Manhole covers, 2	5.50	7.00	7.00	8.00	7.00	5.00
Sewer, 12-in., 387 ft.	.44	.47	.46	.43	.46	.45
15-in., 188 ft.	.59	.56	.58	.53	.59	.55
18-in., 202 ft.	.87	.85	.88	.95	.89	.80
27-in., 106 ft.	2.15	2.15	2.25	2.00	2.20	2.00
36-in., 89 ft.	4.75	4.25	5.25	4.50	4.60	4.00
Curves, 12-in., 2	2.25	1.25	2.25	1.75	2.15	1.00
15-in., 1	2.75	2.75	3.00	2.80	3.00	2.50
18-in., 2	3.75	3.00	3.75	3.00	3.85	3.00
Brick sidewalk, 6,200 sq. ft.	.06	.06	.06¾	.05½	.06¼	.06
Brick sidewalk relaid, 856 sq. ft.	.02	.02	.02	.02	.02	.02
Oak plank, 1,180 ft. B. M.	.03	.03	.02¼	.02½	.02½	.03
Brick pavement relaid, 400 sq. yds.	.16	.15	.18	.15	.18	.10
72-in. culvert, 250 ft.	6.80	6.85	7.00	6.75	6.80	6.75
No. 90 cement concrete, 33 cu. yds.	4.25	4.75	4.35	4.25	4.15	4.50
Rubble masonry, 111 cu. yds.	3.95	4.25	3.90	3.75	3.85	4.00
Manhole, 1	36.00	35.00	35.00	32.00	37.00	35.00
Piling: Furnished, 10,944 ft.	.17½	.18	.17	.16	.16	.17
Driven, 11,664 ft.	.28	.29	.29	.29	.27	.28
Concrete, No. 1, 745 cu. yds.	6.95	6.85	7.00	6.45	6.50	6.75
No. 2, 2,548 cu. yds.	5.15	5.05	5.30	5.25	5.05	4.95
Riprap, 200 cu. yds.	3.00	2.75	3.00	3.75	2.75	2.50
Brick arch masonry, 192 ft.	43.00	43.00	42.75	42.00	41.50	42.00

Boston, Mass.—Supt. of Streets Donovan has received the following bids for paving Merrimac St., between Haymarket square and Causeway St., with granite blocks, pitch joints, and concrete base: Wm. J. Barry, $11,042; Wm. J. Rafferty, $9,397; Edw. J. Hayden, $13,076; Dan. E. Lynch, $13,279; Dan. J. Kiley, $11,731; P. McGovern, $13,490; J. J. Sullivan, $10,308; W. H. Ellis, $11,253; P. H. Bradley, $9,451; J. B. O'Rourke, $11,864; Benj. M. Cram, $12,079. Barnes-Ruflin Co., $10,033. Contract awarded to Wm. J. Rafferty.

Chanute, Kan.—City Engr. of Coffeyville, Kan., E. H. Ricksecker writes that the contract for paving Main St. with brick (bids opened Aug. 18) has been awarded to Stevens, Shulty & Co., Ft. Madison, Ia., as follows: Excavating, at 25 cts. per cu. yd.; crushed stone, $1.50 per cu. yd.; 5-in. curbstone, at 68 cts. per lin. ft.; paving complete, at $1.57 per sq. yd.; sewer pipe laid, 24-in. at $1.40, 18-in. at 75 cts., and 12-in. at 43 cts.; total, $22,181. Other bids received were as follows, prices given being per sq. yd. for paving, and total, respectively: R. S. Gilfellen, Ft. Scott, Kan., $1.85, $26,136; John Ritche, Topeka, Kan., $1.88, $26,560; W. A. Stuckey, Guthrie, Okla. Ter., $1.62½, $22,958; Ramsey & Ramsey, Topeka, Kan., $1.80, $25,430; W. M. Edwards, Kansas City, Mo., $1.87, $26,419; Hanly & McGuire, Leavenworth, Kan., $1.90, $26,843; O. C. Chapin, Leavenworth, Kan., $2, $28,250.

POWER PLANTS, GAS AND ELECTRICITY.

National Home, Wis.—Bids are wanted Sept. 22 for furnishing material and labor necessary for the extension of the electric light plant at this home. Cornelius Wheeler, Governor.

Somerset, Ky.—Mayor F. S. Griffin writes that this city will erect an electric light plant, or sell a franchise and buy light, the latter plan being preferred. It is desired to include franchise for the construction of cold storage plant and electric railway.

Colby, Wis.—See "Water."

Smyrna, Del.—Consulting Engr. T. Chalkley Hatton, of Wilmington, Del., writes that it is proposed to improve the electric light plant at a cost of $5,000. S. A. Anthony, Chmn. of Com.

Eureka, Kan.—The Council is stated to have granted the Eureka Gas & Mineral Co. a franchise for a term of 20 years. It is stated that probably 4 wells will be sunk this summer and gas will be piped to the town before winter.

Cape May, N. J.—The Cape May Light & Power Co. has been incorporated, with a capital of $150,000, by Edw. C. Brainard, Chicago; Edw. F. Mandeville, Camden, and Jas. M. E. Hildreth, Cape May, to operate an electric plant at Cape May.

Ephrata, Pa.—The citizens are stated to have voted Aug. 19 to issue $15,000 bonds for an electric light plant.

Jamestown, N. Y.—The Jamestown Lighting & Power Co. has been incorporated, with a capital of $100,000. Directors: Ernest L. Carr, Melrose, Mass.; Walter E. Griggs, Jamestown, and others.

Asti, Cal.—The Cloverdale Light & Power Co. is reported incorporated, with a capital of $100,000, to supply electric light and power in Cloverdale, Asti, Geyserville and other places. Principal office to be at Asti. Incorporators: A. Sbarboro and F. C. Rossi.

Laramie, Wyo.—The Council has granted Jay Burns, of Omaha, Neb., a franchise for a gas plant.

Chicago, Ill.—By the merging of the Northwestern and Cicero gas companies all the gas plants in Cook County outside of Chicago were brought under one ownership Aug. 20. The name of the new organization is the Northwestern Gaslight & Coke Co., and its capital is $10,000,000. The plans of the new company are to at once build a large central plant in Cicero, and for this purpose an issue of bonds has been authorized by the directors. Nelson A. McCleary, Pres., Chicago.

Williamsville, N. Y.—The Council is stated to have granted Lafferty & O'Donnell, of Bradford, Pa., a franchise to lay pipes and supply the town with natural gas for lighting and heating purposes.

St. Boniface, Man.—See "Water."

Dryden, N. Y.—The Village Trus. are stated to have selected an engineer to investigate the conditions here and make an estimate on the cost of establishing an electric light system.

Superior, Wis.—The Highland Canal & Power Co. is stated to have petitioned the Council for a franchise to set up its line and operate in this city.

Wheaton, Minn.—The Wheaton Electric Light Co., of Wheaton, has been incorporated, with a capital of $25,000. Incorporators: W. I. Gray, Minneapolis; F. W. Murphy and M. J. Jacobson, of Wheaton.

Cordelia, Cal.—The Bay Counties Power Co. is reported to be surveying a route from this point to Napa Junction, where the company will build a line to transmit electricity to operate the machinery in the cement works.

Baldwinsville, N. Y.—The Baldwinsville Light & Heat Co. has been incorporated, with a capital of $100,000, to manufacture and supply gas, natural and artificial, and to manufacture and supply electricity in Baldwinsville, Lysander and Van Buren. Directors: W. F. Morris, Jacob Amos, and others, all of Baldwinsville.

Ulen, Minn.—Village Recorder C. Paulson writes that at the election held Aug. 20 it was voted to construct an electric light plant.

Tucumcari, N. Mex.—Theo. W. Heman, Secy., writes that the Tucumcari Electric Light & Water Co. is now developing the water power and later will install an electric light plant. C. H. Rankin, Pres.

Barberton, O.—T. W. Shelton, of Akron, Supt. St. Dept. of Northern Ohio Traction Co., writes that said company proposes to construct a power and light plant in Barberton, at a cost of $15,000. There will be required 100 fuse boxes, 50 series a. c. arc lamps, 60 cycle on a 4,000 volt circuit, 16 miles 0 wire, 1,000 glass insulators, 200 meters, 100 transformers, etc. There will be no buildings, as the current will be furnished from the Akron power house.

Chicago, Ill.—Bids are wanted Sept. 3 for furnishing material and constructing a conduit on Halstead St. Edw. B. Ellicott, City Electrician.

Belleville, Ill.—The plant of the Belleville Gas Light & Coke Co. is stated to have been purchased by M. M. Stevens, L. D. Turner, Jr., and others, of East St. Louis, Ill. They propose making improvements and extending the gas mains and electric wires.

Big Stone Gap, Va.—It is stated that bids will be received about Sept. 12 for constructing an electric light plant, to cost $12,000. The plant is to have a capacity of about 50 arc and 750 incandescent lights. C. L. Hamblen, Mayor.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Sept. 6 for lighting the public streets, alleys, avenues and roads in the Dist. of Columbia during the year ending June 30, 1903, with naphtha lamps. Wm. Tindall, Secy.

Castile, N. Y.—The citizens are stated to have voted Aug. 26 to install an electric light plant, at a cost of $10,500.

Niagara Falls, Ont.—A press report states that the Ontario Power Co. will proceed at once to construct a temporary cofferdam at Dufferin Island on the Niagara River. A permanent structure will be placed inside the temporary dam, and the latter must be removed not later than June 1, 1903.

Yazoo City, Miss.—See "Water."

Indianapolis, Ind.—John W. and Edw. Schmidt, Proprietors of the Century Bldg., are about to make application to the Bd. of Pub. Wks. for a franchise to furnish electricity for light and power, steam and hot water for heating purposes and cold water in the district bounded by North, South, East and West Sts.

San Francisco, Cal.—The Tonopah Light & Power Co. has been incorporated, with a capital of $50,000. Directors: W. C. Watson, W. C. Waller, and others.

Flint, Mich.—Mayor Alvord is stated to have signed the ordinance granting the Pearce Construction Co., of Chicago, Ill., a franchise to construct and operate a light and heating plant.

Macon, Ga.—Local press reports state that bids will be received by the City Council until Nov. 1 for lighting the city with electric lights for a term of 5 years.

Honeoye Falls, N. Y.—The Ontario Gas Co. has been incorporated, with a capital of $50,000, to bore, drill and operate for petroleum and gas and also to lay and maintain pipe lines and supply gas for light, heat and power in the towns of East and West Bloomfield, Mendon and Lima and in the villages in these towns. Directors: A. Miner Wellman and H. A. Corbin, of Friendship, N. Y.; E. M. Lockwood, of Kansas City, Mo., and others.

ELECTRIC RAILWAYS.

Seekonk, Mass.—The Selectmen are stated to have granted a franchise to the Bristol County Ry. Co. D. A. Brooks, Mgr., 53 State St., Boston.

Salamanca, N. Y.—The Village Trus. are stated to have granted a franchise to the Salamanca & Little Valley Traction Co.

West Superior, Wis.—The Duluth-Superior Traction Co. is stated to have decided to extend its line from the steel plant in Superior to Billings Park, a distance of about a mile; also to erect an addition to its car barns in Duluth, to cost $15,000, and to erect a new car barn in Superior, to cost $30,000. It is reported also that numerous extensive improvements will be made at Duluth. C. G. Goodrich, Pres., Minneapolis, Minn.

Greenville, Pa.—The East End St. Ry. Co., of Sharon, is stated to have secured a franchise in Greenville.

Salt Lake City, Utah.—The Co. Comrs. are stated to have granted the Salt Lake & Utah Valley Ry. Co. a franchise to construct a street railroad from the city limits on the south at highway No. 17, along the Redwood road to Bingham Junction.

Nashville, Tenn.—The Nashville Ry. Co. is considering the extension of the Jefferson St. line 2 miles to connect with the W. Nashville line. N. P. Yeatman, Secy., Nashville.

Hamilton, O.—The Mill Creek Valley St. Ry. Co. is reported to have decided to extend its line from Hamilton to Middletown. W. G. Wagenhals, Mgr., Cincinnati.

Danville, Ill.—The Danville, Urbana & Champaign Ry. Co. has been incorporated, with a capital of $250,000, to construct an electric railway from Danville through Vermilion, Champaign, Piatt, Macon and Sangamon Counties to Springfield. Incorporators: Roy Wright, Urbana; Thos. G. Wood, Champaign, and others.

Pennington, N. J.—Wilbur F. Sadler, of Trenton, is reported interested in the construction of an electric railway between Pennington and Trenton.

Muncie, Ind.—The Muncie & Portland Interurban Ry. Co. (G. O. Driscoll, Pres., Muncie) is about to begin the survey and location of its road.

Somerset, Ky.—See "Power Plants, Gas and Electricity."

Saratoga, N. Y.—J. S. Mott & Son are making a survey for a trolley road from Saratoga to Schuylerville, a distance of 12 miles.

Bristol, Conn.—Boro. Clk. D. J. Heffernan writes that on Aug. 21 the Boro. Bd. voted to grant a permit to the Bristol-Plainville Tramway Co. to construct the Terryville extension.

St. Marys, O.—The Western Ohio Ry. Co. is stated to have decided to extend its line from St. Mary's west through Rockford and Ohio City, Ind., to Decatur and Ft. Wayne. F. D. Carpenter, Gen. Mgr., Lima, O.

Paris, Ky.—The Bourbon Co. Comrs. are stated to have granted the Bluegrass Traction Co. a franchise for an electric railway between Lexington and Paris.

Cazenovia, N. Y.—Jas. R. Barrett, of Cazenovia, is stated to have petitioned the Village Trus. for a franchise.

Charlestown, W. Va.—A charter is stated to have been granted to the Charlestown, Berryville & Winchester St. Ry. Co. to construct an electric railway to connect the places mentioned; capital, $500,000. Incorporators: Geo. E. Yester, Hagerstown, Md.; R. P. Chew, Charlestown, and others.

Andover, O.—The City Council is stated to have granted a franchise to the Conneaut Southern Electric Ry. Co.

New Castle, Pa.—It is stated that the New Castle Traction Co. will extend its Pittsburg line a mile toward the city limits.

San Bernardino, Cal.—The San Bernardino Power Co. is reported incorporated, with a capital of $300,000, to construct and operate an electric railway north on E St. from 3d and then to Highland. Directors: W. E. Harris, S. F. Kelley, and others.

Riverside, Cal.—H. A. Duryee, representing the San Bernardino Traction Co., is stated to have secured a franchise for an electric railway.

Buffalo, N. Y.—The Crosstown St. Ry. Co. is stated to have secured from State Engineer Bond a permit for the construction of a double track in the Hamburg road, from the crossing of the Buffalo, Rochester & Pittsburg tracks to Limestone Hill. The company is to macadamize the road 12 ft. on each side of its rails. Benj. Franklin, Pres., Buffalo.

Hoosick, N. Y.—The Highway Comrs. are stated to have granted the Bennington & Hoosac Valley Ry. Co. permission to extend its line through the town of Hoosick, a distance of about 12 miles. E. H. Libby, Supt., Hoosick Falls.

Trenton, N. J.—The Camden & Trenton Traction Co. is stated to have petitioned the City Council for permission to extend its line into the center of this city. M. B. Perkins, Mgr., Beverly.

Sharon, Pa.—The Sharon & West Middlesex St. Ry. Co. has been incorporated, with a capital of $50,000, to construct a line 4 miles in length. R. Montgomery, Pres., Youngstown, O.

Memphis, Tenn.—Right of way is stated to have been secured by the Memphis St. Ry. Co. for a line from Avery Ave. to the new East Park, a distance of about 1½ miles. F. G. Jones, Mgr., Memphis.

Carlisle, Pa.—A charter is stated to have been granted to the Cumberland & Perry Electric Ry. Co. to connect Carlisle and Loysville by trolley, a distance of about 20 miles; capital, $120,000. Incorporators: E. J. Gardner, T. J. Parmly, and others, all of Carlisle.

Sterling, Ill.—The Sterling, Dixon & Eastern Electric Ry. Co. is reported organized to construct an electric railroad in Sterling and Dixon and between the two cities, also covering Rock Falls. Henry C. Higgins, Neenah, Wis., and T. F. Springfield, of Rochester, N. Y., are among the incorporators.

Reynoldsville, Pa.—The Jefferson St. Ry. Co. has been incorporated, with a capital of $65,000, to construct a line from Reynoldsville through Wishaw to Big Run, a distance of about 8 miles. J. A. Whitman, Pres., Punxsutawney.

Wellsville, Pa.—The Wellsville St. Ry. Co. has been incorporated, with a capital of $24,000, to construct a line from Dover to Wellsville, a distance of 4 miles.

Brookfield, Mo.—Hugo Platt and Gus Gammon, of Brookfield; R. C. Clark, of Fayette, and others, are reported interested in the construction of an electric railway from Brookfield to Cuivre Junction, a distance of about 175 miles.

Ft. Wayne, Ind.—The Ft. Wayne, Logansport & Lafayette Traction Co. has been incorporated, with a capital of $1,000,000, to construct an electric railway between Ft. Wayne, Huntington, Wabash, Peru, Logansport, Delphi, Lafayette, Roanoke and Andrews. Directors: Geo. F. McCulloch, Horace C. Stillwell, and others.

Dillsburg, Pa.—The Dillsburg & Allen Electric St. Ry. Co. has been incorporated, with a capital of $50,000, by Peter Sidle and Geo. W. Cook, Dillsburg, and J. C. Hutton, Harrisburg. The road will be 6 miles in length and run from Dillsburg to Beavertown, Williams Grove, Kunkels Mill and Allen or Churchtown.

RAILROADS.

Portuguese East Africa.—The Minister of the Marine and Colonies, Lisbon, Portugal, will open bids Oct. 8 for the first two sections of the Benguella Ry. The work embraces 61,545 m. of 1-m. track, a wharf and 25-ton traveling crane. Full details were printed in the "Diario de Governo" of Aug. 2, probably on file at the Portuguese Legation, Washington.

Fredericksburg, Va.—The Fredericksburg & Rappahannock R. R. Co. is reported to have a corps of engineers at work surveying the line through Stafford County to this city. This road will run from Washington, Va., by way of Culpeper, to Fredericksburg.

Blackhawk, Miss.—A charter has been granted to the Cotton Growers' Ry. Co. to construct a line from Blackhawk to Greenwood and Itta Bena. Incorporators: H. G. Kichell and Wm. A. Green.

Iuka, Miss.—The St. Louis, Mississippi & Alabama R. R. Co. has been incorporated to construct a railroad from Eastport, Miss., to Tuscaloosa, Ala. Incorporators: J. A. Pyle and L. F. Carmack, of Iuka.

Joliet, Ill.—It is stated that the Joliet & Western R. R. is to be extended from Joliet to Blue Island; it is also proposed to build a branch to Morris, extending to the Wilmington coal fields.

Murphysboro, Ill.—The Illinois Central R. R. Co. is reported to be considering the construction of a second line through Murphysboro to connect with the East St. Louis division. The company is also reported to be securing rights of way and preparing to build a new connecting link between Ebenezer, Miss., and Howard. W. J. Harahan, Ch. Engr., Chicago.

Richmond, Cal.—The Richmond Belt R. R. Co. has been incorporated, with a capital of $500,000, to construct a railroad from the Pacific Coast Oil Co.'s tanks at Richmond along the shore line to Point San Pablo. Directors: Wm. S. Tevis, Bakersfield; J. V. de Leveaga and Horace D. Pillsbury, of San Francisco, and others.

Ashland, Ky.—A charter is stated to have been granted to the Sandy Valley & Elkhorn R. R. Co. to construct a railroad from Ashland to Pond Gap, a distance of about 56 miles.

Middletown, Pa.—A press report states that the Pennsylvania R. R. Co. has in contemplation the following improvements for Middletown: Construction Union St. subway, to cost $25,000; Wood St. subway, to cost $25,000; and Catharine St. subway, to cost $10,000; a new station, to cost $15,000, and sewerage of streams, to cost $10,000. W. H. Brown, Ch. Engr., Philadelphia.

Chicago, Ill.—Bids will be received by McArthur Bros. Co., of this city, for 32 miles of heavy R. R. work, extending from St. Louis down the Mississippi River to Crystal City. Approximate quantities: Earth excavation, 1,500,000 cu. yds.; rock excavation, 500,000 cu. yds.; masonry, 20,000 cu. yds.; piling, 1,500,000 lin. ft.; timber, 2,000,000 lin. ft.

New Castle, Pa.—A press report states that the Pittsburg & Western, a branch of the Baltimore & Ohio, is to be reconstructed at once from New Castle to Akron, O. An extra track is to be built for some distance, and new yards established at New Castle. Some of the contracts for this work have already been let. The improvement at New Castle and between New Castle and Akron will cost about $4,000,000. H. O. Dunkle, Div. Supt., New Castle.

PUBLIC BUILDINGS.

Cincinnati, O.—Bids are wanted Sept. 2 for putting in hot water heating apparatus in the new station and patrol house in the 3d Police Dist. W. H. Harrison, Clk. Bd. of Police Comrs.

Lisbon, O.—Bids are wanted Sept. 15 for the erection of a village hall. Lodge Riddle, Village Clk.

Sewickley, Pa.—The Boro. Council will receive competitive plans for the erection of a municipal building, to cost not more than $40,000. For particulars address D. H. Campbell, Boro. Engr.

Concord, N. H.—Plans for the new city hall will be ready for inspection in a few days.

Camden, N. J.—Fred. W. George, Clk. of Camden Co., writes that certain architects will submit competitive plans for a court house to cost $550,000. Irving Buckle, Chmn. Bldg. Com.

Philadelphia, Pa.—Jesse R. Pharaoh, 1638 N. Carlisle St., is stated to have secured the contract for erecting the Bethlehem Evangelical Lutheran Church on Diamond and 30th Sts., for about $55,000.

Mt. Angel, Ore.—J. Jacobberger, of Portland, is stated to have completed plans for an addition to the building of the Benedictine Fathers, which will cost about $65,000.

Pittsburg, Pa.—The Directors of the Convent of the Good Shepherd are stated to have approved plans for a new home in the East End. A $60,000 building will be erected in the spring.

Massillon, O.—R. H. Turner & Co., of Zanesville, are stated to have secured the contract for erecting 6 new cottages at the Massillon State Hospital, for $149,937.

New York, N. Y.—Plans have been filed at the Bureau of Bldgs. for three 2-story brick public baths, one to be erected on 109th St. to cost $80,000, one in Allen St. to cost $70,000, and one in 41st St. to cost $75,000. Architects, York & Sawyer, 156 5th Ave.

Plans have also been filed for a 2 and 3-story stone church and parsonage to be erected on 137th St. and Brown Pl. to cost $60,000. Rev. A. Arthur King, Pastor, 143 St. Ann's Ave. Architect, Harry T. Howell, 138th St. and 3d Ave.

Buffalo, N. Y.—Bids will be received until Sept. 9 (readvertisement) by the Armory Comn., Rm. 161, 280 Bway., N. Y. City, for erecting and heating the 65th Regt. Armory in Buffalo. Brig.-Gen. Jas. McLeer, Comdg. Natl. Guard.

Allegheny, Pa.—Bids will be received by Archt. de Bobula, Hotel Lincoln, Pittsburg, until Sept. 9 for erecting a $22,000 church in Allegheny. Rev. John Korptnoki, 591 Preble Ave., Allegheny.

Anadarko, Okla. Ter.—Bids will be received by the Bd. of Co. Comrs. until Sept. 9 for erecting a jail in Anadarko. Dyke Ballinger, Co. Clk.

Lagrange, Ga.—The Co. Comrs. are stated to have decided to issue $35,000 bonds for a court house.

Escanaba, Mich.—John W. Lawson is stated to have secured the contract for erecting the Carnegie Library for $18,992.

Pasadena, Cal.—The plans of C. F. Driscoll, of Los Angeles, are stated to have been accepted for an edifice for the Baptist Church, to be erected on Marengo and Union Sts., to cost $30,000.

Sherbrooke, Que.—It is stated that a $40,000 city hall is to be erected here.

Mississippi City, Miss.—Torgerson & Harkness are reported to be preparing plans for a $50,000 court house and jail for Harrison County.

Trenton, N. J.—The lowest bid opened by the State House Comn. Aug. 26 for erecting the new Senate chamber is stated to have been submitted by Lewis Lawton & Son, 432 Hamilton Ave., for $124,450.

Washington, D. C.—Certain architects have been invited to submit competitive plans for the Municipal Building, to cost not more than $900,000. Plans must be submitted by Dec. 8.

Niagara Falls, N. Y.—The lowest bid received by the Library Trus. for erecting the Carnegie Library is stated to have been submitted by Geo. B. Long, Prudential Bldg., Buffalo, for $37,780.

Pittsburg, Pa.—Kerr & Fox, 2565 5th Ave., are stated to have secured the contract for erecting the municipal hospital for $76,876.

New York, N. Y.—Bids will be received by Thos. W. Hynes, Comr. Correction Dept., N. Y. City, until Sept. 11 for furnishing material and labor required for work on boilers, heating and plumbing at Hart's Island, also for making repairs to roof of building No. 4, Hart's Island.

Indianapolis, Ind.—Bids will be received by the Bd. of Trus. of the Central Indiana Hospital for Insane until Sept. 3 for steam boilers and other work connected with same.

Buffalo, N. Y.—It is stated that the Society of Natural Sciences is to erect a building on Elmwood Ave. south of the park line. The Society is reported to have on hand $60,000 for the erection of this building.

New Braunfels, Tex.—Bids are wanted Sept. 22 for the removal of iron railing in front of cells in the Co. jail and for replacing same with full proof crown steel lattice work. R. Bodemann, Co. Judge.

National Military Home, Kan.—Bids will be received at the office of W. W. Martin, Treas., until Sept. 23 for an additional boiler at the Western Branch, N. H. D. V. S. J. G. Rowland, Governor.

Texarkana, Ark.—Bids will be received until Sept. 15 by R. M. Milligan, Archt., 1201 Chemical Bldg., St. Louis, Mo., for erecting a hospital for the St. Louis Southwestern Ry. Co. at Texarkana. Separate bids will be received as follows: On all work excepting plumbing and sewering, gas fitting, electric wiring, steam heating, marble and tile work, finishing hardware and refrigerators; on gas fitting, sewering and plumbing; on marble and tile work; on electric light wiring.

Amsterdam, N. Y.—Bernard Macbold, of Amsterdam, is stated to have secured the contract for erecting the Carnegie Library for $20,755.

Albert Lea, Minn.—The plans of E. F. Warren are stated to have been accepted for a new city hall.

Camden, N. J.—Plans are reported as being prepared by Henry D. Dagit, 435 Chestnut St., Philadelphia, Pa., for a convent to be erected at 1500 Haddon Ave. for the Dominican Sisters of the Perpetual Rosary, to cost about $40,000.

Baltimore, Md.—Wyatt & Nolting, 4 E. Lexington St., are stated to be preparing plans for an armory for Troop A, Maryland Natl. Guard, to cost between $35,000 and $50,000.

Boston, Mass.—Cram, Goodhue & Ferguson, 53 State St., are stated to have been selected to prepare plans for rebuilding St. James Episcopal Church, at Roxbury, which was recently burned; probable cost, $17,000.

South Omaha, Neb.—The Library Bd. is stated to have adopted the plans of T. R. Kimball, of Omaha, for the Carnegie Library, to cost $50,000.

Boston, Mass.—The Trus. of Boston Insane Hospital on Aug. 27 opened the following bids for the erection and completion of 4 new buildings and connecting corridors at the women's department in Ward 23: *a*, for the erection of building with ordinary materials; *b*, bids with the use of Sayer-Fisher brick; *c*, for carrying of foundation to a greater depth than required by the drawings: Chas. King & Co., *a* $235,600, *b* $244,477, *c* $7 per cu. yd.; Goodwin & Weston, *a* $198,800, *b* $210,800, *c* $8.50; L. D. Willcutt & Son, *a* $243,888, *b* $257,768, *c* $11.80; Connors Bros., *a* $224,000, *b* $232,500, *c* $7; Angus McDonald, *a* $247,665, *b* $255,485, *c* $10; J. A. Colsen & Son, *a* $269,000, *b* $279,000, *c* $1.50; Geo. W. Harvey, *a* $223,931, *b* $233,161, *c* $8.50; H. P. Cummings & Co., *a* $256,825, *c* $8; A. Fales & Sons Co., South Framingham, *a* $211,874, *b* $217,000, *c* $12.50; Stephen Brennan, *a* $209,083, *b* $218,711, *c* $7.50. Architects, Wheelwright & Haven, Boston.

Columbus, O.—Bids will be received by the Bd. of Trus. of Columbus State Hospital until Sept. 25 for furnishing material and erecting Awl Hospital and Greer Hospital. E. G. Carpenter, M. D., Secy. Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Hartwell, O.—Bids will be received by the Bd. of Pub. Service until Sept. 12 for a battery of 3 boilers at the City Infirmary, Hartwell. Geo. F. Holmes, Clk.

Paris, Ky.—Bids will be received by the Bldg. Com. of the Co. Fiscal Court until Sept. 15 for erecting a court house at Paris. J. W. Thomas, Jr., Chmn. Frank P. Milburn, Archt., Columbia, S. C.

Ft. Wayne, Ind.—Bids will be received until Sept. 5 by the Bd. of Trus. of the Indiana School for Feeble Minded Youths, for erecting an east wing and dining room additon to the brick building at Colonia; for completing present building at Colonia and for a heating and plumbing plant for the Colonia building. Alexander Johnson, Supt.

Hampton, Ia.—Bids are wanted Sept. 3 for erecting a library. Liebbe, Nourse & Rasmussen, Archts., Des Moines.

Kenton, O.—Bids are wanted Sept. 3 for erecting a library. Dr. F. D. Bain, Secy. Bd. Trus.

BUSINESS BUILDINGS.

Birmingham, Ala.—Wm. C. Western is the architect for a $500,000 office and bank to be built at 20th St. and 2d Ave. Brown Bros. & Co., Agents.

Denver, Colo.—Marean & Norton, Equitable Bldg., have prepared plans for a 4-story brick warehouse 75x120 ft. Owner, N. B. McCrary. Cost, $35,000.

Springfield, Mass.—C. F. Hettinger & Co., of Boston, are the architects for a new brewery plant to be built on Liberty and Charles Sts. T. R. Geisel & C. T. Shean, part owners. Size of building, 151x85 ft., 4 stories high, with a tower; also office building and stable.

Fall River, Mass.—The N. Y., N. H. & H. Ry. will build large freight terminals near Watuppa Station, Fall River; work to be begun immediately. C. M. Ingersoll, Jr., Ch. Engr., at New Haven, in charge.

L. G. Destremps, Bennett Blk., has prepared plans for a brick stable to be erected for Wm. Dunn; probable cost, $12,000. Address the architect.

Baltimore, Md.—The Directors of the Hebrew Friendly Inn & Aged Home have purchased a site on Bond and Fayette Sts. and will erect a new home on the site at a cost of about $25,000.

Parker & Thomas, 1 Somerset St., Boston, Mass., are stated to be preparing plans for a hotel to be erected on Charles and Chase Sts. for the Belvidere Bldg. Co.; it will cost, with site and furnishings, about $1,750,000.

Joliet, Ill.—It is stated that plans are being prepared for a warehouse to be erected on Van Buren St. and Eastern Ave. to cost about $60,000. John Healherwick and L. M. Rubens, both of Joliet, are reported interested.

Minneapolis, Minn.—It is stated that plans are being prepared for a building for the Northwestern Natl. Bank, to be erected at 505 to 409 1st Ave. S., to cost about $250,000.

Louisville, Ky.—A permit is stated to have been issued to the Louisville Paper Co. to erect a 5-story warehouse on Main St. near Floyd, to cost $18,000. Architect, John B. Hutchings, Columbia Bldg.

Ironwood, Mich.—D. M. Glassner is reported interested in the erection of a $25,000 opera house.

San Francisco, Cal.—The following building permits are stated to have been issued Aug. 18: To Jas. Schwartz, for the erection of a 6-story brick building on Jones and Lewis Sts.; to the S. & H. Lachman Estate, to erect an 8-story brick building on Sutter and Mason Sts.; and to D. Zelinsky, to erect a 6-story brick building on Post and Taylor Sts.

New York, N. Y.—Plans have been filed for a 6-story brick factory and warehouse to be erected on 31st St. and 10th Ave., to cost $90,000. Owner, Standard Rock Candy Co., 87 Bedford Ave., Brooklyn. Architect, John M. Baker, 85 Borden Ave., L. I. City.

Lakewood, N. J.—Oakley Bros., Archts. and Builders, 84 Asbury Ave., Ocean Grove, are preparing plans and specifications for a hotel to cost $15,000 at Lakewood, and will receive suggestions and quotations from steam heating, bath and electrical concerns. The building will be of brick construction.

Kansas City, Mo.—J. W. McKecknie, N. Y. Life Bldg., is preparing plans for remodeling Victoria Hotel, located at McGee and 9th Sts. Estimated cost, $12,000.

Whitney Bldg., owned by W. T. Kemper and located on Delaware between 7th and 8th Sts., is to be remodeled at a cost of $40,000.

A brick store is to be built at 1400 St. Louis Ave. Cost, $17,000. Owners, Ploweas Estate.

Edmonton, Alberta, N. W. Ter.—A $30,000 hotel is to be built by L. Bureau.

Jacksonville, Fla.—F. D. Burbridge will build an opera house to cost $50,000 or more.

Pittsburg, Pa.—Grant McCargo and Chas. R. Miller are stated to have purchased a site on Penn Ave. and Whitfield St. and will erect a business building on same, to cost about $150,000.

Fairmont, W. Va.—The grand lodge of Odd Fellows is stated to have selected a site here for a home for the aged and indigent members. The buildings will cost about $60,000.

Jennings, La.—The plans of W. L. Stephens are stated to have been accepted for a hotel to be erected here, to cost $75,000. M. C. Mahaffey is reported interested.

Dubuque, Ia.—It is stated that the Illinois Central R. R. Co. will erect a 15-stall roundhouse in Dubuque. F. B. Harriman, Div. Supt., Dubuque.

Knoxville, Tenn.—The Y. M. C. A. is stated to have decided to erect a $50,000 building. R. H. Sanson, Secy.

Marion, Ind.—It is stated that the Pan Handle R. R. will erect a $20,000 freight depot on Railroad Ave. Thos. Rodd, Ch. Engr., Pittsburg, Pa.

Philadelphia, Pa.—The Germantown Cricket Club is stated to have awarded to Ashton S. Tourison, 6805 Germantown Ave., contracts for two new buildings on the Manheim Cricket Grounds, at Morris and Manheim Sts., Germantown, to cost $75,000.

New Orleans, La.—Andry & Bendernagel, 337 St. Charles St. are stated to have completed plans for a new building on Camp St. for the Germania Trust & Savings Bank.

Boston, Mass.—Plans have been filed by Archt. B. D. Growell, of Bar Harbor, Me., for a brick and stone mercantile building at 47 and 48 Pitt St. Owner, Bernard Spuerling, Wilmington, Mass. Builder, H. A. Slaken, Tremont Bldg. Estimated cost, $25,000.

Reinbeck, Ia.—It is stated that bids are wanted Sept. 5 for erecting an office building in this city. Address Chas. J. Adams.

Bedford City, Va.—Bids will be received by Meade D. Detweiler, Chmn., Harrisburg, Pa., until Sept. 10 for plumbing and heating with steam, vapor or hot water the National Home for Aged Elks at Bedford City. Lewis & Burnham, Archts., Rm. 17-19 Nat. Bank Bldg., Lynchburg, Va.

Buffalo, N. Y.—Mugler & Umlauf are to erect a 3-story brick warehouse at 543 Seneca St., to cost $16,000.

The Buffalo Foundry Co. is to erect a 2-story brick building 146x320 ft., to cost $100,000.

The Double Truss Cornice Brake Co. is to erect a 2-story brick factory on Chandler St., to cost $14,000.

The Buffalo Structural Steel Co. is stated to have secured the contract for the steel work required on the Lafayette Hotel. The remaining contracts will be let in a few days; total cost, about $700,000. Owner, Walter B. Duffy, of Rochester. Architects, Bethune, Bethune & Fuchs, 47 W. Chippewa St.

Pittsburg, Pa.—Machin & Brown, 147 N. 7th St., Philadelphia, are stated to have secured the contract for erecting the $800,000 hotel, apartments and flats in Pittsburg for the Monongahela Real Estate Corporation, according to plans prepared by Milligan & Webber, 520 Walnut St., Philadelphia.

Philadelphia, Pa.—Cramp & Co. are stated to have secured the contract for a 4-story addition to the building of the Provident Life & Trust Co. from plans of Farness, Evans & Co., 1001 Provident Bldg.; cost, $60,000.

Toledo, O.—A. Bentley & Sons, 419 Madison St., are stated to have secured the contract for erecting the passenger and freight station on Cherry St. for the Toledo Ry. & Terminal Co., not including plumbing and gas fitting. Total cost, $300,000.

Houghton, Mich.—It is stated that J. R. & T. S. Dee, of Houghton, will erect a 4-story brick block, 38x90 ft., to contain stores, offices and a public hall, to cost $50,000.

DWELLINGS.

Nashua, N. H.—It is reported that Gen. E bert Wheeler and Wm. D. Swart will build residences on adjoining lots on Concord St. to cost about $15,000. They may be addressed at Nashua.

Boston, Mass.—Plans have been filed by Archts. Parker & Thomas, 1 Somerset St., for a 3-story brick and stone apartment house on Boylston and Hereford Sts. Owner, The Hereford Trust. Builder, F. C. Whitcomb. Estimated cost, $40,000.

Chicago, Ill.—Fred Koenig, 1619 W. 12th St., is stated to have prepared plans for an apartment house to be erected on Douglas Park Boule. and Kedzie Ave. to cost $75,000.

Perley Hale, 6737 Yale St., is reported to be preparing plans for an apartment building to be erected on 65th St. and Ellis Ave. for Chas. Schell, to cost $40,000.

Henry J. Lueders is stated to have had plans prepared by Wm. Strippleman, 161 La Salle St., for a 3-story apartment house, 150x70 ft., of blue Bedford stone and roman pressed brick to be erected on Hamlin Ave. and Adams St., to cost $60,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

111 E 69th St, stone front dwelig; c, $20,000; o, Francis G Lloyd; a, Trowbridge & Livingston.

Madison Ave & 78th St, 3 br and stone dweligs; c, $240,000 all; o, J C Lyons Building & Operating Co; a, York & Sawyer.

SCHOOLS.

Munhall, Pa.—Bids will be received until Sept. 5 by the School Bd., at the office of U. J. L. Peoples, Archt., Times Bldg., Pittsburg, for erecting a school at Munhall.

Denver, Colo.—F. E. Kidder, of Denver, is architect for a brick and stone addition to be built to the Smedley School, Dist. No. 7, North Denver. Cost, $14,500.

T. H. Dryden has prepared plans for an 8-room brick and stone school to cost $24,000.

Deadwood, S. D.—Bids are wanted Sept. 29 for an 8-room school to be erected in the 1st Ward. Job Lawrenson, Secy. Bd. of Educ.

New London, Conn.—The question of erecting an addition to the borough school, to cost about $25,000, is being considered.

Niagara Falls, N. Y.—Wentworth, McMillan & Co. are stated to have secured the contract for erecting the 3d Ward school for $22,574.

Pawtucket, R. I.—The Com. on Property of the School Bd. is stated to have adopted the system of heating and ventilation of the Aetna Engineering Co., of Springfield, Mass., for the new schools at South Woodlawn and Darlington.

Old Town, Me.—Eben T. Hartwell, of Old Town, is stated to have secured the contract for erecting a school for $20,370.

Reedsburg, Wis.—The citizens are stated to have voted to issue $30,000 bonds for a high school.

Winona Lake, Ind.—The plans of Vonnegut & Bohn, Indiana Trust Bldg., Indianapolis, are stated to have been accepted for a memorial building for the Winona Agricultural and Technical Institute.

Niles, Mich.—The plans of W. Irving Tillotson, Oneida, N. Y., are stated to have been accepted for a 6-room brick school to be erected on the Central school grounds.

Grand Junction, Colo.—John J. Lumsden is stated to have secured the contract for erecting a school for $20,573.

Boston, Mass.—The following are reported to be the lowest bids opened by the Schoolhouse Comrs., Aug. 21, for a school to be erected on Columbia Road, Dorchester: General construction, F. G. Coburn & Co., $140,500; heating, Bradley & Chatman Co., $14,300; plumbing, Kelley & Gaffey, $7,700, and electric plant, Erickson Electrical Equipment Co., $5,478.

Marengo, Ia.—Proudfoot & Bird, of Des Moines, are stated to have been selected to prepare plans for 2 schools for Morengo, one to cost $28,000, the other $12,000.

Connersville, Ind.—The Council is stated to have decided to issue $50,000 bonds for a high school.

Detroit, Mich.—Harry J. Rill, 54 Buhl Blk., is stated to have prepared plans for a parochial school for the Church of Our Lady of the Rosary, to be erected on Harper and Woodward Aves., to cost $18,000.

Vancouver, B. C.—It is stated that bids are wanted Sept. 8 for erecting a reformatory school and park building. W. S. Gore, Deputy Comr. Lands & Wks. Dept., Vancouver.

East Trenton, N. J.—It is stated that bids are wanted Sept. 2 for erecting a 2-story brick school, 80x158 ft., to cost about $30,000. Brouse & Arend, Archts., 1st Natl. Bank Bldg., Trenton.

Paterson, N. J.—It is stated that competitive plans will be received until Sept. 3 by the Bd. of Educ. for a brick school to be erected at Morton, Vine and Market Sts., to cost about $40,000. Jas. J. Bailey, Chmn. Bldg. Com.

Denver, Colo.—Philip Varian, 413 Taber Blk., is the architect for a brick and stone school for State Home, to cost $24,000.

San Francisco, Cal.—The Bd. of Educ. is stated to have appointed Louis S. Stone, 330 Pine St., as consulting architect to aid in selecting plans for new schools for which $315,000 was recently appropriated.

Jersey City, N. J.—The Michael Lynch Contracting Co., of Paterson, is stated to have secured the contract for erecting a school on Palisade Ave., Union Hill, for $38,960.

Edgefield, S. C.—Clk. of the Court writes that on Aug. 23 it was voted to issue $15,000 bonds for schools.

East Orange, N. J.—The Council is stated to have passed an ordinance providing for the issue of $45,000 bonds for an addition to Elmwood School.

Bath, Me.—Chas. W. Morse, of New York, N. Y., is stated to have offered this city $50,000 for a high school.

Springfield, O.—Wm. Poole is stated to have secured the contract for erecting a school in East Springfield, for $25,683.

Newark, N. J.—The Bd. of Educ. is stated to have selected architects for the following school additions: Thos. Cressey, 800 Broad St., to prepare plans for a 14-room addition to Bergen St. school, to cost $35,000; Hooper & Co., 238 Washington St., for a 4-room addition to the Roseville school, to cost $10,000; and Gustav Staehlin, 238 Washington St., for an addition to the 13th Ave. school, to cost $22,500. A $32,000 school will also be erected in a locality which will afford relief to the Summer Ave. and the Elliott St. schools.

Springboro, O.—Bids are wanted Sept. 20 for erecting a school. Chas. Banta, Clk.

Hartford, Conn.—Bids are wanted Sept. 2 for the construction, and separate bids for the plumbing and heating of the proposed addition to the Wilson St. school. Hermann Lilienthal, Clk. of Com.

STREET CLEANING AND GARBAGE DISPOSAL.

Adams, Mass.—Bids will be received by the Bd. of Health until about Sept. 20 for the collection and disposal of garbage. Dr. A. Desrochers, Secy.

Oakland, Cal.—It is stated that if the Council will grant an exclusive franchise, local capitalists will form a company and build a garbage crematory having a capacity of 40 tons per day.

Racine, Wis.—Local press reports state that the following bids were opened recently for a 25-ton garbage crematory: Dixon Garbage Co., Toledo, O., 6 propositions ranging from $9,660, for wooden frame building and steel smokestack to $10,910 for brick building and chimney. Davis Garbage Furnace Co., of Lancaster, Pa., $8,600 for frame building with steel smokestack, $850 extra for brick chimney and $2,200 additional for brick building. Decarie Manufacturing Co., Minneapolis, 4 propositions ranging in price from $9,000 for frame building with brick chimney to $16,000 for all steel fire-proof plant.

Los Angeles, Cal.—The garbage contract is reported to have been awarded to Franklin & Alexander at $1,790 a month.

GOVERNMENT WORK.

New York, N. Y.—Bids are wanted Sept. 25 at the U. S. Engineer Office for dredging in Great South Bay and Patchogue River, as advertised in The Engineering Record.

Ft. Totten, N. Y.—Bids are wanted Sept. 19 for constructing addition to Guard House at this post, as advertised in The Engineering Record.

Newport, R. I.—Bids are wanted Sept. 17 at the Office of Constructing Q. M., for a frame addition to Guard House, Ft. Greble, as advertised in The Engineering Record.

Boston, Mass.—See "Water."

Washington, D. C.—Bids are wanted Sept. 4 for furnishing all material and erecting a building and elephant house and yards, etc., in the National Zoological Park. Archts., Hornblower & Marshall, 1509 H St., N. W. Richd. Rathbun, Acting Secy., Smithsonian Institute.

Washington, D. C.—Bids will be received at the U. S. Engr. Office until Sept. 26 for furnishing electrical fixtures and supplies for new building for Government Printing Office, as advertised in The Engineering Record.

Cleveland, O.—Maj. Dan C. Kingman, Corps of Engrs., U. S. A., writes that all bids opened Aug. 18, for the reconstruction and repair of parts of the east and west piers at Fairport Harbor, have been recommended for rejection, owing to high prices.

Aberdeen, S. Dak.—Bids will be received until Oct. 14 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (excepting heating apparatus, electric wiring, and conduits), of the U. S. Post Office at Aberdeen.

Brunswick, Ga.—Bids will be received until Sept. 19 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for installing a conduit and electric wiring system for the U. S. Custom House and Post Office at Brunswick.

Portland, Me.—Bids are wanted Sept. 29 for dredging in Bucksport Harbor, Camden Harbor and Georges River, Me.; also for ledge excavation at Sullivans Falls, Me., as advertised in The Engineering Record.

Newport News, Va.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Oct. 9 for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Custom House and Post Office at Newport News, as advertised in The Engineering Record.

Cleveland, O.—Bids are wanted Sept. 4 for removal of wreck of steamer "George Dunbar" in Lake Erie. Maj. Dan. C. Kingman, Corps Engrs., U. S. A.

Philadelphia, Pa.—The contract for erecting a pattern shop and storehouse addition to the steam engineering building at League Island Navy Yard has been awarded to the Penn Erecting Co., Philadelphia; it will be a 2-story steel fire-proof structure, 65x103 ft.

Philadelphia, Pa.—Bids will be received until Sept. 13 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for furnishing and installing 2 electric elevators at the Navy Yard, League Island.

Denver, Colo.—Bids are wanted Sept. 15 for installing steam heating plants in barrack buildings and officers' quarters at Ft. Logan. Address, Col. J. W. Pope, Ch. Q. M., Denver, Colo.

Annapolis, Md.—Bids will be received until Sept. 10 by Col. F. L. Denny, Q. M., U. S. Marine Corps, Washington, D. C., for furnishing material and constructing 1 commanding and 2 junior officers' quarters at Marine Barracks, Naval Academy, Annapolis.

San Francisco, Cal.—Bids are wanted Oct. 1 for dredging in San Pablo Bay, Cal. Address Lieut.-Col. W. H. Heuer, Corps Engrs., U. S. A.

Philadelphia, Pa.—Bids will be received at the office of the Light House Engr., Philadelphia, until Sept. 16 for furnishing material and erecting a lighthouse, an oil house, bat barn, etc., at the Reedy Island Front Light Station, Del., as advertised in The Engineering Record.

Philadelphia, Pa.—The following bids are stated to have been opened at the U. S. Engr. Office Aug. 21 for dredging Delaware River and constructing an artificial retaining bank; the contract calls for excavating and depositing 10,900,000 cu. yds. of material, and for 175,000 yds. of material placed in retaining banks: Maryland Dredging & Contracting Co., of Baltimore, 16 cts. and 90 cts. a cu. yd., total $1,901,500; Morris & Cummings Dredging Co., of New York, 14 4/10 cts. and 1.05 cts. a cu. yd., total $1,753,350; American Dredging Co., Philadelphia, 13 9/10 cts. and 48 cts. a cu. yd., total $1,559,100.

Bids were opened Aug. 25 at the U. S. Engr. Office for the construction of a timber bulkhead enclosed basin at Dan Baker and Stony Point Shoals. The lowest bid was $239,057 from Sanford & Brooks Co., of Baltimore, Md.

Buffalo, N. Y.—Maj. T. W. Symons, Corps of Engrs., U. S. A., writes that the lowest bid opened Aug. 22 for the hire of dredging plant for excavating in Niagara River and Tonawanda Harbor was from the Lake Erie Dredging Co., Buffalo, at $112 per day of 8 hours for each dredge and drill boat, including crew, tugs, scows, etc. There is $245,000 available, contract to run until this is used up, but not longer than Dec. 31, 1904.

Newport, Vt.—The following bids were opened Aug. 21 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office, etc., at Newport, Vt.: Richardson & Burgess, Washington, $78,867; Conners & Brother, Lowell, Mass., $75,800; S. C. Moore & Son, Kokomo, Ind., $80,612; Congress Const. Co., Chicago, Ill., $83,843; Peter Keeler, Albany, N. Y., $91,696; A. B. Stannard, New York City, $78,000.

Memphis, Tenn.—Bids were opened Aug. 7 by Capt. E. E. Winslow, Corps of Engrs., U. S. A., and contracts have been awarded as follows: To Memphis Contracting Co., of Memphis, work in Reelfoot Dist., 150,000 cu. yds. at 12.40 cts. per cu. yd.; also work in Yazoo Levee Dist., 360,000 cu. yds. at 16.70 cts. per cu. yd.; to Anderson & Van Hook, of Helena, Ark., work in White River Dist., 60,000 cu. yds. at 15.85 cts.; to Geo. R. Lacy, of Arkansas City, Ark., work in White River Dist., 60,000 cu. yds. at 18.95 cts. Bids received at the same time on the following levee work were rejected and new bids for same will be opened Sept. 2: Work in White River Dist., including 90,000 yds. of enlargements near Helena, Ark., 160,000 yds. on beginning of the Modoc loop, and 50,000 yds. of construction at Ferguson.

Memphis, Tenn.—Bids were opened Aug. 20 by Capt. Chas. L. Potter, Corps of Engrs., U. S. A., for levee work in 3d Dist., Improving Mississippi River, and contracts were recommended for acceptance, as follows: To M. J. Rosch & Co., Memphis: Stations 3,100-3,125, 143,000 cu. yds.; Stations 3,125-3,156, 145,000 cu. yds.; Stations 3,156-3,189, 145,000 cu. yds., Stations 3,189-3,229, 145,000 cu. yds.; Stations 3,229-3,245, 147,000 cu. yds. all at 19.70 cts. per cu. yd. To Lawrence Bros., Wickliffe, Ky.: Stations 2,572-2,880, 60,000 cu. yds., at 16.50 cts.; Stations 3,800-3,942, 105,000 cu. yds. no bid recommended for award. To Israel R. Bobbet, Cofield, La.: Stations 4,670-4,725, 137,500 cu. yds., at 15.95 cts. per cu. yd.; Stations 4,725-4,780, 137,500 cu. yds., at 16.70 cts.; Stations 4780-4,924, 120,000 cu. yds., no bid recommended for award; Stations 4,887-5,230, 161,000 cu. yds., no bid recommended for award. All of above stations are in the Lower Yazoo Levee Dist. The following stations are all in Upper Tensas Levee Dist.: Stations 783-808, Arkansas River, 105,000 cu. yds., no bid recommended for award; Lewis & Jenkins, Memphis, Stations 2,252-2,533, 144,000 cu. yds., at 21.50 cts. per cu. yd. To M. L. Linnan, Lauderdale, La.: Stations, 3,950-4,080, 95,000 cu. yds., at 16 cts.; Stations, 190-256, 72,000 cu. yds., at 17.48 cts. To Donovan & Daily, Rougere, La.: Stations 4,080-4,210, 100,000 cu. yds. at 19.70 cts.

MISCELLANEOUS.

Osceola, Ark.—Asst. Engr. of St. Francis Levee Bd. John A. Fox writes that the contract, for dredging about 13 miles of drainage canal (223,000 cu. yds.) has been awarded to the Drainage & Improvement Co., of Kankakee, Ill., at 11½ cts. per cu. yd.

Philadelphia, Pa.—Local press reports state that bids are about to be asked by the Bureau of Surveys for dredging the channel of the Schuylkill River, southwest from Grays Ferry bridge. Estimated cost, $200,000.

Stockton, Cal.—The contract for constructing a concrete bulkhead along the water front, 200 ft., has been awarded to John Craven, of Stockton, at $25.47 per ft.

St. Ann's, N. S.—Bids are wanted Sept. 5 for constructing an extension to wharf at South Gut, St. Ann's. Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.; E. G. Millidge, Res. Engr., Antigonish, N. S.

Galveston, Tex.—Bids will be received by the Co. Comrs. until Sept. 6 (readvertisement) for constructing a seawall, 17,593 ft. in length, of concrete on a piling foundation with rip-rap protection. G. W. Boschke, Engr. in Charge, Galveston.

Co. Treas. J. S. Waters has secured the approval by Judge T. S. Johnson, office assistant Attorney General, of $500,000 seawall and breakwater bonds. This is the first batch of this issue of $1,500,000 bonds which will be presented to the Attorney General for approval.

NEW INDUSTRIAL PLANTS.

The Pennsylvania Malleable Co., 1119 Frick Bldg., Pittsburg, will spend $200,000 in improvements at McKees Rocks, Pa., which include a 120x300-ft. frame construction building for a daily capacity of 600 to 700 wheels and an addition of 300 H.-P. to power plant, for which boilers, engines and electrical equipment will be required.

The Portsmouth Cereal Co., Portsmouth, O., expects to erect in near future a 60x45-ft. building and a 45x42-ft. engine and boiler house.

The International Harvester Co., Deering, Chicago, Ill., is building a foundry and 5-story manufacturing building in which machinery is to be driven electrically from its central power station.

The Jeanesville Iron Works Co., Jeanesville, Pa., is about to build a plant at Hazleton, Pa., comprising 6 buildings, the main structure 106x538 ft. of steel frame and brick. The other buildings include a 2-story 50x74-ft. pattern shop, a 3-story 50x202-ft. pattern storage, a 47x87-ft. power house, a 3-story 60x65-ft. office building and a 2-story stable, all of brick, with slate roofs. Machinery will be electrically driven, there will be 5 to 20-ton electric cranes, the main building will be heated by blower system and there will be 3 cupolas in foundry. Hales & Ballinger, 12th and Chestnut Sts., Philadelphia, are architects and engineers.

The Cocheco Mfg. Co., Dover, N. H., is putting up a 230x70-ft. power station in which a 10,000-H.-P. boiler plant will be installed. The boiler specifications are not yet finished.

BUSINESS NOTES.

The York Manufacturing Co., York, Pa., reports the following contracts recently placed: Orange, Tex., Light, Ice & Water Wks. Co., 35-ton ice-making plant; Eastern Kentucky Asylum for Insane, Lexington, Ky., 10-ton plant; Allegheny, Pa., County Morgue, 7½-ton plant; Rock Island, Ill., Plow Co., 20-ton plant for tempering vats; Ideal Cocoa & Chocolate Co., Lititz, Pa., 7½-ton plant; Meridian, Miss., Ice Co., 50-ton plant; People Pure Ice Co., Muncie, Ind., 30-ton plant; Washington, D. C., Market Co., 20-ton freezing and distilling system.

The C. O. Bartlett & Snow Co. has been incorporated, succeeding C. O. Bartlett & Co., and its plant for building mill, paint, conveying and elevating machinery and steam and direct heat dryers is located on its own property bounded by French, German, Winter and Falls Sts., Cleveland, O.

The Westinghouse Electric & Manufacturing Company has removed its district office from the Sun Building, Washington, D. C., to the Continental Trust Building, Baltimore, Md.; this move being made on account of the large amount of business which that company transacts in Baltimore.

The Pittsburg Valve & Fittings Co. has placed a contract with the Westinghouse Electric & Mfg. Co. for the electrical equipment of its new works at Barberton, O.

Mr. Wm. J. Martin, of the mechanical department of the Geo. A. Fuller Co., 137 Broadway, New York City, wishes to receive catalogues of every description for office files, reference and ordering.

An engine built by the Ball Engine Co., Erie, Pa., is being installed in the tobacco factory of R. & W. Jenkinson, Pittsburg, for electric lighting.

The Jessop Steel Co., of England, has recently purchased direct current apparatus from the Westinghouse Electric & Mfg. Co. for electric power distribution in a large steel plant it is erecting at Washington, Pa.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Sept. 4. Chicago, Ill. .... Aug. 30
Sept. 4. New York, N. Y. .... Aug. 23
Sept. 4. Farmington, Mo. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 5. Engine and boiler, Milwaukee, Wis. .... July 19
Sept. 6. Pipes, Washington, D. C. .... Aug. 9
Adv., Eng. Record, Aug. 9.
Sept. 6. Gates, valves, Washington, D. C. .... Aug. 2
Adv., Eng. Record, Aug. 2.
Sept. 8. Wonewoc, Wis. .... Aug. 30
Sept. 8. Los Angeles, Cal. .... Aug. 16
Sept. 9. Biloxi, Miss. .... Aug. 30
Sept. 9. Houma, La. .... Aug. 9
Adv., Eng. Record, Aug. 23.
Sept. 10. Aiken, S. C. .... Aug. 30
Sept. 10. Reservoir dike, Paterson, N. J. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 11. Baldwins, L. I., N. Y. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Sept. 11. Navajo Agency, New Mex. .... Aug. 23
Sept. 12. Philadelphia, Pa. .... Aug. 30
Sept. 15. Fairmont, W. Va. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Sept. 15. South Atlantic, N. J. .... Aug. 30
Sept. 17. Graham, Va. .... Aug. 30
Sept. 18. New York, N. Y. .... Aug. 30
Dec. 1. Pumps, Seguin, Tex. .... July 26

SEWERAGE AND SEWAGE DISPOSAL.

Sept. 2. Trenton, N. J. .... Aug. 30
Sept. 2. St. Paul, Minn. .... Aug. 30
Sept. 2. Glassport, Pa. .... Aug. 30
Sept. 2. McKeesport, Pa. .... Aug. 30
Sept. 3. Terre Haute, Ind. .... Aug. 30
Sept. 3. East Liverpool, O. .... Aug. 30
Sept. 3. Cincinnati, O. .... Aug. 30
Sept. 3. Harrisburg, Pa. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 3. Athol, Mass. .... Aug. 16
Adv., Eng. Record, Aug. 16.
Sept. 4. Boston, Mass. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Sept. 6. Champaign, Ill. .... Aug. 23
Sept. 6. Lakewood, O. .... Aug. 16
Sept. 9. Waterbury, Conn. .... Aug. 30
Sept. 9. New York, N. Y. .... Aug. 30
Sept. 9. Oshkosh, Wis. .... Aug. 23
Sept. 10. Salem, O. .... Aug. 23
Sept. 10. Alliance, O. .... Aug. 23
Sept. 13. Washington, D. C. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 16. Irvington, N. J. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Sept. 16. St. Louis, Mo. .... Aug. 23
Sept. 17. Cleveland, O. .... Aug. 30
Sept. 17. Two Rivers, Wis. .... Aug. 30
Sept. 19. Cedar Rapids, Mich. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Oct. 10. Ridley Park, Pa. .... Aug. 16
Adv., Eng. Record, Aug. 16.
——— Progreso, Mex. .... Aug. 23

BRIDGES.

Sept. 2. Wilmington, Del. .... Aug. 30
Sept. 3. Culpeper, Va. .... Aug. 30
Sept. 3. Alexandria, S. D. .... Aug. 23
Sept. 3. New Brunswick, N. J. .... Aug. 23
Sept. 3. Appleton, Wis. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 3. Fowler, Ind. .... Aug. 23
Sept. 3. Parker, S. D. .... Aug. 9
Sept. 3. Substructure, Chicago, Ill. .... July 19
Adv., Eng. Record, July 19.
Sept. 3. Superstructure, Chicago, Ill. .... July 19
Adv., Eng. Record, July 19.
Sept. 4. Buffalo, N. Y. .... Aug. 30
Sept. 5. Milwaukee, Wis. .... July 19
Sept. 8. Belleville, Ont. .... Aug. 23
Sept. 9. Allegheny, Pa. .... Aug. 30
Sept. 9. Bloomington, Neb. .... Aug. 23
Sept. 9. Caldwell, Idaho .... July 12
Sept. 10. Catlettsburg, Ky. .... Aug. 23
Sept. 13. Mansfield, O. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 15. Downieville, Pa. .... Aug. 30
Sept. 15. Luray, Va. .... Aug. 30
Sept. 20. Terre Haute, Ind. .... Aug. 30
Oct. 1. Castroville, Tex. .... Aug. 23

PAVING AND ROADMAKING.

Sept. 2. Atchison, Kan. .... Aug. 30
Sept. 2. Glassport, Pa. .... Aug. 30
Sept. 2. St. Paul, Minn. .... Aug. 30
Sept. 2. Lawrence, Kan. .... Aug. 30
Sept. 3. Leavenworth, Kan. .... Aug. 30
Sept. 3. Baltimore, Md. .... Aug. 30
Sept. 3. Oskaloosa, Ia. .... Aug. 30
Sept. 3. Brooklyn, N. Y. .... Aug. 23
Sept. 3. Chico, Cal. .... Aug. 23
Sept. 3. Leavenworth, Kan. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 3. Terre Haute, Ind. .... Aug. 16
Sept. 3. Toledo, O. .... Aug. 9
Sept. 4. New York, N. Y. .... Aug. 30
Sept. 4. Decatur, Ind. .... Aug. 30
Sept. 4. Boston, Mass. .... Aug. 23
Sept. 5. Cedar Rapids, Ia. .... Aug. 30
Sept. 5. Terre Haute, Ind. .... Aug. 30
Sept. 5. Dayton, O. .... Aug. 16
Sept. 5. Williamsport, Pa. .... Aug. 16
Sept. 6. Grossepointe, Mich. .... Aug. 30
Sept. 6. Hamilton, O. .... Aug. 23
Sept. 8. Toledo, O. .... Aug. 30
Sept. 8. Spokane, Wash. .... Aug. 30
Sept. 8. Eureka, Cal. .... Aug. 30
Sept. 8. Chester, W. Va. .... Aug. 23
Sept. 8. Charlton, Ia. .... Aug. 16
Sept. 9. Camden, N. J. .... Aug. 30
Sept. 9. New York, N. Y. .... Aug. 30
Sept. 9. Schenectady, N. Y. .... Aug. 30
Sept. 10. Boston, Mass. .... Aug. 30
Sept. 10. Massillon, O. .... Aug. 23
Sept. 12. Hendersonville, N. C. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Sept. 15. Toledo, O. .... Aug. 23
Sept. 16. Green Bay, Mich. .... Aug. 30
Sept. 18. Cincinnati, O. .... Aug. 30
Sept. 18. Niles, O. .... Aug. 30
Sept. 20. Janesville, Wis. .... Aug. 30
Sept. 20. St. Louis, Mo. .... Aug. 23

POWER, GAS AND ELECTRICITY.

Sept. 3. Chicago, Ill. .... Aug. 30
Sept. 3. Elmira, N. Y. .... Aug. 23
Sept. 5. Columbus, O. .... Aug. 23
Sept. 6. Washington, D. C. .... Aug. 30
Sept. 8. Amsterdam, Holland .... Aug. 2
Sept. 11. Memphis, Tenn. .... Aug. 23
Sept. 12. Big Stone Gap, Va. .... Aug. 30
Sept. 13. Akron, O. .... Aug. 23
Sept. 17. Cheviot, O. .... Aug. 23
Sept. 22. National Home, Wis. .... Aug. 30
Oct. 1. Weiser, Idaho .... Aug. 23
Oct. 15. Chicago, Ill. .... Aug. 23
Nov. 1. Macon, Ga. .... Aug. 30

GOVERNMENT WORK.

Sept. 2. Memphis, Tenn. .... Aug. 30
Sept. 2. Bldg., Johnson City, Tenn. .... Aug. 9
Adv., Eng. Record, Aug. 9 to 30.
Sept. 2. Rapid City, S. D. .... Aug. 9
Sept. 2. New Orleans, La. .... Aug. 9
Adv., Eng. Record, Aug. 9 to 30.
Sept. 3. Dredging, Annapolis, Md. .... Aug. 16
Sept. 3. Plumb'g lab'atory, Washington, D. C. Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 3. Wiring lab'atory, Washington, D. C. Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 3. Dredging, New York, N. Y. .... Aug. 9
Adv., Eng. Record, Aug. 16 to 30.
Sept. 3. Dam, Charleston, S. C. .... Aug. 2
Adv., Eng. Record, Aug. 16 to 30.
Sept. 4. Nat. Zoo bldg., Washington, D. C. .... Aug. 30
Sept. 4. Cleveland, O. .... Aug. 30
Sept. 4. Post Office, Lockport, N. Y. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 6. Louisville, Ky. .... Aug. 16
Sept. 6. Bremerton, Wash. .... Aug. 2
Sept. 8. Tompkinsville, N. Y. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 8. Htg. laboratory, Washington, D. C. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 8. New York, N. Y. .... Aug. 23
Sept. 8. New Orleans, La. .... Aug. 16
Adv., Eng. Record, Aug. 16 to 30.
Sept. 9. Htg. P. O., Elmira, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 10. Annapolis, Md. .... Aug. 30
Sept. 10. St. Louis, Mo. .... Aug. 23
Sept. 10. Brooklyn, N. Y. .... Aug. 16
Sept. 10. Post Office, Anniston, Ala. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 11. Water supply, Navajo Agency, N. M. Aug. 23
Sept. 11. Wilmington, Del. .... Aug. 16
Sept. 11. Dredging Baltimore Harbor, Md. .... Aug. 16
Adv., Eng. Record, Aug. 16 to 30.
Sept. 11. Dredging Curtis Bay, Baltimore, Md. Aug. 16
Adv., Eng. Record, Aug. 16 to 30.
Sept. 11. Dredging, etc., New York, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16 to 30.
Sept. 11. Wiring P. O., New Brunswick, N. J. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 11. Htg. P. O., New Brunswick, N. J. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 13. Elevators, Philadelphia, Pa. .... Aug. 30
Sept. 13. Boston, Mass. .... Aug. 16
Sept. 13. Dock, Norfolk, Va. .... July 26
Adv., Eng. Record, Aug. 2, 9.
Sept. 15. Denver, Colo. .... Aug. 30
Sept. 15. Riprap, etc., Philadelphia, Pa. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 15. Tampa, Fla. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 15. Htg. P. O., Abilene, Tex. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
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Shop Tests of Engines of Moderate Size.

While it is probable that in these busy times purchasers of steam engines are more concerned in having them shipped and put in operation promptly than they are in the amounts of steam they will use under various conditions imposed by service, yet many, doubtless, will be interested in reading, in an abstract of one of the selected papers of the Institution of Civil Engineers, printed on another page, the careful manner in which it is evident that engines are tested by one of the largest firms in Great Britain before they are shipped from the works. The paper in question, by Mr. E. H. Rayner, states that this practice of testing has been caused by the exacting requirements of engineers as regards the economy of an electric generating plant, and brings out the fact that builders obtain many data useful in future orders, and that they are able to effect improvements which would hardly be possible unless the tests were made. Of course tests as usually made are costly and take much time, and to reduce this the builders have devised quick and accurate methods. A plant has been installed for supplying steam, for condensing it, and for weighing it after it is condensed, also for measuring the electric current, and thus determining the load. By weighing the steam condensed the consumption can be obtained in a few minutes where it would take almost as many hours if the steam were measured by weighing the water fed to the boilers. The author states that it would be the work of several days to obtain satisfactory results by weighing the feed water supplied the boilers when testing engines at full, three-quarter, half and quarter load, both condensing and non-condensing, such as can be obtained with the adopted method between breakfast and dinner hour. Not the least important feature of this practice is that it gives data which enable one to proportion an engine properly for a given service so that it will develop power with the least expenditure of fuel. The tests also show if the valves are set properly and insure that piston and valve leakage or abnormal friction is discovered and corrected before the engines leave the shop.

This practice is in striking contrast with that in the United States, where few builders are equipped for making such tests, although it is the custom of all builders of small engines to at least run them under full load for a period sufficient to set the valves and see that they run properly. A few have facilities for testing the water consumption, but this even is difficult with direct-connected generating sets, as the generators are seldom sent to the shops of the engine builders as seems to be the practice in Great Britain, and it is inconvenient to secure full load by means of a brake for any but small engines. Tests made after an engine is installed are so costly and difficult, if not impossible, to make that they are almost invariably omitted. It is to be regretted when specifications for engines, particularly those of the compound high rotative speed type, call for guarantees as to the steam consumption, that tests are not made in each instance to see if the guarantee is fulfilled. Not that the difference of a pound or two in the steam consumption of an engine of small power will make a very material difference to the owner, but such saving in almost any engine would be sufficient to cover a good deal more than the cost of a test in a short time and the test would show any abnormal conditions affecting adversely the economy of the engine. Of course if these tests are made the purchaser will have to pay for them, either in the first cost of the engine or by agreement to do so. He can undoubtedly well afford to do so in most instances on account of the better operating engine that will be secured.

It is proper to mention at this time another matter regarding engine tests made under different loads that seems to be neglected in the tests described in the paper and is usually ignored in tests. It should not be forgotten that there are two points that it is important to know in an engine. One is its most economical load, or, to put it in another way, the load under which an engine will operate with the lowest possible steam consumption per horse power per hour. The second is the maximum load that it will operate under continuously without too great a reduction in speed. The speed requirement is of importance in electric driving. The economy at the "rated load" means little or nothing, for the rated loads of engines of the same cylinder size and rotative speeds vary considerably with different builders, as will be seen by anyone that will take the trouble to compare their catalogues. In all steam-consumption tests made at different loads, the load should be increased sufficiently above the load of lowest steam consumption per unit of power developed, as shown by the test, to determine what this most economical load is. This is easily obtained, as the steam consumption per unit of power developed increases with an increase or decrease in load above or below that which is the most economical one. Furthermore the load should be increased up to the maximum horse power of the engine, not so much to determine the steam consumption as to find out how much work the engine can do. Data on the former point are useful in proportioning cylinders and data on the latter enable one to know in advance how much power can be obtained from an engine—particularly useful information when it is to be used in electric service. This kind of data on compound engines is sadly lacking. Information upon both of these points, not only with compound engines but engines of all types, is much more valuable than the number of pounds and fractional parts of a pound of steam that an engine uses in operating at some load much less than the average that it is designed for.

The Engineering Legacy of Victor Hugo.

Years ago Victor Hugo wrote in "Les Misérables" a fanciful essay on the sewerage system of Paris. It is a vivid literary work, and, even in the average poor translation, it pictures the great conduits and their streams of filthy water so forcibly that to-day, years after the author's death, the Paris sewers are probably regarded by most people of moderate education as among the wonders of the world. In one part of this essay, to use a name fitting such a digression from the story he was telling, Hugo bewails the unintelligent waste of the flood of sewage, which was passing into and polluting the Seine instead of renewing the fertility of the fields about the city. His computation showed that the authorities were stupidly allowing fertilizing materials worth enormous sums to be entirely wasted, and his arraignment of such a policy remains a model of sarcasm to writers for newspapers.

The only unfortunate feature of the matter is the fact that the great Frenchman was not confining his attention to actual conditions and to scientific truths, for his seeming knowledge was as much a fiction as the adventures of the oppressed Valjean. But such was his convincing clearness of style and so great his skill in the marshalling of alleged facts, that ever since his time men of letters have felt called upon to pose as authorities on sewage disposal. Inasmuch as a literary fellow reaches an audience far larger than his humble scientific brother can expect to gain, and he tells his tale with a grace hopeless of attainment when coupled with mathematical formulas and chemical equations, his engineering influence is decidedly for the bad. That this is so, the following extract from a Hugo-inspired editorial in a Brooklyn paper of great influence bears ample witness: "The truth is that the present system of sewering is radically wrong and abominably wasteful. We are throwing away in the waste of the cities materials for which the land may one day starve; indeed, many acres of farm land already show the effect of hunger and no longer produce the crops they yielded to the first tillers. Even on the prairies, where it was supposed that the soil would require no fertilizing for a century to come, the farmers are buying bone dust, guano and the compounds of Barren Island, yet every town is casting away phosphates and nitrates that would satisfy the craving of the emptiest soils and make the brown earth green again."

The lack of information such a statement indicated is equalled only by the evident good intentions of the writer, yet good intentions proverbially pave the place where the spread of such fairy tales puts the unfortunate engineer. His scientific knowledge is placed at naught by the chimera of a French novelist, and one of the most difficult problems of municipal engineering and applied chemistry is settled with a few strokes of a pen. The absurdity of the statements in the above quotation is evident from the fact that the investigations of Dr. Nichols and other eminent chemists have shown the fertilizing materials in a ton of sewage to be worth only from one to four cents. It costs four times as much to prepare a farm for sewage irrigation as it does for ordinary agricultural methods, and when the land is ready the cost of management is much raised by the presence of the sewage, while the returns are restricted by the limited number of crops which can be profitably grown with sewage irrigation. Except with dry climates or very sandy soil where the land needs water, sewage is a hindrance rather than an advantage, and if fertilizers are required the wisest course to pursue is to purchase them from manufacturers who supply a material far better for the land than a flood of stinking water. This is truth, resting on facts demonstrated by able scientific investigators. The quotation from the "Brooklyn Eagle" is merely graceful, well-meant untruth.

The evil effect of such statements in influential journals is evident from the facts in the present case. The quotation is from an article attacking the system of sewage disposal designed for the Passaic River valley in New Jersey by Messrs. Rudolph Hering, Wm. M. Brown and J. J. R. Croes. These men have spent a lifetime gathering information from all sources which will be of use in solving just such problems as the drainage of this valley presents. They have available in their libraries all the data which the agricultural chemists can supply concerning the fertilizing value of sewage, and if they decide from their knowledge and experience that it is better for the taxpayers along the Passaic for the sewage of the valley to be discharged into New York harbor than to be spread overland, it is hardly in the line of good public policy for their decision to be so oracularly overturned. They are all men of international reputation for the value of their knowledge on the subject, and it is not in keeping with its usual sound sense for the journal named to question their mature judgment so flippantly and on such ridiculous grounds. The towns and cities in the Passaic Valley are already in conflict over the sewerage system recommended by these engineers, but the controversy is over financial and not engineering subjects. The disposal of the sewage in New York Harbor, as proposed, will cause no trouble, no inconvenience, no nuisance; investigations of tidal flow and channels have settled that question and rendered needless any apprehension on that score among the people on the Brooklyn shore of the harbor. All these facts could have been readily learned by the "Eagle" had it cared for facts.

The Use of a Sand Box under the foot of a column which is to be lowered slowly has been proved to be very old by recent discoveries in Egypt, mentioned by Mr. Ludwig Borchardt in the "Centralblatt der Bauverwaltung." Three similar tombs were found near the pyramid of Onnos, all dating from about 500 B. C., and one ready for the interment of a mummy. It was a chamber about 17 feet long, 9 feet wide and 10 feet high to the crown of the arched roof of large cut stones, the first stone arch of the kind on record. The sarcophagus was in place and over it was the heavy limestone cover slab which was to be lowered when the mummy was in position. This stone was 13 feet long, 3 feet thick and just a trifle narrower than the tomb chamber. It was upheld by six rough pillars of inferior workmanship to the other masonry and evidently temporary, and had two massive tenons on each side, fitting in vertical slots or niches in the walls. These niches were carried down about 6½ feet below the floor of the chamber and in them would be placed sand to support wooden posts on which the weight of the slab, about 17 tons, would come when the temporary masonry pillars were removed. Between the two niches on each side of the chamber a pit was excavated large enough to hold a man, and the niches had openings at different elevations connecting with this pit. When it was time to lower the stone, it would only be necessary to have a man enter each pit and open these passages one after the other in order to allow the sand to escape and the timber posts to settle slowly. Such posts were found in the niches of the two tombs containing mummies. When the slab was in place the men could crawl over it and thus leave the chamber.

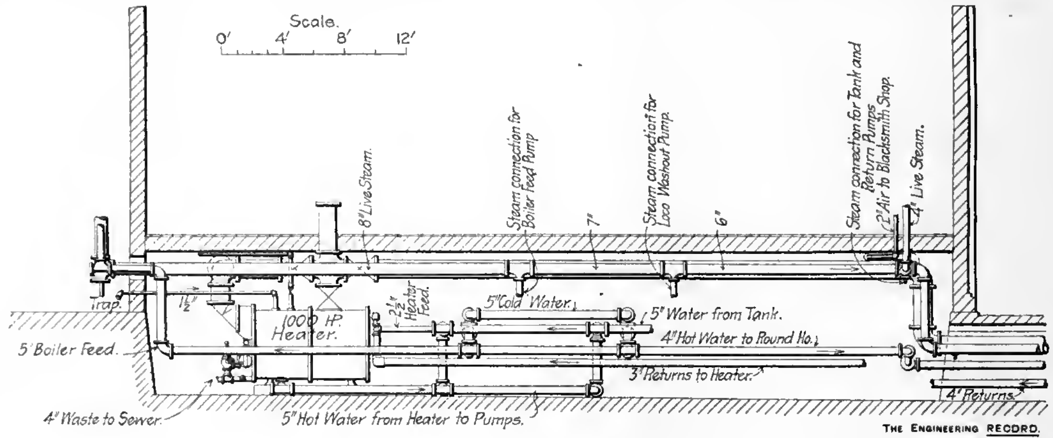
Power, Lighting and Heating at the Du Bois Shops of the Buffalo, Rochester & Pittsburg Ry.

The Buffalo, Rochester & Pittsburg Railway has recently completed a new colony of locomotive shops at Du Bois, Pa., for which the electric and compressed air system of power transmission was adopted, with power, lighting, compressed air and heating all served from a central station. A power plant, designed on modern lines, has been provided for this work with underground tunnels or subways connecting power station and the various buildings. For warming, the fan system of circulating heated air is used.

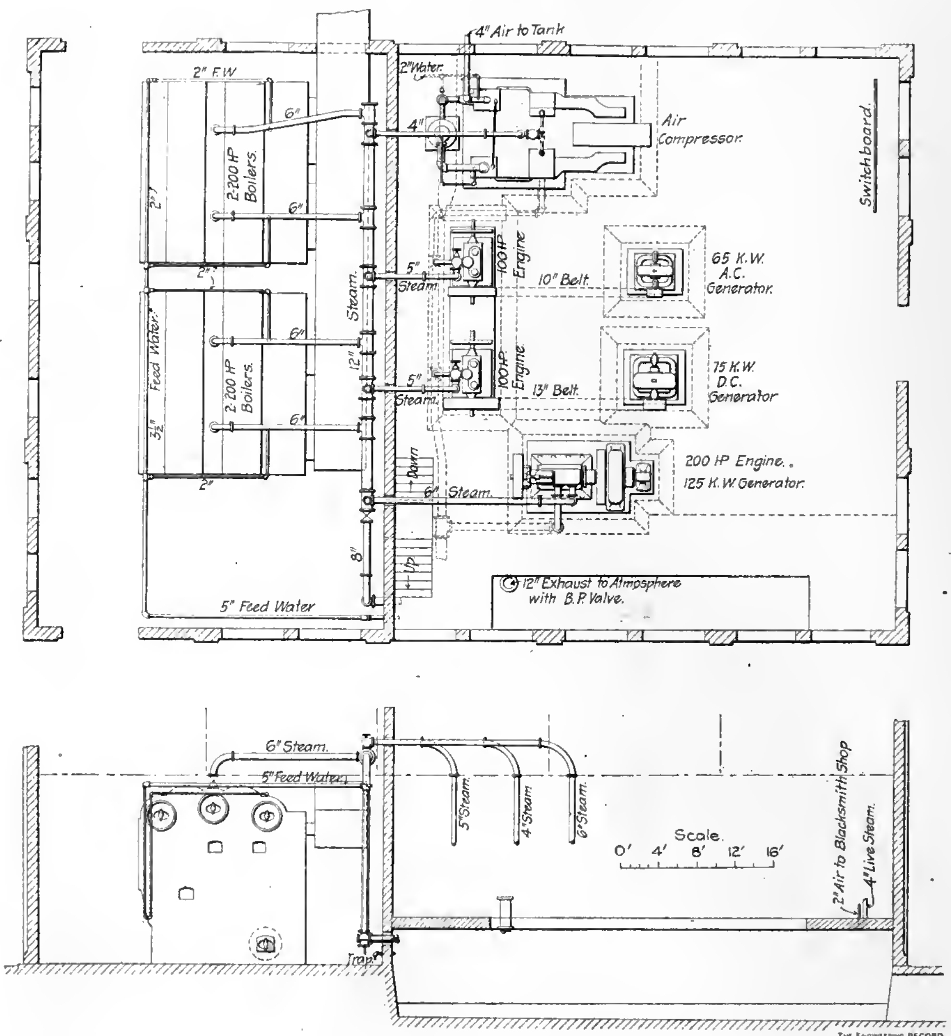
The Du Bois shops, for which 32 acres of land were available for both shop plant and yard, are planned to handle the repairs on about 150 locomotives with provision for expansion for five years, or for 75 engines final increase, making a total of about 17 engines per month. The shops include a main building 134x524 feet in plan, comprising the machine, boiler and tank shops, a blacksmith shop 80x142 feet, the power house 63x93 feet, an office and storehouse 60x120 feet and in addition to these a 30x60-foot oil house, a 16-stall roundhouse and a 26x140-foot coal, coke and bar iron storage.

The power house is of brick with a steel truss roof, the walls 13 inches thick with 17-inch pilasters. It is of the class with boiler and engine rooms side by side, separated by a 12-inch brick wall; the boiler room is 37 feet in width and the engine room 54 feet. The engine-room floor is as usual in this type of plant at a higher level than that of the boiler room and a basement is provided underneath for pumps, heater and incidental apparatus, piping and electric feeders. The building is connected through the locomotive shop to the roundhouse by a 5 feet x 4 feet 7-inch brick and concrete subway, which is drained to a sump at the roundhouse end. A plan and cross-sectional elevation of the power house and an elevation of the piping at one end of the power house basement are given in the accompanying drawings.

The boiler equipment comprises four 200-



PIPING IN THE POWER HOUSE BASEMENT.



PLAN AND CROSS-SECTION OF THE POWER HOUSE.

horse-power Stirling water-tube boilers, set in two batteries, and provision has been made for an additional 200 horse-power boiler. The boilers are hand fired and the coal is received on a trestle alongside the boiler room and delivered through the wall by gravity. For draft a 120-foot brick stack, 6.5 feet in inside diameter, is provided, located outside the building. It rests on a concrete foundation 14.5 feet square and has an outside diameter of 14.5 feet, tapering with a batter of ¼ inch in 12 inches to a diameter of 9 feet 4 inches at the top. Each boiler has a separate steam connection to the steam header with a stop valve close to the boiler. The header is located overhead in the boiler room, and branch pipes to the machinery in the engine room pass through the partition wall into the engine room with an angle valve in each case at the header.

The equipment of the engine room includes one direct-connected electric generating set of 125 kilowatts capacity for power and day lighting and two belted generators, one for lighting shops at night and furnishing such power as required, and the other for yard and distant lighting for which alternating current distribution was adopted. These units are all of the Westinghouse manufacture, the direct-connected set consisting of a 14 and 24x14-inch compound engine and a 250-volt 125-kilowatt engine-type generator driven at 280 revolutions per minute. The belted machines are each driven by a 12x11-inch standard engine, the direct-current machine being of 75 kilowatts capacity, at a speed of 750 revolutions per minute, and the alternating-current machine of 65 kilowatts capacity, giving two-phase current at 2,200 volts and 7,200 alternations per minute at a speed of 900 revolutions. Besides the electrical machinery there is a steam actuated Ingersoll-Sergeant air compressor with a capacity of 950 cubic feet of free air per minute. It has 14x18-inch duplex steam cylinders and compound double-acting air cylinders 14¼ and 22¼ x18 inches in size.

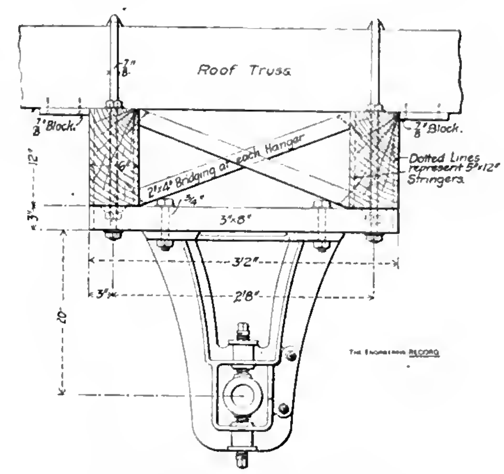
The exhaust from the steam machinery is collected by a system of pipes running under the engine room floor in the basement, where at one end is located a feed water heater and various pumps, as shown in an elevation referred to. Ordinarily all the steam is passed through the heater, which is a 1,000-horse-power Cochrane open-type heater and thence is carried in a main 12 inches in diameter to the shops where it can be utilized for heating. The heater can be by-passed when desired and provision is also made at the heater for surplus exhaust steam to pass to the atmosphere, the out-board exhaust pipe being fitted in the usual way with a back pressure valve so that steam is only allowed to go to waste when the supply of it exceeds the demand. The boiler feed, return and locomotive wash-out pumps are arranged in line with the feed-water heater, though not shown on the drawing. The return pump discharges water of condensation from the heating system to the feed-water heater, the condensation being delivered to a return tank from the subway mains; and the boiler feed pump draws from the feed-water heater and delivers to the boilers. The pump for supplying water to the locomotive shop for washing out locomotive boilers is interchangeable with the boiler feed pump. The pumps are all of the Worthington type.

The switchboard, in the engine room, is of the Westinghouse pattern, of white Italian marble, 28 feet long and 8 feet high. The panels at one end contain the controlling apparatus for the alternator with plunger switches, one per phase and each leg fused with porcelain tubular enclosed fuses on the back of the board. The panels at the other end contain the instruments and switches for the motor feeder circuits, which are ordinarily fed from the 125-kilowatt direct-current generator; and in between are the panels for the 75-kilowatt direct-current machine and instruments for the lighting circuits. There are two sets of direct-current bus bars, one for light and the other for power, and either generator may be operated on either or both, or both machines on either light or power.

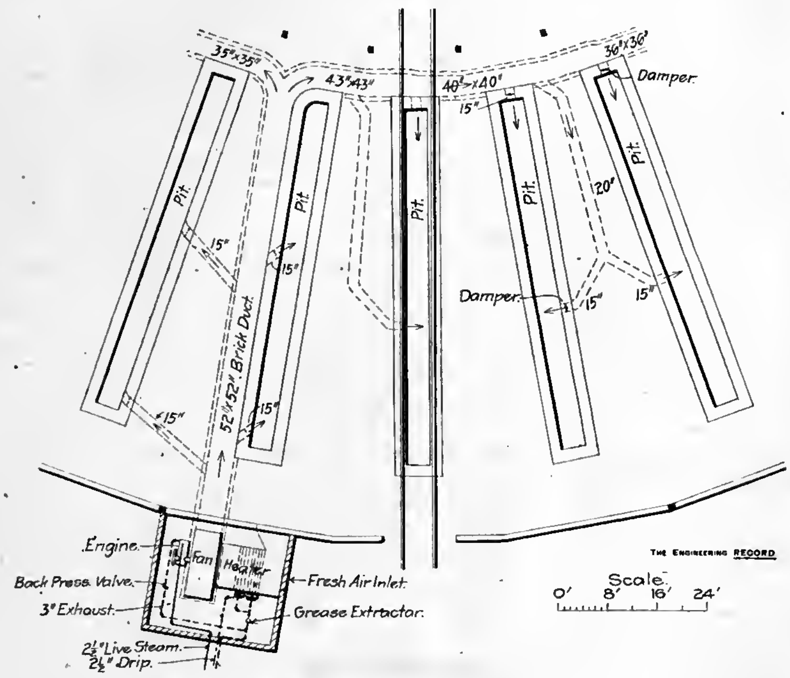
The electric feeders encased in wrought-iron pipes are carried in the subway to the buildings, as explained. For power work the group system was adopted with line shafts attached to the roof trusses of the machine shop bays. The shafting hangers are suspended from stringers, which were attached to the trusses by means of U-bolts, to avoid weakening the truss timbers by any boring or cutting. An accompanying detail drawing will serve to show the general design of the hanger supports. The line shafts are carried on Hyatt roller bearings. Five motors drive the machine shop, the largest of 40 horse-power. Altogether there are about 160 horse-power in motors in the shops, supported in general on platforms elevated about 6 feet above the floor. In addition there are two 50-ton Shaw electric traveling cranes in the machine shop, each with a 6-ton auxiliary hoist; the cranes have a span of 68 feet and a travel of 520 feet or more. The main hoist has a speed of 6 feet per minute, the trolley, of 100 feet per minute and the bridge, of 250 feet. The feeders for these motors as well as the lighting circuits, are controlled from a distributing panel in the locomotive shop.

The artificial illumination of the machine shop is effected by three rows of arc lamps, nine in each row at 60-foot centers. One of these is at the center of the building and the others are under the crane runways. In addition each machine and bench has one or more 16-candle-power incandescent lamps. In the blacksmith shop there are three circuits for incandescent lamps and eight long-burning arc lamps. Each circuit has usually 20 incandescent lamps, which are of the 230-volt type. Each arc lamp is controlled by a separate switch. The outside lighting comprises three miles of conductor with lamps spaced 400 feet apart. The lamps are connected on three circuits of 25 lamps each and are of the Manhattan alternating-current series enclosed long-burning type. The alternating system also includes a fourth circuit which feeds incandescent lamps on 104-volt circuits at distant points, transformers being installed at the points of use to effect the required drop in voltage. The outside arc circuits are connected in series with a Manhattan series alternating-current voltage regulator.

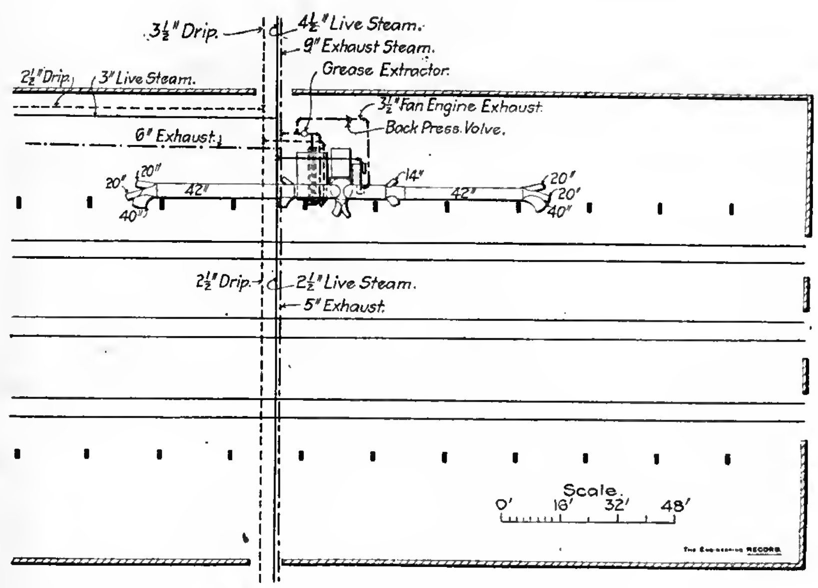
Compressed air is used in the hoists on the various jib cranes, nineteen of which were built by the Whitney Foundry Equipment Company, of Harvey, Ill., in the portable drills, riveters, hammers and jacks; in oil house for raising the oil from basement to the floor above; also in roundhouse drop pits. The first floor of the oil



Support for Shaft Hangers.



Method of Heating Round House.



One of the Two Fan-Heater Units in Main Shop.

house has a clear headroom of 12 feet 10 inches, is 4 feet above the tracks and there is an 8-foot basement. The building is divided into two sections by means of a 12-inch firewall. One section is used as a distributing room and contains shelving for the storing of portable equipment removed from engines. The other section is used for storing oil and waste. The basement contains the tanks. The oil flows from large tanks to smaller tanks through a check valve, and the smaller tanks are emptied by air pressure.

The method of warming the buildings is indicated in the accompanying part plans of the apparatus in the machine or locomotive shop and of that in the roundhouse. The main portion of the machine shop measures 38 feet to the roof truss and there are two lateral extensions each measuring 20 feet to the roof truss. The total cubic contents of the building is 2,440,000 cubic feet. Half way between one end and the middle of the building, each placed in the same side extension, are two duplicate fan units, these being 170-inch three-quarter housing up-blast Buffalo steel-plate fans of the exhauster type. They have 10-foot blast wheels direct connected to 9½x10-inch single horizontal center-crank Buffalo engines, capable of driving them at a speed of 175 revolutions per minute. The speed at which they are designed to run is 150 revolutions per minute, delivering 59,000 cubic feet of air per minute at a pressure of three-quarters of an ounce per square inch.

Each fan draws the air through a heater composed of eight sections of steam coils in series. These sections or coils consist, each, of two staggered rows of 1-inch wrought-iron pipe screwed into the usual sectional cast-iron base or header. From the fan the air is blown directly upward through a 72-inch pipe to a point above the roof truss where the pipes divide into two smaller branches each 50 feet long. From these branches the air is blown through outlets at a velocity of 1,200 feet per minute outward in all directions and downward at an angle of 35 degrees. The farthest distance the air is blown is 120 feet. The air supply is taken directly from the building, the assumption being that sufficient ventilation is provided by the numerous windows and doors.

The steam used during the day time is entirely the exhaust from the fan engines and that from the engines in the power house. A grease extractor is placed in the exhaust pipe leading to the heater, so that the exhaust steam from either source has first to pass through the extractor before reaching the heater. All the condensation is returned to the power house for delivery to the boilers. The combined apparatus is designed to warm the building in every part to a temperature of 65 degrees when the outside temperature is 15 degrees below zero.

The scheme of air circulation is as follows. The current of heated air leaving the outlets at a high velocity, but far above the heads of the workingmen spreads out and diffuses, returning by a gentle flow along the floor from all parts of the shop toward the apparatus. The heating installation is designed to produce a 20-minute air change, that is, once in every 20 minutes the entire air in the building is designed to pass through the heater and be re-distributed. The temperature of the discharge is allowed a maximum of 160 degrees Fahrenheit.

The warming of the roundhouse is also accomplished by the hot-blast system, the use of radiating coils in the pits being discarded on the grounds of being slow to heat up the space to be warmed and of offering great inconvenience to the men working under the engine. The roundhouse has at present 16 pits each 60 feet long, and its total cubic capacity is 912,000 cubic feet. The fan unit is located just outside the building proper. The heater consists of eight separate sections each 7 feet wide by 8 feet 10 inches high. The air is exhausted from the building through the steam coils by means of a 140-inch three-quarter housing, bottom horizontal discharge, Buffalo fan, direct connected to an 8x8-inch horizontal center-crank Buffalo engine. The blast wheel is 99 inches in diameter and is driven under ordinary conditions at a speed of 200 revolutions per minute, giving a blast density of approximately ¾ ounce per square inch. The air is conveyed to the farther side of the building at about 2,000 feet per minute through an underground brick duct, which divides into two branches passing along the ends of the pits. From these a 15-inch tile branch enters at the end of each pit, while between each pair of pits a 20-inch tile branch is carried, supplying two 15-inch branches blowing it at the sides of the pits. A volume regulating damper is placed in each branch. The tile piping and brick ducts are laid in Portland cement. The bottom of the brick ducts has a slope of ⅛ inch per foot for drainage in case of a leak. The heater also utilizes exhaust steam, and an oil separator is used and the condensation returned to the power house.

The shops were designed under the supervision of Mr. R. H. Soule, as consulting engineer, by Mr. J. M. Floesch, chief engineer of the Buffalo, Rochester & Pittsburg Railway, and Mr. C. E. Turner, superintendent of motive power. The details of the mechanical equipment were placed in charge of Mr. W. R. Maurer, chief draftsman of the motive-power department. The steel work of the buildings was furnished by the American Bridge Company; the brick work by Mr. Hiram H. Edgerton, of Rochester, N. Y.; the piping by Messrs. Howe & Bassett, of Rochester; the electric wiring by the Higgins-Almstead Company, of Rochester; and the heating apparatus, together with an extensive installation of down-draft forges for the blacksmith shop, was designed and installed by the Buffalo Forge Company, of Buffalo.

The Steam Plant of the Carpenter Steel Company, Reading, Pa.

About a year ago the Carpenter Steel Company built at Reading, Pa., a 1,200-horse-power steam plant to run two rolling mill engines, to supply water under pressure for several hydraulic rams and presses and to provide for other necessities about the plant. The company's property borders the Schuylkill River where that stream is utilized as a portion of the Schuylkill Navigation Company's canal, and occupies a bluff about 25 feet above the tow path. The steam plant was located on the bank of the river so that the water could be availed of for condensing purposes and the rocky bank was blasted away to make room for the building. Vertical boilers were installed, so that comparatively little ground area was required for the steam plant, and although the building was carried upward sufficiently high to permit the withdrawal of boiler tubes, the building from the general ground level of the steel works appears to be quite low. The railroad tracks being at the works' level, the provision of coal bunkers was comparatively easy to make. In connection with the collection of steam from the boilers and the delivery of feed water to them, an interesting system of piping has been evolved.

The boiler house is 38x56 feet in plan and is of brick construction with a steel truss roof carrying a monitor 53 feet above the boiler room floor and with windows on all sides. Six boilers are at present in place, but as indicated in the accompanying plans, the building can be extended from one end and additional boilers added. The various pumps are placed in a separate room adjoining the boiler room at the floor level of the latter, but the pump room does not extend above the yard level. Its roof supports the yard and consists of expanded-metal concrete arches designed to carry 500 pounds per square foot. The coal pockets are located along the inner wall of the boiler house, between that wall and a substantial retaining wall supporting the yard. There are three pockets, one for each pair of boilers, and they are provided with bottoms floored with concrete and sloped to deliver through openings in the boiler house wall, one opening opposite each boiler. The coal cars are run over the pockets and dump directly into them, their total capacity being about 125 tons.

The boilers are of the Manning type, built by The Bigelow Company, of New Haven, Conn. Each is 74 inches in diameter and 24 feet 9 inches high, and is rated at 250 horse-power. In each boiler there are 284 tubes 2½ inches in diameter and 15 feet long, and a furnace 84 inches in inside diameter. The total heating surface in tubes in each boiler is 2,030 square feet and the total water and superheating surface, 2,888 square feet. The boilers are hand fired and bituminous coal is used; 150 pounds steam pressure is ordinarily carried. Each pair of boilers is served by a single self-supporting steel stack, 6 feet in diameter and 65 feet high, bringing the top about 75 feet above the grates. The area of each boiler smoke outlet from the boiler is 8 square feet, while the gross area of the stack is 19 square feet. The stack rests on a cast-iron ring base plate and is provided at that point with a 6x4x½-inch stiffening angle bar riveted to the inside. The anchor bolts, of which there are four, in each case, pull at their bottom against a grillage of four 20-pound channel bars.

Each boiler has a 7-inch steam outlet and the 7-inch pipe is turned upward in a long sweeping curve to a 16-inch header, into which it enters at the bottom. Each boiler connection has two stop valves, one at the boiler and the other at the header and between the first valve and the boiler outlet is a safety valve. While the use of two valves tends toward a doubly tight connection between boiler and header, the valve at the boiler is provided with a drain, in case water should collect above it. Expansion of the header is allowed for by the sweep connections, and the header being nearly 12 feet above the general yard grade was continued horizontally into the mill, as a main for the supply of the steam engines, pitching slightly, however, to provide for a flow of the condensation occurring within it in the direction of steam flow. The pipe joints were made with Merwith metallic gaskets.

For the supply of the pumps a 7-inch pipe taps the header in the boiler room. It starts in a long upward sweep from the top of the header before dropping to the pumps, to avoid carrying water to their steam cylinders, it being undesirable to attempt to make this connection in the outside run of the header between boiler house and mill building, and to allow furthermore of cutting out the steam main to the engines without shutting off the supply to the pump room. In the case of the steam engines, De Rycke separators are inserted in the branch live steam supply pipes.

The pumping equipment consists of a Blake twin pump and jet condenser, two boiler feed pumps, a tank pump, a pressure pump and two heaters in connection with the utilization of exhaust steam for heating the feed water. The primary heater is located at the entrance of the exhaust main into the pump room and is of the National type. The condenser employs a 12x30x18-inch twin vertical air pump.

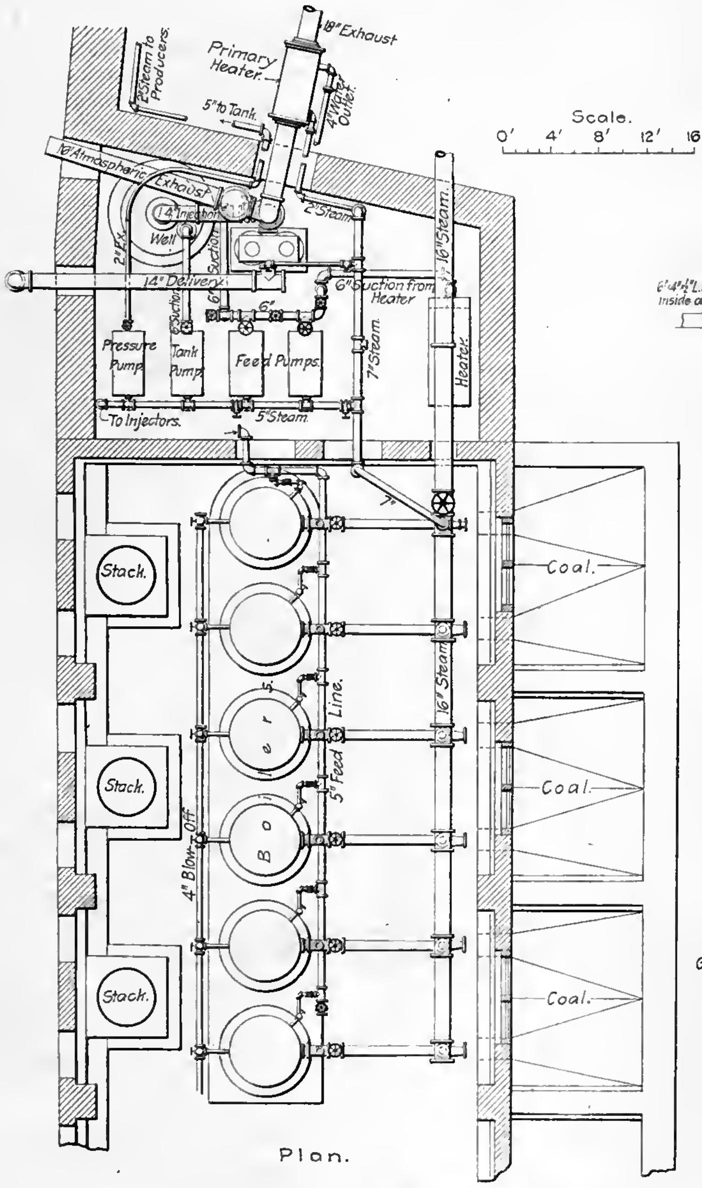
The pump draws from a well built below the pump room and filled by a 14-inch pipe from the river. Both injection and delivery pipes of the condenser are 14 inches in diameter.

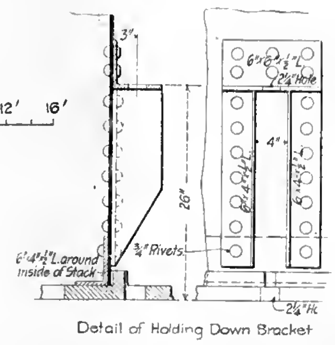
For the delivery of feed water, there is, as stated, a duplicate installation of feed pumps, and there are also a pair of Eynon & Korting injectors in the pump room, as a relay to the pumps. The pumps are arranged so that either one may draw from the auxiliary feed-water heater, which is of the open type, and then deliver to the boiler feed main, while the other draws what fresh feed water is necessary from the condenser injection pipe and pumps it either through or around the primary heater, according as to whether that heater is in commission or not, and thence into the open heater, from which it is taken by the pump mentioned and passed into the boiler feed main. The open heater is of the Cochrane type built by the Harrison Safety Boiler Works, of Philadelphia, and has a rating of 2,000 horse-power.

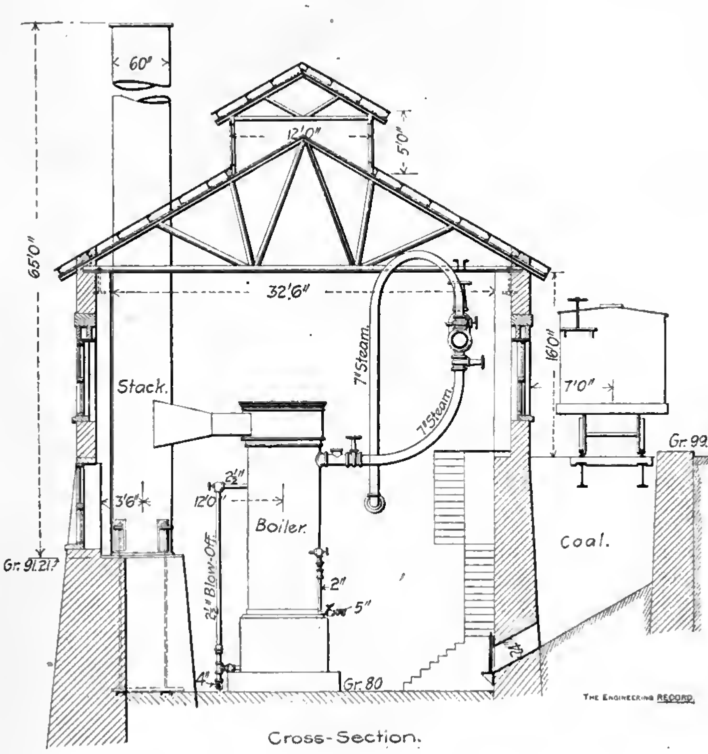
The feed water being drawn from the injection pipe is thus obtained from the river, and it was found that a water purifying plant would be desirable. For this work, duplicate installation of the Bachman purification system, controlled by Messrs. D. W. and R. P. Patterson, of Philadelphia, was made in the boiler room, occupying the spaces between the chimney bases. The feed water on the way to the boilers is passed through this apparatus, which comprises two filters and four chemical tanks. The feed main extends across the fronts of the boilers and the manner of taking off the individual boiler supplies to provide for expansion and contraction is indicated in the accompanying drawings.

The tank pump has a separate suction from the intake well and delivers to a 12,000-gallon tank in the mill building 50 feet above the floor line, for cooling purposes. When the injectors for boiler feeding are used, the water is taken from the delivery pipe of the tank pump. The pressure system for different rams and presses likewise takes its suction from the delivery of the tank pump. The boiler feed pumps are 10x7x10 inches in cylinder dimensions and the tank pump, 10x8½x10 inches, all of the Barr make; and the pressure pump is a Buffalo 7½x4x8-inch pump, and is controlled by a governor to maintain a pressure of 300 pounds for the hydraulic system, which includes a weighted accumulator.

The plant was designed by the E. G. Spilsbury Engineering Company, of New York City, the details of the work being laid out by Mr. George A. Mayland, of that company.







THE STEAM PLANT OF THE CARPENTER STEEL CO., READING, PA.

Economy Derived From Reheating Compressed Air.

The following is an account, reprinted from the "American Engineer," of tests performed by Messrs. W. G. Edmondson and E. L. Walker, students in the Railway Engineering Department of Cornell University, to ascertain the magnitude of the gain derived from reheating compressed air for use in small motors, with the idea that some such method could be advantageously put into application in connection with the use of compressed air in railroad shops, mines, etc., where compressed air is extensively used.

A small 2-horse-power vertical engine with a shaft governor was used as the motor. The compressed air coming from the compressor was first passed through a meter, and then before being admitted to the engine was passed through a reheater.

The amount of air used in each run was recorded by the meter, which was furnished for the test by the Equitable Meter Company of Pittsburg. The meter was especially designed to withstand high pressures and the air passed through it at the temperature of the atmosphere. The meter was calibrated for the pressures used in the experiments, before and after the runs were made, and the meter readings were then corrected from this calibration.

The reheater was constructed of three lengths of 1¼-inch wrought-iron pipe, which was surrounded by an outer casing of 6-inch pipe. This casing was also covered with an asbestos non-conducting covering to prevent the escape of heat. Gas was used as the fuel, and was burned in a burner placed at the base of the reheater. Gas was selected on account of the ease with which the supply of heat could be governed. A gas meter recorded the amount of gas used in each run, so that the amount of heat supplied to the reheater could be easily computed when the heat value per cubic foot and the number of cubic feet of gas supplied per hour were known. The engine was equipped with a prony brake, and an indicator was attached to the cylinder, which allowed both the brake-horse-power and the indicated-horse-power to be computed. In every case the temperature of the air was taken at the meter, and again after it had passed through the reheater, at a point as near to its entrance to the engine as possible.

In conducting the experiments three series of runs were taken as follows: Series I.—In which six runs were made, all at about 57 pounds gauge pressure, while the temperature of the air entering the engine was varied from 60 degrees Fahr. to 401 degrees. Series II.—In which five runs were made, all at about 82 pounds gauge pressure, while the temperature of the air entering the engine was varied from

60 degrees to 395 degrees. Series III.—In which two runs were made, at about 77 pounds gauge pressure, and the temperature of the entering air 42 degrees and 266 degrees respectively.

The average results from each run were then taken from the log of each run and are shown on the general result sheets, one of which is reproduced. The tests were performed during the month of April, 1902, in the Mechanical Laboratory of Sibley College, Cornell University. The term cubic feet of free air is used to represent the volume of air at standard conditions, which are taken in this case to be at a pressure of 14.7 pounds absolute, and at a temperature of 60 degrees Fahr.

Results and Conclusions.—The net gain in economy obtained with the lower pressure was 38.4 per cent., while with the higher pressure it was but 31.7 per cent. under the same conditions. In other words, a reduction of 31 to 38 per cent. in the cost of the production of compressed air for a plant by reheating the air from 60 to 400 degrees Fahr. before using it.

The curves in Figure 3 illustrate how the economy is raised by increasing the temperature. It is seen that the increase in economy is gradually lessened after the temperature reaches about 300 degrees. By continuing the curve it would indicate that the point would soon be reached where an increase in the temperature would not cause any further increase in economy, this point being reached at about 450 degrees.

The results obtained in these experiments afford a very interesting comparison of the effects produced by different degrees of reheating, as well as by the use of different working pressures. Of the three different series of runs taken, the one employing the lowest pressure (56 pounds) seemed to give the most efficient results.

It was not considered advisable with the engine to raise the temperature of the entering air much above 400 degrees, on account of the bad effect it would have on the packing in the valve rod and piston rod glands, and also on the lubricant; however, a much higher temperature could have been attained with the reheater used.

Although the economy derived from the application of heat to the air may result from the increased volume, the experimenters were led to believe that the high results obtained are due partly to other changes of condition in the working of the engine, resulting from the higher temperatures. By reheating the air the engine is relieved from the difficulties due to freezing of the moisture in the exhaust passages and the choking up of the valve. It was noticed that as the temperature of the air was raised while the pressure remained constant, the speed of the engine was increased, the cut-off was made shorter, and in general the operation of the engine was rendered much smoother.

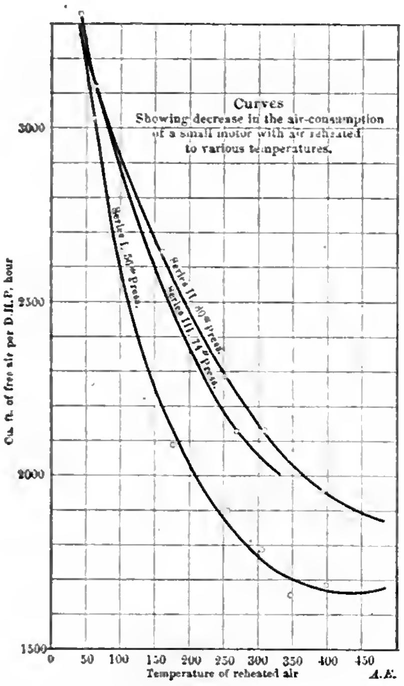


Figure 1.

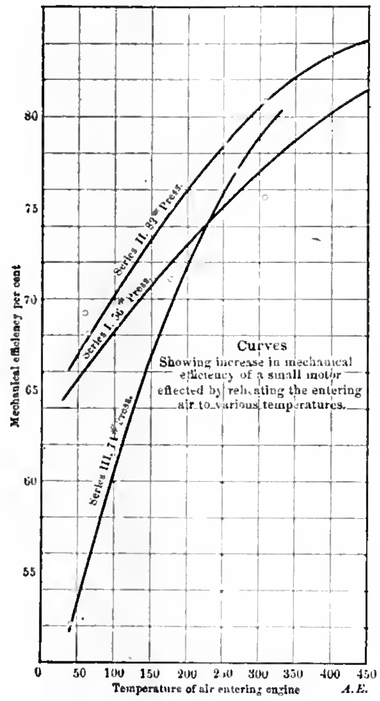


Figure 2.

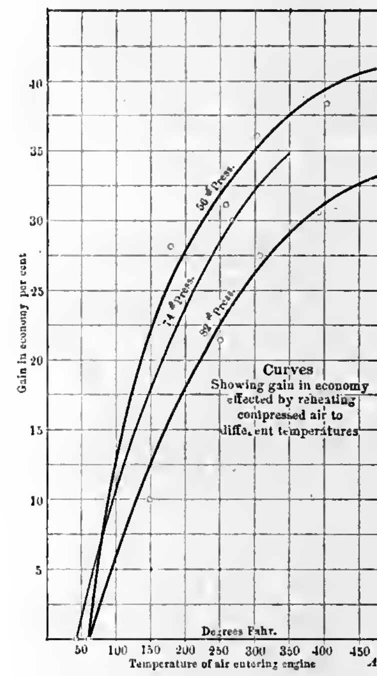


Figure 3.

General Results of Series 1.

No. of run	1	2	3	4	5	6
Duration, hr.	1	1	1	1	1	1
Air pressure at engine, lbs.	55	53	53.8	56	57	57
Temperatures, deg. F.:						
Air at meter	51.2	86.8	86.3	79.1	81.5	74.3
Air at engine	59	176.5	256	306	348	401
Air at exhaust	7	87.6	147	177	198	236
Room	48	79	83	78	76	70
Heater flue	...	220	309	352	...	421
Air, cu. ft. per hr.	377	323.4	303.4	274.4	252.6	238
Cu. ft. per hr. standard	1,877	1,445	1,367	1,295	1,204	1,150
Air, lbs. per hr.	143.5	110.4	104.4	99.0	92.2	87.8
B. T. U. absorbed per hr.	2,659	2,350	4,210	5,340	5,840	6,820
Gas, cu. ft. per hr.	...	8.7	15.7	21.4	...	28
Efficiency of reheater, per cent	...	51	50.6	47.1	...	45.9
Cut off, per cent	56	36.5	35	32.2	29.4	28
Expansion ratio	1.79	2.74	2.86	3.11	3.40	3.57
Temperature range	52	88.9	109	129	150	165
Revolutions per min.	330.5	363	375	378.9	381.5	357.5
B. H. P.	.629	.693	.717	.724	.727	.682
I. H. P.	.909	.976	.945	.956	.910	.860
Mechanical efficiency, per cent	69.2	71	75.9	75.6	79.9	79.3
Free air per B. H. P. per hr.	3,030	2,085	1,901	1,790	1,658	1,688
Air saved, per cent	...	31.2	37.3	40.9	45.3	44.6

By referring to the curves in Figure 1 it is seen that the decrease in consumption of air is in almost direct proportion to the increase in temperature, until the higher temperatures are reached, when the decrease becomes more gradual, and finally ceases when the temperature is raised above the limit of practicability. In Series I., which employed a pressure of about 56 pounds, it is seen that a saving of 44.6 per cent. of the air used cold was effected by reheating it from the temperature of 59 degrees to 401 degrees. With Series II. and III., in which higher pressures were used, the gain was not quite as much.

Referring to the results obtained in Series I., the maximum gain in air saved with the highest temperature is 44 per cent. of the amount of cold air required to produce the same amount of power, which indicates that the power derived from the same weight of air would be increased about 78 per cent. by reheating it from 60 degrees to 400 degrees. In other words, a compressor which is able to supply 100 horse-power at the motor with cold air could be made to supply 178 horse-power by the use of reheaters. As the increase in volume obtained by raising the temperature of the air for this amount is only 65.3 per cent., it will be observed that the increased saving must be due partly to the more favorable conditions that the heated air provides for the engine to operate under.

The percentages of gain given in the results refer to the brake-horse-power, and the increased mechanical efficiency caused by the use of heated air must have a considerable effect upon the results. The increase in mechanical efficiency is shown by the curves in Figure 2.

Three important points are secured by the use of a reheater, viz.: (1) absence of freezing, (2) reduced cost of plant throughout, and (3) great increase in permanent economy.

Sewage Purification Experiments at York, England.

The subject of sewage disposal was very carefully investigated at York, England, during the last few years under the direction of the city engineer, Mr. Alfred Creer, M. Inst. C. E., whose elaborate report on the subject will be reviewed in the following notes. In consequence of complaints from the West Riding Rivers Board as to the unsatisfactory character of the effluent turned into the Ouse River from the chemical precipitation works at Naburn, investigations were begun to determine the feasibility of a further purification by passing the effluent over land. Trial holes were opened in various parts of the 18 acres available, but it soon became evident that the land was most unsuitable for such a purpose and that if it was used for sewage treatment the result would probably lead to a more serious nuisance than that arising from the discharge of the effluent from the precipitation works directly into the river.

After about a year's negotiations it was decided in the fall of 1898 to lay out experimental works with the view of "obtaining reliable data as to the effects of the various methods of treatment." The original plan included experiments with filtration on prepared land, with artificial filters and with a closed septic tank; but further experiments were suggested from time to time and were carried into effect. The following is a list of the experiments made: (1) Treatment of sewage by covered septic tank and single contact; (2) treatment by double contact bacteria beds; (3) treatment by a "ladder" filter; (4) treatment by open septic tank and continuous filtration; (5) treatment by open septic tank and double contact beds; (6) treatment of filtrate from experiment No. 1 through prepared land; (7) treatment of sewage by open septic tank and intermittent gravel filter.

For a proper understanding of the conditions, it should be stated that the sewage of the city gravitates to the pumping station at Fulford, where it passes through coarse screens and is then pumped to the disposal works at Naburn. For some years after the opening of the works it was found necessary to remove by hand large quantities of sand that accumulated in the reservoirs or pump culverts directly under the engine house. Since November, 1899, however, no such removal has been necessary, everything passing the coarse screens being carried to the disposal works. The sewage when delivered at Naburn was therefore very much worse to deal with during the experiments than it was when the sand was to a large extent deposited at Fulford.

For the purpose of these experiments a 15-inch pipe was laid from the sewage channel along the side of the precipitation tanks to a gauge chamber where sluice valves and gauges were fixed to control and measure the quantity treated. Under normal conditions the sewage occupies about five hours in flowing from the center of the city to the disposal works. To insure fair average samples of the sewage being obtained for analysis, portions were taken every half hour for ten or twelve hours, generally from 8 A. M. to 8 P. M. These were put into a bucket and well mixed before being sent to the analyst. Samples of the effluent from the continuous filter were obtained in a similar way, representing the flow over a lengthened period.

The provisional standard of purification fixed by the West Riding Rivers Board, with which the results obtained were compared, is one grain per imperial gallon of oxygen absorbed, and one-tenth of a grain per imperial gallon of albuminoid ammonia, which are equivalent in parts per 100,000 to 1.429 and 0.143 respectively.

Experiment No. 1. Covered Septic Tank and Single Contact Bed.—The tank was of concrete, of 48,000 U. S. gallons capacity, and as nearly airtight as possible. The sewage entered by three inlets 3 feet below the surface, and was withdrawn at the same level. The four contact beds were each 40x20x3 feet deep, with floors of concrete and sides and division walls of sod backed with clay puddle. Later, however, owing to the ravages of moles, the sod walls were removed and the sides lined with brickwork, the filters being reduced to half their original area. The material for filling the beds was clinker, cinder and coke. It was graded from ⅜ to 1¼ inches and put in in three layers, the larger material being at the bottom. It is stated that in all the experiments very little of the filtering material was of a quality best suited for the purpose; much of it was insufficiently burned, with the result that it soon became disintegrated and was partly washed out with the filtrate.

In this first experiment the gauge was set so as to allow a flow into the tank at a rate of from 15,600 to 48,000 gallons per day, giving a stay in the tank of from one to three days. The beds were worked in cycles varying from 8 to 12 hours. For the 8-hour cycle, two hours were occupied in filling, two in standing full and the remainder in emptying and standing empty. For the 12-hour cycle the time of filling was extended to three hours. When the working arrangement permitted, each bed was given a week's rest in rotation, that is, once in four weeks. The best results were obtained with a cycle arranged as follows: Filling, 1½ hours; standing full, 2 hours; emptying and and standing empty, 4½ hours.

At first one of the contact beds was used for a few weeks with the effluent from the chemical precipitation tanks. This had already been purified to the extent of about 56 per cent. before passing into the contact bed. The total purification obtained was from 85 to 90 per cent. However, as the object of the experiments was to determine the advantage of bacterial methods over chemical treatment, this arrangement was discontinued.

For the first period of working, from April 24, 1899, when the experiment was begun, till October 28, 1900, the area of the contact bed was 355½ square yards, and the average rate at which the sewage was passed through, including rests, was 249,100 U. S. gallons per acre per day. For the second period, from December 10, 1900, to August 31, 1901, the area of beds was 177¾ square yards, and the rate was 705,900 gallons per acre per day. The total quantity of sewage passed through the beds up to August 31, 1901, was about 17½ million U. S. gallons, and it is stated that the maximum depth of deposit at that time was 14 inches.

In the analyses of the effluent, slight traces of calcium nitrate were observed on only two occasions. The free ammonia was reduced from an average of 4.16 parts per 100,000 to 2.43. The purification in parts per 100,000 effected is shown by the following table, seven values being given in the report for each period:

	Alb. ammonia. Sewage.	Alb. ammonia. Effluent.	Oxygen absorbed. Sewage.	Oxygen absorbed. Effluent.
First Period.				
Max.	0.70	0.37	4.78	1.57
Min.	0.30	0.16	2.31	0.67
Avge.	0.54	0.27	3.52	1.15
Second Period.				
Max.	1.35	0.30	7.96	2.87
Min.	0.36	0.04	1.74	1.04
Avge.	0.72	0.18	4.29	1.54

The results of this experiment were distinctly disappointing in view of the success of the system in other places; and Mr. Creer was unable to account for its failure. He states that everything possible was done with the means at his disposal to make the experiment a success.

Experiment No. 2. Double Contact Beds.—These beds were 90x30 feet in size and 2 feet 9 inches deep, and were placed at different levels so that the entire contents of No. 1 could be discharged directly onto No. 2. The floors were of concrete and the walls of sod backed with clay puddle. The filling material was the same as that used in the previous experiment, but in No. 1 it was larger, being 1¼ to 3 inches in size, the coarser material on top. In bed No. 2 the size of the material was ⅜ to ¾ inch. These beds were filled once in eight hours except on Saturday, when they were filled only once, and Sunday, when they remained empty all day.

This experiment was a far more severe test than the one preceding it. The raw sewage was run directly onto contact bed No. 1, with no attempt at preliminary sedimentation. In order to fill the bed in the shortest possible time (about one hour), the flow through the 15-inch pipe leading from the sewage channel was for one hour in every eight increased from 34 to about 240 gallons per minute. As a consequence, every time the sluice to this bed was opened, large quantities of sludge that had been deposited in the pipe during the slow flow were washed out onto the surface of the bed. Under these circumstances it is not surprising to find that the liquid capacity of bed No. 1 was rapidly reduced, though a marked restoration resulted from periods of rest.

The total capacity of the basin was 55,200 U. S. gallons. On June 13, 1899, after the clinker had been put in and the bed filled with sewage a few times, the liquid capacity was 22,260 gallons, or about 43 per cent. of the gross contents. On September 11, after about 90 days' use, the capacity was reduced to 11,160 gallons, about half what it was before. As a result of 14 days' rest the capacity had increased to 16,380 gallons and after 42 days' use had become reduced again to 11,520 gallons. Subsequent tests showed the absolute necessity of frequent periods of rest. On several occasions the surface of the bed had to be forked up, and twice dried sludge to the extent of a cartload had to be removed from the surface. In no case did the liquid capacity of the bed become reduced to below 10,800 gallons, owing probably to the bed being allowed to rest every Saturday afternoon and Sunday. It was twice necessary to put additional clinker on bed No. 1, owing to the settlement and disintegration of the material. No appreciable reduction in the liquid capacity of bed No. 2 was observed during the experiment.

During the time these beds were in use, from June 13, 1899, to October, 1900, there were passed through them 11,138,900 U. S. gallons of sewage, the rate, including rests, being about 183,500 gallons per acre per day. A summary of the nine analyses given in the report is as follows, values being given in parts per 100,000:

	Alb. ammonia. Sewage.	Alb. ammonia. Effluent.	Oxygen absorbed. Sewage.	Oxygen absorbed. Effluent.
Max.	0.70	0.21	4.78	0.96
Min.	0.30	0.10	2.31	0.33
Avge.	0.52	0.145	3.34	0.64

It will be seen that in both cases the averages were practically within the provisional standard of the West Riding Rivers Board, although in the albuminoid ammonia test about 50 per cent. of the results were worse than the standard. On one occasion only was calcium nitrate present in the effluent in measurable quantity, although on five other occasions there were traces. The average of the free ammonia in the sewage was 4.70 parts per 100,000 and in the effluent, 1.21.

The results obtained from this experiment were on the whole very satisfactory, the main objections to this arrangement being the limited quantity of sewage that can be treated per acre of filter, and the loss in capacity of the beds.

Experiment No. 3. Ladder Filter.—This filter was composed of ten chambers, each 4 feet by 3 feet 5 inches by 2 feet deep, filled with similar clinker to that used in the first experiment. Each successive chamber was placed 6 inches below the previous one, and was separated from it by a 2-inch flag division. Under each alternate division a space about 2 inches in depth was left. The raw sewage flowed onto the first chamber, passed through the 2 feet of filtering material, under the division into No. 2, up through No. 2, over the next division into No. 3, down through No. 3, and so on, passing altogether through about 20 feet of filtering material, the liquid being aerated by coming in contact with the atmosphere in passing over the top of each alternate division. Facilities were provided for emptying each pair of chambers for the purpose of aerating.

This filter was brought into use on June 8, 1899, and was continued at the rate of 3,310 U. S. gallons per day until July 13. On July 4, the purification was 82 per cent., three days later it was 71 per cent., and on the 13th, it had deteriorated so much that the filter was stopped and divided into two separate sections of five chambers each.

A new start was made on July 17 at the rate 2,160 gallons per day to each section, but notwithstanding additional periods of rest, the purifying power of the filter deteriorated steadily, and further experiments with it were abandoned on September 15, 1900.

Experiment No. 4. Open Septic Tank and Continuous Filter.—In February, 1900, it was decided to convert one of the chemical precipitation tanks into an open septic tank, and to construct a circular filter. The supply pipes for the tank, perforated with 2-inch holes, were supported on old iron rails along one side of the tank about three feet from the bottom, and along the other side similar pipes were provided for the effluent, which then flowed into an open channel and finally reached the filter through 8-inch cast-iron pipes which were carried down under the floor of the filter and then up again above the surface of the clinker. The form of distributer used spread the tank effluent over the whole area of the filter in the form of fine jets.

The filter, for which the name York is proposed, is circular, 67½ feet in diameter. The floor is of Portland cement concrete with radial grooves 1½ inches wide and deep, beginning 3 feet from the center and terminating at the outer edge, where they are about 6 inches apart. From the center to the circumference the floor has a fall of about 6 inches. Around the floor, and forming a part of the same construction, is a shallow channel 2½ feet wide, to receive the filtrate as it leaves the filter.

On the concrete floor about 6 inches from the channel, a 9-inch brick wall was built up in pigeon-hole work, 8 feet 9 inches in height. The space inside this wall was filled with clinker to a depth of 6½ feet. Some of the clinker was of fairly good quality, but a large proportion of it was insufficiently burnt, and even after 13 months' use continued to flow out with the effluent in the form of a very fine ash. As the clinker was put in and levelled, perforated unglazed pipes 4 and 6 inches in diameter were laid radially at intervals of 2 feet vertically, making three series of them. In all 24 of these air ducts were laid.

The tank was filled with sewage on June 26, 1900, and allowed to stand full until July 5, when it was assumed to be sufficiently prepared to begin treatment. For the first seven weeks there was only 5 feet of filtering material in the filter. On July 24, 1900, while passing 1,219,000 U. S. gallons per acre per day, analysis of the effluent showed the oxygen absorbed to be 0.46 and the albuminoid ammonia 0.046 parts per 100,000. From July 5, 1900, to August 31, 1901, the tank and filter were not stopped more than 31 days in all, the longest rest being six days. The quantity of sewage dealt with varied from 1,219,000 to 4,850,000 U. S. gallons per acre per day, averaging 2,555,500 gallons, and the total quantity dealt with up to August 31, 1901, was about 82½ million gallons, and the total quantity of sludge in the tank on September 9, was 225 cubic yards.

The analysis of the effluent gave very uniform results during the whole period, well within the standard adopted, and seemingly regardless of the rate of filtration or the percentage of impurity present in the sewage. The following table giving values in parts per 100,000, is condensed from the tabulated results of forty tests:

	Sewage.	Effluent.
Oxygen absorbed:		
Max.	9.92	1.28
Min.	1.74	0.16
Avge.	4.32	0.67
Albuminoid ammonia:		
Max.	1.70	0.140
Min.	0.35	0.030
Avge.	0.73	0.071
Nitrogen as calcium nitrate, avge.	0.00	11.56
Free ammonia, avge.	3.94	0.26
Chlorine, avge.	12.81	10.42

For about ten months after starting the experiment no permanent scum formed on the surface of the septic tank. At the end of the period the scum averaged 2 inches thick, but it was evidently not a necessity to the proper working of the tank, but rather an incident to the liquefaction of the solids.

In regard to the condition of the filter, it is stated that the portion of the filtering material near the surface became coated with a gelatinous substance containing a large number of small thread-like worms, some red in color, while others had the same colorless appearance as the substance adhering to the cinder. In addition to the worms there were large numbers of small flies not only in the pigeon holes of the containing wall but throughout the whole filter where it had been examined. Occasionally large numbers of the worms were washed out, probably accounting for the many fish at the outlet of this tank.

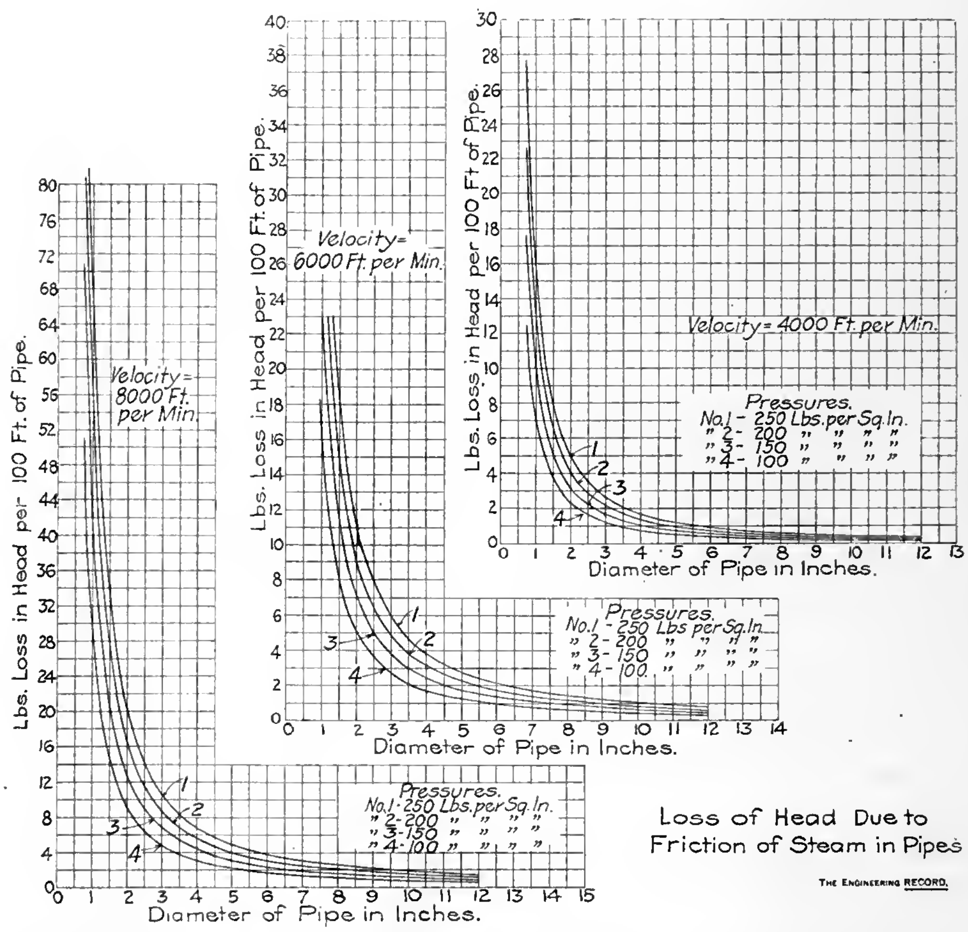
Experiment No. 5. Open Septic Tank and Double Contact Beds.—The same beds used in Experiment No. 2, after a rest of 39 days, were used for this also. During the rest bed No. 1 had been forked up and about 6 inches of the top replaced with clean material. Operations were begun with these beds on November 23, 1900, with three fillings per day of effluent from the open septic tank, and continued till July 1, 1901. Durin~ this period 5,868,000 U. S. gallons of tank effluent were passed through the beds, at a rate of about 215,000 gallons per acre per day. The poor results obtained from these contact beds, both in this experiment and when they were used with crude sewage, may perhaps be partly explained by the fact that on opening up bed No. 1 the material was found to have solidified to a considerable extent, and to be like a mixture of ordinary soil with ashes and fibrous material.

The effluent gave better average results by the albuminoid ammonia test than when the crude sewage was used on the beds, although the results were not quite so good by the oxygen absorbed test. The following is a summary of the sixteen analyses, in parts per 100,000:

	Sewage.	Effluent.
Oxygen absorbed:		
Max.	7.95	1.68
Min.	1.75	0.42
Avge.	4.32	0.92
Albuminoid ammonia:		
Max.	1.50	0.28
Min.	0.36	0.03
Avge.	0.79	0.10
Nitrogen as calcium nitrate, avge.	0.00	2.81
Free ammonia, avge.	3.07	0.57

Experiment No. 6. Effluent from Experiment 1 on Prepared Land.—A quarter of an acre of land was divided into two plots, trenched 2½ feet deep and underdrained. After using the plots for about two months the surface began to cake over, and it is stated that the effluent from the contact beds would lie on the surface for weeks, showing the unsuitability of the land for filtration purposes.

Experiment No 7. Open Septic Tank and Intermittent Gravel Filter.—The tank was 7 feet 10 inches square and 1 foot 9 inches deep, holding about 787 gallons, and was provided with an Adams' automatic syphon. The filter was something over 19x11 feet and 3 feet deep, with walls of pigeon-hole brickwork. It was filled with clean gravel as follows: 9 inches of 1½-inch at the bottom, then 9 inches of ¾-inch, then 9 inches of ½-inch, 4½ inches of ⅜-inch and 4½ inches of coarse sand.



Loss of Head Due to Friction of Steam in Pipes

When the liquid in the syphon chamber reached a certain depth the contents of the tank were discharged over the whole surface of the filter by means of a perforated trough, covering the filter to a depth of about 2 inches. Although various periods of discharge were tried, no satisfactory filtrate was obtained during the eight months the experiment was in operation.

In conclusion, Mr. Creer recommended to the consideration of the sewerage committee the results of experiment 4, the open septic tank and continuous filter.

The Friction of Steam in Pipes.

Among the theses presented by the class of 1902 of the Virginia Polytechnic Institute was one by Messrs. W. L. Chewning and W. P. Tams, Jr., on the friction of steam pipes. This contained a number of diagrams plotted from tables prepared particularly for the use of designers of power plants, and was sent to this journal by Prof. L. S. Randolph because of the useful data it contained. The introduction explains the general form of the equation for the flow of steam by comparing it with that for water. For the latter, assuming there is no friction, h, the loss of head, is equal to $v^2 \div 2g$ by the law of falling bodies. Friction exists, however, and varies directly as the length, l, and inversely as the diameter, d, so that the actual flow is more closely represented by $h = flv^2 \div 2gd$. Since 2g is a constant, this equation can be reduced to the well-known Weisbach expression

$$h = f' \, lv^2 \div d \ldots\ldots (1)$$

As water is almost incompressible, its density is not taken into account, but this must be done when the flow of steam is considered and the above formula modified accordingly. Experiments made under the direction of the Italian government many years ago show that the usual formula for the flow of compressible fluids through pipes could be used for steam. This formula is $Q = c \sqrt{(pd^5 \div wl)}$, where Q is the volume in cubic feet per minute, p is the difference in pressure in pounds per square inch causing the motion, d is the diameter in inches of the pipe, w is the density of the fluid in pounds per cubic foot, and l is the length in feet of the pipe. If W is the total weight of the fluid discharged per minute, $Q = W \div w$, and the equation can be written in the following form, $p = W^2 wl \div c^2 w^2 d^5$. But $W = kwvd^2$, where k is a constant, hence

$$p = k'wlv^2 \div d \ldots\ldots (2)$$

If formulas (1) and (2) are compared, it will be seen that the only difference in form is the introduction in the latter of the density. According to the Italian experiments, the value of c in $Q = c \sqrt{(pd^5 \div wl)}$ is 58, and this value might be used in determining k'.

A modification of this formula was introduced by Mr. G. H. Babcock and used by him in the computation of his well-known tables issued by the Babcock & Wilcox Company. It is

$$W = 87 \sqrt{(w \, p \, d^5 \div l \, [1 + (3.6 \div d)])} \ldots (3)$$

Comparing this formula and that of the Italian authorities, it will be seen to allow for a variation of the constant for different sizes of pipes. Thus, for a 1-inch pipe, the constant would be 40.5, for a 3-inch pipe 58.6 and for a 10-inch pipe 74.8. This formula was employed in computing the tables plotted in the accompanying diagrams. For changes in the initial pressure multiply the values in the diagrams by the ratio of the densities at the new and old pressures. The loss caused by a globe valve is stated to be about equal to that in a pipe of a length equal to $114d \div (1 + [3.6 \div d])$. The loss caused by elbows is two-thirds that due to globe valves.

Testing of Combined Steam-Engine and Dynamo Sets.

Extracts from a paper presented to the Institution of Civil Engineers by Edwin Hartree Rayner.

The exacting requirements of engineers and others, in specifications relating to the economy of generating-plant, have caused makers of engines used for the generation of electricity to instal apparatus for the rapid testing of steam-dynamo sets. This comprises special steam-raising plant, arrangements for controlling and dissipating the electrical output, and instruments for its measurement and for the measurement of the steam used by the engine. In the following paper the author proposes to outline the tests usually applied to such sets, and the methods used in the testing-shops of engine makers.

In England, where the manufacture of engines and dynamos is largely carried out by separate firms, the dynamo is usually sent to the engine maker with a coupling on the armature-shaft, by which it is fixed to the crank-shaft of the engine. The engine maker fits the two together and steams them according to the tests required. By this means, in a few hours, an insight is obtained into the economy of the set, such as it is almost impossible to acquire in a central station or private installation. The engine builders obtain, at the same time, data for future orders, and are able to effect improvements which would hardly be possible except by having most of their engines steamed under the eyes of men whose work it is to get engines to run satisfactorily, and who have had much experience of former engines. Satisfaction is given to customers by the fact that when finally erected the engines usually run satisfactorily at once. The performance of these tests is an important item in the cost of the engine to the builder. The methods now employed in all tests where reliable results are required in a reasonable time were instituted by the late Mr. Willans at Thames Ditton. High-speed-engine builders have now erected special buildings and laid down plant at considerable expense for the purpose; and engines up to about 1,200 horse power are now usually tested before leaving the works. Engines of over 1,500 horse power are more conveniently tested on site after erection, on account of the large boiler-power required and the cost of such a trial.

In the following paper the author proposes to deal chiefly with the work done in the testing department of Messrs. Willans & Robinson's works at Rugby. This department has been built entirely separate from the rest of the works. The engines (small sizes complete, ready for the steam and exhaust-piping; larger ones in parts) are brought on trolleys running on rails from the erecting-shop, the men from which erect the engine on the steaming-beds. The boiler-power required is considerable, as several engines are often running at once, if not on official trial, yet on preliminary runs to see that all is satisfactory. The rapid fluctuation in the demand for steam, due to the engines being continually started and stopped, necessitates the employment of a boiler readily controllable as to rate of steam-production; and, as it is usual to run all engines off a common steam-pipe, the boilers must easily maintain the highest pressure required by modern triple-expansion engines, viz., about 200 pounds per square inch. These requirements are best fulfilled by water-tube boilers, and at Rugby there are installed four Niclausse water-tube boilers rated at 250 horse power each, but which easily produce 400 horse power. They are also used to supply steam, day and night, to two engines driving the dynamos which supply power for the traveling cranes, forty in number, the pattern-shop machinery, circulating pumps for the condensers, and for lighting the whole of the works. These engines are three-throw engines of standard pattern with two-pole dynamos, rated 900 amperes at 120 volts. A power-house is now in course of construction, in which electricity will be generated for works' use; electrical power-transmission will soon be completely installed for all purposes, and larger generators will be used. The steam arrangements include three duplicate feed-pumps, a Green economizer of 192 tubes, with motor-driven scrapers, and two motor-driven circulating-pumps for the surface-condensers. The water is purified in two settling-tanks, in which it is softened by the Archbutt-Deeley process. A railway siding passes the boiler-house door, and the covered bunkers are capable of storing large quantities of coal.

The testing-shop consists of four bays, in which the dynamos and condensers are placed. Each is served by two electrically-driven traveling cranes. In the front, away from the boiler wall, there is a pit, 3 feet in depth and 6 feet in width, in which the field-magnets of large machines are fixed, and over which large fly-wheels are hung, as by this means the engine itself is kept down and is therefore more easily steadied. There is also in one bay a shorter parallel pit. The engine bed-plate is usually planed underneath and supported on girders about 1 foot high, which are bolted to cast-iron slots grouted into the cement floor. In small sets the magnets are fixed on the same bed-plate as the engine, and in larger sets they have to be packed up to the required height either from the floor-level or from the pit-bottom. The floor furthest away from the boilers is raised, and on it the engines are placed after the trial, and are taken down, examined, oiled, and, in the case of the smaller ones, re-erected.

All electrical readings are made in the weigh-bridge room, where the steam used by the engine is weighed after it comes out of the condenser, and where practically the whole trial is made. There is also an underground system of pipes by which the exhaust of an engine may be taken to the atmosphere. One person sitting before the weigh-bridge beam has before him a clock, on the one side a bell to signal to the driver or persons indicating the engine, on the other the shunt-resistance controlling the output of the machine, and in full view the scales reading by reflected light the output of the machine. By this means the consumption of steam by the engine is obtained in a few minutes with greater accuracy and satisfaction than if it were done by the older method of measuring the feed-water supplied to the boiler, which with all its losses and inaccuracies would require as many hours. It would be the work of several days to obtain satisfactory results by the latter method from an engine tested at full, three-quarter, half and quarter load, both condensing and non-condensing, such as can be done by the former method between breakfast and dinner hour.

Numerous pipes supply live steam to the engines by means of temporary copper and wrought-iron piping, and there is usually a separator for removing the water in the steam on the engine bed-plate, as well as separators permanently fixed to the steam mains. Loose flanges enable the connection of the temporary steam-piping to be easily made. The condensing water is taken from a main supply-pipe by means of flexible pipes, and is discharged through a special drain into one of the condensing ponds. The steam used by the engines is condensed in a surface-condenser, and gravitates into one of two tanks on weigh-bridges. In the case of condensing trials, it is pumped out of the condenser by the air-pump. The layer of oil on the top of the water prevents any undue evaporation from the surface of the warm water in the weigh-tank. The main current from the dynamo is carried by temporary cables to terminals on wooden boards fixed on the pillars supporting the roof. The mains run to the screw-plug testing switchboard, from which some twenty circuits lead to resistances in the resistance-room, where the energy is dissipated by passing the current through iron-wire netting or through water-tanks. To smaller terminals are connected two wires from the main terminals of the machine, by which the effective voltage is measured, and two others are similarly provided for the exciting circuit, whether the machine be self or separately excited.

The field-coil circuit is taken to the instrument room, where temporary connections are made to shunt-resistances and switches, and an ammeter is placed in the circuit. By means of the shunt-resistance the load on the machine is adjusted. In ordinary working the field-coils of a shunt-wound machine gradually increase in resistance after running for some time, as they become heated by the current. The extra resistance in the circuit has therefore to be reduced as the machine becomes warm, if the voltage is to be kept constant. The testing switchboard on the gallery is divided into an upper and a lower panel, one for each pole of the machine. It consists of a number of horizontal bars to which the machine terminals are connected; and at the back of the switchboard are a number of vertical bars connected to resistances in the resistance-room, through a switch by the making or breaking of which the load, or part of it, is put on or taken off the machine being tested. By screwing plugs into holes in the back bars, any machine may be put on to any of the resistances in the resistance-room. In the latter the frames are arranged, chiefly by means of copper connections in mercury cups, to suit the voltage of the machine. The current, per switch, is usually about 100 amperes with 500-volt machines, and 200 amperes or more at lower voltages. By means of copper bars from the adjacent lighting switchboard the whole load of one of the lighting engines may be taken up on the frames for experimental purposes, or current may be taken for any special purpose, as may be required. Arrangements are provided by means of which the field of any machine may be at once excited, if required, from the ordinary lighting circuit or battery, or by any other machine which may happen to be running at the time on the testing-beds.

The most important point to be ascertained in the economy of a steam-dynamo is the amount of steam consumed by the engine for a given output of energy by the dynamo, or the number of pounds of steam required by the engine per electrical horse power-hour, or per kilowatt-hour, developed by the dynamo. As an engine is more economically worked if fully loaded, it is of great importance to determine how the consumption per electrical horse power-hour, or per kilowatt-hour, increases as the engine is more lightly loaded. For this purpose tests are often made at three-quarter, half, and quarter load, as well as at full load. The water running out of the condenser or air-pump falls into one of the weigh-tanks in a pit below the level of the floor. In measuring the steam-consumption the weight on the beam is moved along till it overbalances the water. As the tank fills, the beam rises and causes an electric bell to ring, and the observer notes the hour, minute and second on the clock. He sets the weight forward a certain amount, varying between 10 pounds and 300 pounds according to the size of the engine and its load, so that the bell will ring again in about a minute. At each observation note is made of the electrical output of the machine in volts and amperes; and, if the water is found to be coming out steadily from the engine, 20 minutes is usually a sufficient length of time to ascertain the steam consumption of the engine for all practical purposes.

Two of the most important quantities to be observed are the current produced by the dynamo, and the voltage at which it is generated. In testing-works, where currents of hundreds of amperes and also currents of small fractions of an ampere have to be measured daily, it is evident that without very carefully designed instruments a large number of these might be necessary, since measurements accurate to one-third per cent., and often even more accurate, are required.

At Rugby the system used for the measurement of continuous currents was designed by Capt. H. R. Sankey, R. E., M. Inst. C. E., and the late Mr. F. V. Andersen, and the adaptability of one of the instruments to measurements widely different in magnitude is remarkable. In measuring current the same instrument is used to measure 2,000 amperes and 0.000002 ampere, accurate to within one-third per cent., and a similar instrument is used to measure voltage between 1,000 volts and 0.001 volt. The system used is a direct deflection method. The current from the machine passes in its circuit through a standard low resistance of a few ten-thousandths of an ohm. The difference of potential between the ends of this resistance, if the resistance be constant or practically so at all temperatures reached in practice, is proportional to the current flowing. Two wires from the ends of this resistance are connected to a galvanometer in the instrument room, and in the circuit is a resistance so calculated that the galvanometer, which reads by light reflected from a small electric lamp, shows amperes direct on the scale, which is 1 foot 8 inches in length, and is divided into 200 parts, each of 0.1 inch. If the current is over 200 amperes the resistance is so arranged that the scale-reading is one-half or other fraction of the total current. By using main resistances of different capacity and magnitude, currents of largely different value can be easily measured, reading direct in amperes or multiples or submultiples of an ampere. The current taken by the galvanometer is an inappreciable fraction of the whole—about one-millionth. The galvanometers used are of the d'Arsonval type, in which the current passing round a coil suspended in a magnetic field produced by a permanent horse-shoe magnet tends to deflect the coil. The restoring couple is supplied by the fine strip of metal which supports the coil and also leads the current to it, a similar strip below acting as the other conductor. This type is the only one available for the work required, as the large and variable currents dealt with would, by the magnetic field they produce, render useless any other type of galvanometer. The measurement of voltage in the case of continuous currents is done in a manner similar to that used for the measurement of the current.

One of the most important quantities to be determined is the indicator-horse power of the engine. For this purpose an indicator is fixed on to each cylinder, and communication with the receiver above is also effected, by means of a three-way cock. The motion for the indicator-drum is derived either from an eccentric on the shaft or from an inclined plane on the cross-head, by a plunger acting through the crank-chamber door. The indicating is done on an electric-bell signal being given from the weigh-bridge room, where bell-pushes are placed near the scales on which the amperes and volts are read. Usually three complete sets from each indicator are taken, the electrical readings, speed, steam-pressure, and vacuum being noted at the same time. When an engine is indicated at different loads, it is usual to plot, on squared paper, the indicator-horse power against the output of the dynamo. The results usually fall on a straight line, from which the efficiency is at once obtained. The steam-consumption of the engine is also plotted in a similar manner, the steam used, in pounds per hour, against the dynamo output. This gives at once consumption per electrical horse power-hour or per kilowatt-hour, and, from the efficiency curve, the consumption per indicator-horse power-hour.

It has been found desirable to test all pressure-gauges and indicator-springs used. The apparatus employed for this purpose consists of a vertical cylinder of copper partly filled with water, which is acted on by steam pressure from the boilers, and is in connection with a small ram of 0.1 square inch in cross-section. This ram is loaded with 1 pound weights, every 1 pound representing a pressure of 10 pounds per square inch when the ram is just balanced. The balance is obtained by allowing steam to escape by a needle-valve. By adjusting this valve and the inlet-valve the pressure may be kept nearly constant at any desired amount, and the reading on the gauge is noted when the ram is just balanced. There is an attachment to which an indicator is fixed for testing indicator springs, which are thus tested at their working temperature.

A Froude hydraulic brake, made by Messrs. Mather & Platt, of Manchester, is used for measuring brake-horse power. It absorbs the power of the engine by churning water which passes through it. The power is measured by hanging the required number of 80-pound weights on the end of a lever, the smaller adjustments being made by a jockey-weight. By adjusting the cocks controlling the inlet and outlet of the water, the beam is made to balance horizontally. From the weight on the lever, the distance of the weight from the center of the shaft, and the speed of the engine, the brake-horse power is obtained. The brake is capable of absorbing about 700 horse power at 250 revolutions per minute, and will keep the beam horizontal automatically if required.

The Expansion of Concrete has been investigated by Mr. C. A. Lyford in the physical laboratory of the Worcester Polytechnic Institute. Earlier experiments already mentioned in this journal gave the expansion as 0.0000115 per degree Centigrade. Later tests of two bars have given 0.0000102 and 0.0000115 as the mean values between 20 and 50 degrees Centigrade. These results are slightly higher than those obtained by Professor Pence and described in this journal on February 22.

A Large Sewer Tunnel Contract in Brooklyn, N. Y., for which proposals will soon be asked, is now occupying the attention of contractors. The sewer, which will be for both surface and house drainage, is to be 13 feet in diameter, 6,200 feet long, and will furnish long-desired sewerage facilities for the Dyker Heights section. When ultimately extended eastward it will reach Bensonhurst. The outlet will be at 92d Street and New York Bay. The estimated cost of the work is stated by Mr. H. R. Asserson, chief engineer of the Bureau of Sewers, to be $665,000.

The Blair Building, New York.

The 76½x80-foot Blair Building at Broad Street and Exchange Placé, New York, is a steel-cage office building twenty stories high above the curb. It has 35 steel columns on concrete piers sunk by the pneumatic caisson process to rock at about 45 feet below the curb. The cellar floor will be from 27 to 31 feet below the curb and about 14½ feet below the ground-water level at the deepest place. Two of the interior caissons are rectangular and support two columns each, the remaining eight are from 8 to 9 feet in diameter and each supports one column on the center line. The caissons for the wall columns are from 6 to 7 feet wide, from 13 to 40 feet long, and are arranged to form a continuous enclosure around all sides but one of the lot.

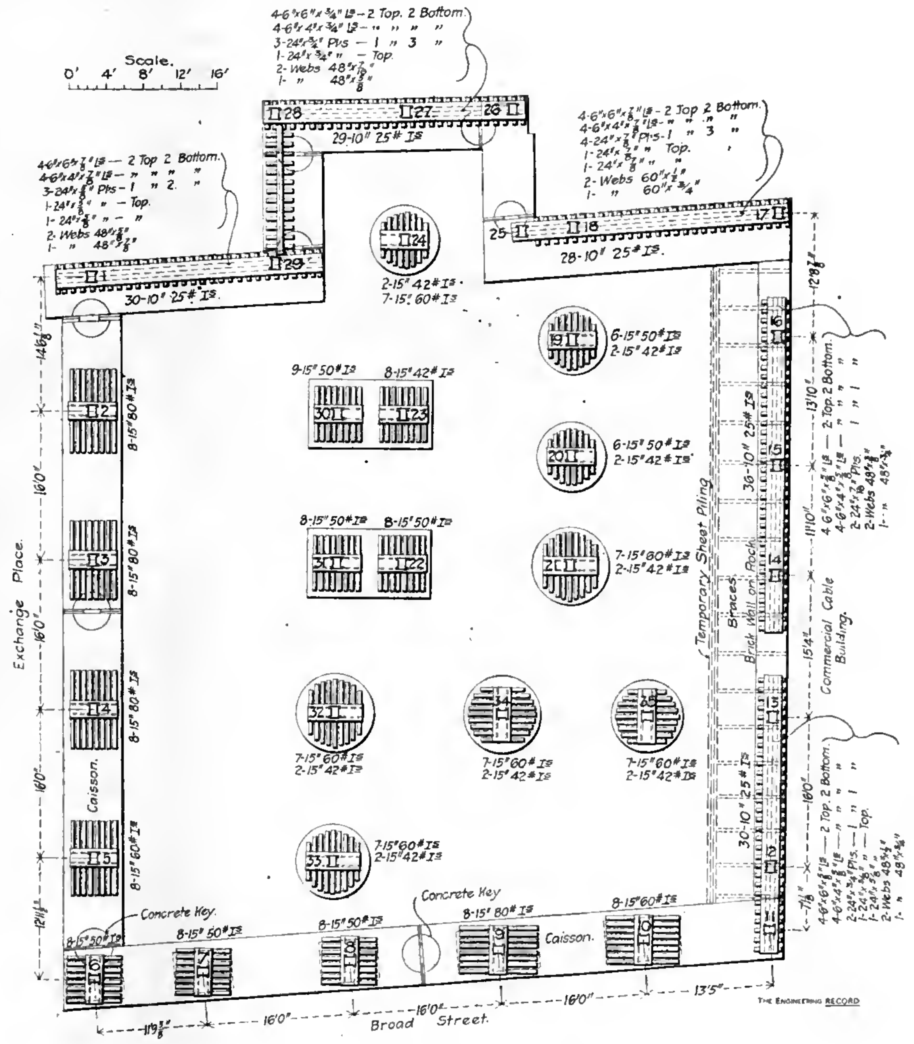
The cellar floor in the old building was from 7 to 9 feet below the curb, and through it four test holes near the corners of the lot were sunk from 34½ to 36 feet deep to hard bottom before the old building was removed. The lot was excavated to about 12 feet below the curb or 2½ feet above the ground-water line, and caisson sinking was commenced June 20. All caissons had vertical wooden staves 4 inches thick secured to interior horizontal angle-iron frames by bolts with countersunk heads which left a smooth exterior surface. The bottoms of the caissons had steel-plate cutting edges and the working chambers of the cylindrical ones had removable domed steel roofs and air shafts similar to those described in previous articles on foundations in this journal. The lower sections, which were the caissons proper and included little more than the working chambers, were uniformly 9 feet high. Their walls were carried 28 feet higher by two sections which were really simple cofferdams connected to them and to each other by vertical bolts through the top and bottom inside horizontal flange angles.

All of the interior caissons and cofferdams were sunk through guide frames of horizontal timber rectangles with a clearance of 2 or 3 inches from the caisson on each side, and fillers packed in the center of each side in contact with the caisson, which had the corresponding stave well greased at its bearing. The frames were diagonally braced to the bottom of the general excavation and served to preserve the verticality of the caissons. The cylindrical caissons were loaded with pig iron filled in between the air shafts and the cofferdams and handled by small hoisting engines which operated light tackles suspended from brackets above the tops of the cofferdams. A 6x6-inch vertical timber was bolted to the side of the cofferdam, and at the top, 10 feet above the upper edge, there was attached to it a simple swinging bracket about 3 feet long made of a pair of small channel bars back to back with a sheave between them for the hoist rope at their outer end, which was guyed to the top of the vertical piece. The spoil was hoisted out of the caissons in cylindrical steel buckets which were inverted by snubbing a line attached to their bottoms while they were being lowered, and thus dumped their contents on platforms whence it was shoveled into wagons and carted off before a large quantity was allowed to accumulate. Concrete was lowered into the caissons in cylindrical steel buckets with automatic flap doors in the bottom.

At the corners the wall caissons overlapped and were nearly at right angles to each other with the end of one abutting against the side of the other with very small clearance. Adjacent to the line of contact in each caisson a semi-cylindrical well was left open when the working chamber and cofferdam were filled with concrete. The straight side of the well corresponded to the vertical sheathing boards and the curved side was enclosed by expanded metal centering on braced wooden scarf boards. After both caissons were sunk the sheathing planks at the edges of the wells in both walls were bolted together, the center ones removed and the edges of the opening calked, thus establishing communication between the working chambers and cofferdams of both caissons and making the two wells into a single one of approximately circular cross section with two vertical radial diaphragms composed of the sheathing planks extending half way from the circumference to the center on opposite sides. The well was grouted and concreted and the two caissons were thus keyed strongly together and a substantially watertight joint was made between the caissons. Similar connections were made between the abutting ends of caissons in the same line in the middles of the walls. The caisson and cofferdam sections were delivered whole on wagons drawn by several teams.

The very long cofferdams were braced by interior transverse angles 5 or 6 feet apart, which were bolted to belt courses of flange angles about 4 feet apart vertically ou the sides of the cofferdams. The horizontal panels between them were braced by adjustable diagonal rods at the ends and in intermediate panels, which were removed as the cofferdam was concreted. Special care was taken to secure accuracy in the positions and dimensions of these foundations and the plans were made to 1/32 inch and lines and levels were frequently checked instrumentally by the engineers. The ends of the caissons were sunk with very slight clearance and the deviations from the perpendicular in sinking were slight. The general design and principal details of the caissons and methods of sinking them corresponded closely to those described for the New York Stock Exchange in The Engineering Record of September 28, 1901.

The building has street fronts on two sides, and as the wall caissons are well within the curb line no special precautions were necessary to prevent undermining the street. On one side, the lot is bounded by the continuous line of foundation caissons for the Commercial Cable Building, which are carried down to solid rock as described in The Engineering Record of April 17 and May 8, 1897, and on the remaining side the foundations of the adjacent building were underpinned before excavation was commenced for this building, by jetting down under them to solid rock, five 10-inch pipes which were filled with concrete. The same wall was braced with inclined timber shores which were seated on transverse timber sills across the tops of the cofferdams of the wall caissons.



Plan of Foundations, Blair Building.

After the wall caissons were all sunk they excluded the ground water and the interior excavation was made to the required depth with comparatively little pumping. The sheathing of the insides of the cofferdams was removed as the excavation progressed and the grillage beams were bedded on top of the concrete piers.

On the east side of the lot the wall columns are supported on a foundation wall which is carried down to bed rock about 50 feet below the curb and is built up solid against the caissons of the Commercial Cable Building. The pit for these footings might have been excavated in the open without special methods after the lot was enclosed by the wall caissons, but to expedite its construction it was commenced before the general excavation was made inside the caissons, and a row of 9-inch Wakefield sheet piles was driven across the lot between the wall caissons about 8 feet clear of the Commercial Cable Building caissons. This formed a cofferdam to exclude ground water and resist earth pressure and in it excavation was carried down to bed rock, the sheet piles being timbered and braced to the caissons as the earth was removed. The bottom of the trench was filled with concrete 4 feet thick and on it a brick wall 40 inches thick at the base was built and capped with short transverse grillage beams under the wall columns.

Different parts of the lot were successively covered by a heavy timber deck at street level, which was shored up from the bottom of the excavation and served for a working and storage platform and was shifted from place to place as the caissons were sunk. On it was placed a stiff-leg derrick with two 50-foot booms and two 30-foot vertical masts braced together about 15 feet apart. The masts are swung by bull wheels and the derricks were operated by two hoisting engines. A trestle bent about 40 feet long and 12 feet high, with seven vertical posts scabbed to a cap and to a bottom sill, was made of 12x12-inch timber, X-braced, and set up on the Broad Street building line. A similar parallel trestle was set 25 feet away, in the street beyond the curb line and transverse beams about 30 feet long were laid across the caps and cantilevered 5 feet beyond the street bent. They were kneebraced to the vertical posts and covered with thick floor planks which formed a roof protecting the sidewalk and forming a shelter over the edge of the street under which offices and small shops were located.

At the corners of the platform nearest the building, two vertical derrick masts were set and braced together in the plane of the trestle bent and farther secured by stiff legs anchored to the opposite side of the platform. Each mast had a long boom, swung by an independent hoisting engine, and these booms, with those previously described, commanded the whole area of the lot and handled all the caissons and cofferdam sections, which were delivered complete and weighed up to 16 tons or more each. The two air compressors, the pumps and the other machinery were located in the excavation, where there were also dressing rooms for the caisson men, who worked continuously in 8-hour shifts under pressure below 20 pounds at the maximum. Concrete was mixed by hand on platforms in the excavation and at the street level, and was handled in steel buckets lowered by derricks into the caissons, and by wheelbarrows from which it was dumped into the open cofferdams.

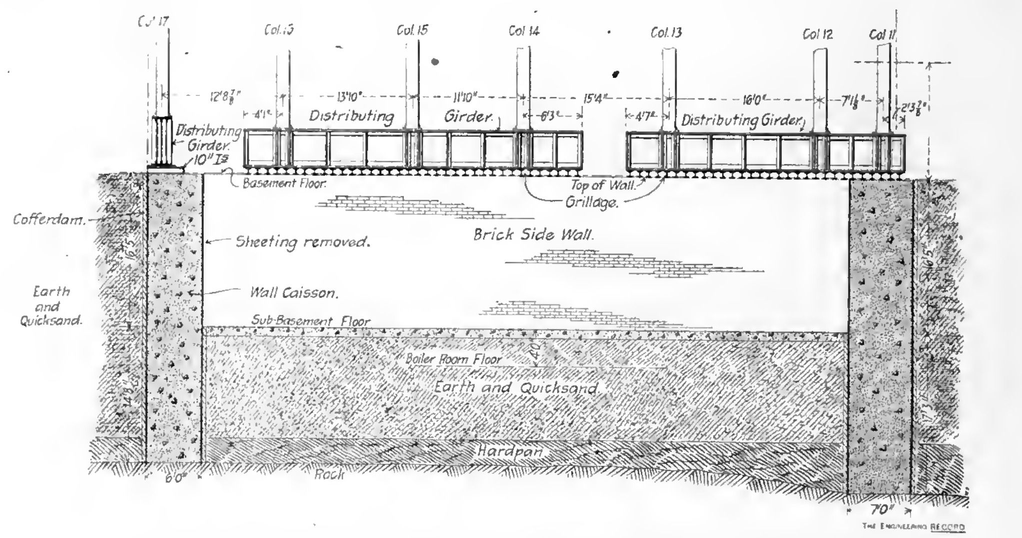
The last caisson was sealed July 22, thirty-two days after air pressure was put on the first one; the deepest caisson was excavated 52 feet below the curb and the most rapid sinking was about 2 feet an hour. The circular caissons were loaded with about 50 tons, and the largest rectangular caisson was loaded with 400 tons of pig iron. As the steel decks were removed from the working chambers of the circular caissons after they were concreted there was no concrete filled into their cofferdams until after the caissons were sunk to their final positions. The rectangular caissons had, on the contrary, flat steel roofs which were permanently left in position. On them the first two sections of the air shafts were permanently left in position. They were loaded with concrete 15 feet in depth to promote sinking, before the excavation was commenced. The foundation quantities included about 2,400 yards of caisson excavation, 4,000 yards of excavation around the caissons and 2,000 yards of concrete in the caissons and cofferdams. A total force of about 350 men was employed on the foundation work and was divided into two 12-hour shifts for the men outside and three 8-hour shifts for the men in the caissons. All the material above hard pan was excavated in the caissons rapidly and easily by shovels, but the hardpan required picking.

The tops of the concrete piers are levelled off 3¾ feet below the cellar floor for the interior columns and about 16½ feet higher, at the basement floor level, for the wall columns. The tops of the circular piers are nearly covered with grillages of six or seven 15-inch I-beams. The two rectangular interior piers and the wall piers on the two street sides have grillages consisting of sets of eight 15-inch I-beams from 6 to 8½ feet long, concentric with the columns. These piers are all symmetrically and concentrically loaded but the wall piers next to the adjacent buildings are eccentrically loaded on grillages of 10-inch transverse I-beams 3 feet long and about 1 foot apart, set close to the building line. In all cases about one-half of the surfaces of the wall piers are covered by the grillages.

The interior columns and the wall columns in the street fronts have extended bases made with wide gusset plates riveted across the cover plates at the lower ends and stiffened with flange angles to receive base plates which reach from side to side of the grillages and serve for distributing girders to transmit the column loads equally to all the grillage beams. On the wall piers next the adjacent buildings the columns have ordinary bases and are seated on distributing girders which reach from end to end of the piers. With one exception these girders have three webs and eight 6x6-inch flange angles. All of them have one or more 24-inch cover plates and the plates and angles are from ⅝-inch to ⅞-inch thick. One girder has webs 60 inches deep and one girder has a single 36-inch web. The longest girder receives columns 14, 15 and 16, and is 36 feet long and 48 inches deep; but is not as heavy as the girder 30 feet long, 5 feet deep and 2 feet wide which receives columns 17, 18 and 25 and weighs about 32,000 pounds. All grillages, girders and column bases receive two coats of asphalt paint and are entirely covered with fine rich concrete which is rammed between their webs and all interstices carefully grouted.

In the typical floors the columns are connected by pairs of I-beams in the planes of the exterior walls. The web of one beam is in the plane of the outer face of the columns and that of the other beam is a little inside the opposite face of the column so that the end of that beam abuts against the side of the column. The two beams are connected by cast-iron separators and are arranged so that the outer one carries wall load only and the inner one carries floor load only. Most of these beams are 12 inches deep, but in one case they are 18 and in another 20 inches deep. From each of the street wall columns except those on the corners a girder extends normal to the front of the building to a column in the next row of interior columns. These girders are all pairs of 18-inch 55-pound I-beams with riveted transverse diaphragms or separators and their webs engage the opposite faces of the columns. All other girders between columns are single I-beams from 9 to 20 inches deep, which are connected to them on the center lines of their faces.

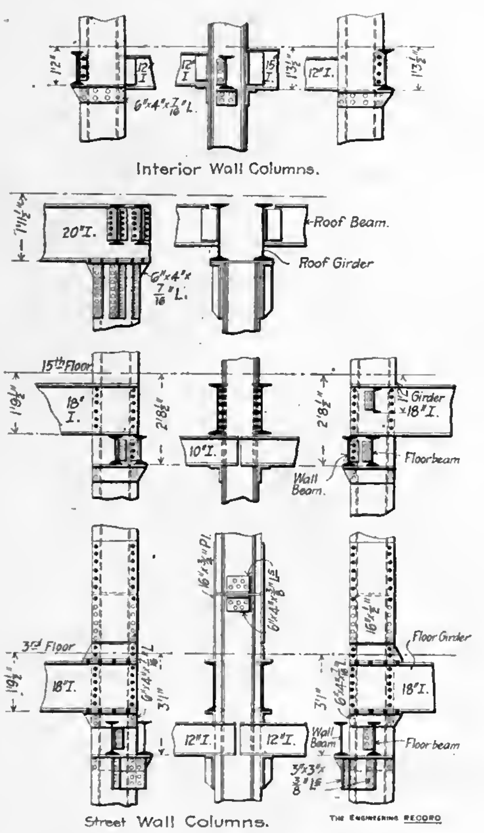
The floorbeams are of about 16 feet maximum span and from 4 to 5 feet apart on centers. They are single I-beams from 8 to 15 inches deep and are web-connected to the girders, with the top flanges flush with those of the girders and uniformly 3½ inches below the finished floor level except for the 8, 9 and 10-inch beams which have their bottom flanges 14 inches below the floor level. The beams have the usual horizontal tie rods from web to web and support flat hollow-tile side construction arches which are proportioned to carry a total load of about 200 pounds per square foot. The roof is similar to the floors except that it is slightly pitched and is proportioned for a total load of 150 pounds per square foot and is covered with hard burned thin flat tiles laid in cement instead of having a wood surface like the floors.



DISTRIBUTING GIRDERS ADJOINING COMMERCIAL CABLE BUILDING.

The columns all have a rectangular closed cross-section made with two channels and two cover plates, and are spliced about 18 inches above the tops of the girders by two cover plates and a horizontal diaphragm. The wall columns have bracket angles with reinforced horizontal flanges on which the wall beams are seated just beyond the face of the column. The parallel floorbeams are seated on the same angle but are additionally connected by a short vertical angle riveted to the beam web and to the face of the column. The floor girders have their flanges sheared on one side at the ends so that the webs lie flat against the faces of the sides of the columns and are riveted to their column cover plates. Their flanges are also riveted to top and bottom horizontal angles on the columns. In the upper stories these connections are slightly modified as shown in the elevations, by cutting the flanges of the wall beams to allow them to set closer to the columns and connecting them to the columns with short vertical angles like those of the floorbeams. The floor girders have their webs fillered out from the sides of the columns. The tops of the columns have cap plates bearing on the ends of vertical angles and supporting the lower flanges of the 20-inch I-beam roof girders. All beam and girder connections are made to the interior wall columns with single vertical web-connection angles and bottom bracket angles without reinforcement for their horizontal flanges. The beam and girder connections to the interior columns are made in the same manner, and all are field-riveted with pneumatic hammers.

The architects of this building are Messrs. Carrere & Hastings, and Mr. Owen Brainard, of that firm, is the engineer in charge. The structural steel work was designed by Mr. Henry W. Post, and is being supplied by the American Bridge Company who are fabricating it at their Pencoyd plant. The general contractor for the building is the Andrew J. Robinson Company. The caisson work and the general foundation work was executed by Mr. John F. O'Rourke, the work for him being in charge of Mr. T. B. Bryson. Mr. Brainard has expressed his very great satisfaction with the accuracy and expedition with which the foundation work was carried on, it having been completed before the expiration of the contract period. He considers it a first-class example of the efficiency and certainty of the building methods which have been made necessary and



Details of Columns.

developed by the extraordinary conditions prevailing in building operations in the downtown district in New York.

The Technolexicon or technical dictionary in German, English and French which the Society of German engineers has undertaken to prepare, is reported to be progressing satisfactorily. German contributors have been secured for words in 730 classes, English and American for 450 and French for 93. In addition 266 German societies, 23 English and American and 22 French have agreed to assist in one way or another.

Tar Macadam Roads in Nuneaton, Eng., were pronounced a success by Mr. J. S. Pickering in "The Surveyor" some time ago. He states that a tar macadam road can be made complete for about 46 cents per square yard, with 3 inches of macadam as a foundation and 1½ inches of chippings as a top surface. The price stated includes the cost of material, cartage, heating and tarring material, removing old macadam, laying and steam rolling.

Fall of the Campanile of St. Mark's, Venice.

Abstract of a paper presented to the Royal Institution of British Architects, by Luca Beltrami, Director for the Conservation of Monuments in Lombardy.

The fall of a monument of such exceptional importance as the Campanile of St. Mark's, Venice, could not fail to produce a vivid and painful impression on all sides, owing to its imposing mass, its intrinsic interest to artist and historian alike and the countless memories associated with an existence of over one thousand years. It is not difficult to understand, therefore, that its sudden disappearance has left a void to which the mind refuses to adapt itself, and people naturally desire some immediate explanation of the catastrophe, as though this might help them to accept with resignation an occurrence to which the imagination at first refuses credence. The very gravity of the disaster makes one hesitate to formulate the causes which led to it, with that precision which the general demand for a prompt explanation renders desirable. In order to define the main elements of the catastrophe and prepare the mind to form a full and exact conception of them, a careful study of the facts is required, and these cannot be fully known until the results of the inquiry now set on foot with a view to ascertaining, as far as possible, the causes of the unexpected collapse, are made public.

Though the early chroniclers are unable to agree as to the precise date of the foundation of the Campanile of St. Mark's, it seems probable that the work of construction was begun by Pietro Tribuno Memmo, who filled the post of Doge from 888 to 912. At this date excavations were made down to the stratum of clay found over large portions of the alluvial gravel of the Venetian lagoon. A footing was obtained in this clay by means of piles formed of tree-trunks, this pile-work being made to extend to the zone surrounding the foundations. On top of the piles was placed a *zatterone*, a solid raft-like structure consisting of a double layer of planks, and on this were erected the foundation walls, consisting of six courses of large stone blocks, of which the lowest course, resting on the *zatterone*, projected about 0.35 meter on every side for the purpose of increasing to some extent the area of the base.

These details, which we owe to the painstaking researches carried out in 1885 by Cav. Giacomo Boni, the architect at present in charge of the excavations in the Roman Forum, have discredited once and for all the old tradition, according to which the foundations of the Campanile are said to have been carried to a fabulous depth, with a consequent large increase in the area of the base. As a matter of fact, the foundations prove to have been out of all proportion to the remarkable height of the Campanile, the actual ratio being less than 1 to 20. This circumstance suggests the following questions: Was the total height—of 100.32 meters above the ancient level of the Piazza—to which the Campanile eventually attained, really the height contemplated by its builders when they fixed the depth of the foundations? Or was this height gradually added to, in the course of works which extended over six hundred years, until the superincumbent load came to exceed the limits which the foundations were able to support?

In endeavoring to answer these questions, we must first of all note the fact that, in spite of there being no records or drawings of the original plan, we are driven to the conclusion that the height originally contemplated by the builders of the ninth century can have been but little lower than that which was eventually attained in the early part of the sixteenth century, and which remained unchanged until the last few days. As a matter of fact, the lower part of the Campanile, with its little angle windows following the course of the inclined planes leading to the upper portion, rose to a height of about 54 meters, a height which we may assume to have been in harmony with the plans used in laying out the foundations, for, since the base was 12.80 meters square, the height of the solid portion of the Campanile was little more than four times its breadth. Nor are we justified in assuming that when the work of construction was first put in hand there was any intention of adopting more squat proportions, since it is manifest that the idea was to add to the impression of slenderness by means of the pilasters, connected above by arches, on the four sides of the tower.

This height of 54 meters was not reached till the days of Domenico Morosini, who was Doge from 1148 to 1156, and whose portrait in the great Council Hall of the Ducal Palace serves to record the fact that "sub me admirandum opus campanilis S. Marci construitur." An offering of two hundred pounds, Venetian currency, made by one Ottone Baseggio in 1133 "in order that the tower may be completed," tends to confirm the supposition that it was about the middle of the twelfth century that the bell-tower was finished, although the belfry itself was still to be added.

This massive lower portion, with its internal inclined planes supported by pillars connected one with another by series of arches, was composed for the most part of bricks 0.08 meter in thickness, with sides 0.4 meter square, in imitation of the Roman brickwork, reinforced at the outer angles with a few courses of Istrian stone. It should, moreover, be noted that it was not long before this lower part of the building suffered injury. The fire which broke out in Venice during the massacre of the Candians in 976 extended as far as the base of the Campanile.

In the latter half of the twelfth century it was decided to add to the tower the *loggia* or belfry and the famous *coronamento cuspidale.* In regard to this part of the work we must assume that the original idea was not carried out in the building which has just perished. Undoubtedly an arched belfry must have been contemplated in the original plans; but the cusp was meant to rise directly above this belfry, in a conic or pyramidal form and not with a square base, and placed on top of a heavy attic, as was the case in the design afterwards adopted. The total height, therefore, originally intended was somewhat less than that actually attained in 1517. It ought properly to have been about 9 meters lower, this being the measurement of the almost solid mass, devoid of openings, which the builders insisted on interposing between the belfry and the heavy pyramidal roof—with a result which, as we now see, was questionable from both the technical and the æsthetic standpoint.

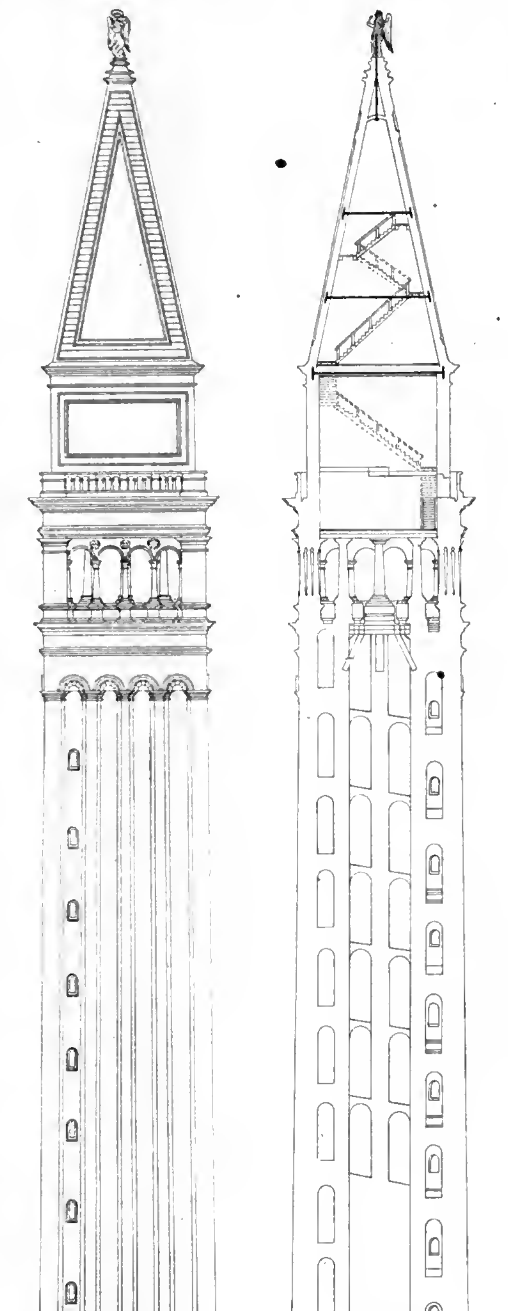
It was about 1173 that the first belfry was erected through the agency of Maestro Barattiero, but this must have been a somewhat unstable piece of work, since we find it had to be repaired or renewed in 1329 by Maestro Montagnana. From this date onwards the records are less scanty, and we read of various injuries sustained by the Campanile. In addition to others of which no record has been kept, there was a fire, close to the Campanile, during the festival at the accession of the Doge, Michel Steno, in 1400; in 1417 the woodwork of the roof was set on fire by lightning; in 1436 another conflagration destroyed the shops round the base of the Campanile. All these accidents must have inaugurated a condition of decay in various parts of the building, which was destined in the course of time to produce its results. In 1490 the belfry was again damaged by one of the numerous thunderbolts attracted by this great mass towering above the lagoon. It was, therefore, decided in 1510 to rebuild the *loggia* in a more substantial form. The records tell us that the task was entrusted to a certain Maestro Buono, but an earthquake interrupted the work and prevented the bells from being rung for several days. In 1514 both the heavy attic and the pyramidal roof were at last completed, and in 1517 the revolving statue of the Angel Gabriel, a lily in its left hand, its right raised in the act of benediction, attracted the eyes of all who sought to learn the direction of the wind. Thus more than six centuries had passed before the original purpose of Pietro Tribuno Memmo was realized.

It is scarcely a matter for surprise that, in planning a total additional height of 44 meters from the floor of the belfry to the head of the angel, the builders should have omitted to take into account the limits of resistance possessed by the foundations, when we remember that a tradition fortified by the lapse of centuries asserted that the foundations had been carried down to a fabulous depth. Moreover, the lower part of the tower, although it had been in existence for hundreds of years, showed but little deterioration, with the exception of a slight subsidence of but little importance compared with that of other less daring structures in Venice. This, too, in spite of the fact that the roof added in the early part of the sixteenth century had raised the load on the foundations to the not inconsiderable figure of 6 kilogrammes per square centimeter of their total area, about 6 tons per square foot.

It should be added that this important addition to the height of the Campanile had the effect of exposing it to much greater risks from electrical discharges. In 1548, 1565, 1656, 1745, 1761 and 1762, lightning wrought havoc on its mass of masonry. A remedy for this was found in the lightning-conductor fixed on the tower by Toaldo in the year 1776, but, unfortunately, this was subsequent to the thunderbolt of April 23, 1745, which wrought greater damage to the Campanile than it had ever before sustained, causing no less than thirty-seven fissures, the repair of which, though carried out with insufficient thoroughness, involved an expenditure of 8,000 gold ducats.

These various circumstances must not be lost sight of in any attempt to trace the causes of the catastrophe of the 14th of July last. The mass of masonry, erected without any special precautions in the way of binding the materials together, exposed as it was to unusual pressure, and shaken by thunderbolts and earthquakes, must have undergone a slow but continuous process of disintegration in its general structure, and of actual fracture in some places, with the result that it was reduced to a condition of precarious stability. This is the first conclusion with which we are confronted, and it would by itself serve to explain the sudden catastrophe that has occurred. Nor need we believe that the causes of this catastrophe are even partly to be sought for in the foundations, even admitting that these may have been disproportionate to the mass which they so long supported. Had there been any kind of movement in the foundations, it would have been evidenced by a disturbance of equilibrium in the building before and during the catastrophe itself: whereas the *insaccamento* of the *débris* and their minute disintegration lead one to believe that the masonry, already affected by serious general decay, had become, as it were, devoid of all power of resistance, and thus readily lent itself to a reopening of the old wounds of 1745. And here we come face to face with the question as to how far the recent catastrophe might have been avoided, retarded, or minimized.

In order to reply to these questions, it would be necessary to know the exact condition of the Campanile during the ultimate phase of its



The Campanile of St. Mark's.

existence—*i. e.*, from the instant when the movement which eventually led to its downfall first became apparent. The extreme brevity of this ultimate phase (three days, nineteen hours), and the complete collapse of the whole mass, prevented and still prevents us from obtaining the data necessary to reconstruct the history of this phase and draw the necessary deductions therefrom. An inquiry has been promptly opened by the Minister of Public Instruction, and the committee assembled at Venice shortly after the disaster. The committee of inquiry may, perhaps, succeed in collecting enough facts to enable them to trace the development of the catastrophe, and throw light on what may have been its most probable immediate cause. In the meantime we must content ourselves with the few data at present known and sufficiently authenticated. In the first place it will be of interest to remember that for some years past considerable apprehension has been felt in regard to the stability of the Campanile. We must not, however, attach undue importance to pronouncements which, since the disaster, have been and will doubtless continue to be published by persons who imagine that they can now claim credit for having foreseen its downfall all along. These prophets confined themselves for the most part to the expression of fears based on mere impressions and totally unsupported by any profound knowledge of the actual condition of the monument. A proof of this may be found in the fact that no specific proposal accompanied any of their prophecies, while the utmost that those who possessed a first-hand knowledge of the actual state of the monument could have done in the way of sounding a reasonable and effectual alarm would have amounted to some such warning as this: "The Campanile of St. Mark's was built at various periods of time, from various materials, by various processes. After standing for centuries it is now in a dangerous condition, and your first duty above all others is to avoid any innovation or meddling which may tend to aggravate its precarious state." This was the essential condition on which a prolongation—though not an indefinite prolongation—of its precarious condition might be hoped for.

Actual measures of general restoration did not appear to be so easily advisable. In fact, even if men had realized how far the general decay of the walls had progressed, it would not have been a case of pronouncing on the probable result of clamping with iron girders or even on the effect of underpinning, since neither the one nor the other would have proved efficacious or even advisable, except in dealing with defects confined to special parts of the whole mass, or in case it had been found necessary to restore certain definite portions of the building. In other words, even if the catastrophe had not been so sudden, it would have been very difficult—if not altogether impossible—to devise or adopt any measures which would have proved truly radical and efficacious. By this I do not wish to imply that the condition of the Campanile should have been viewed with fatalistic indifference, or that we ought to have awaited with resignation the moment of its downfall. For instance, there was one fissure, which, though insignificant in appearance, and therefore treated as of little consequence, suddenly became very serious and proved to be one of the determining factors in the final catastrophe. It will be remembered that there were close to the corners of the Campanile—to be precise, along the left side of each of its internal walls—a series of small windows which served to light the various inclines leading to the belfry, there being one window to each of the landings forming the turnings of the inclines. These small windows, of which there were eight on each side of the Campanile, were very happily arranged in so far as the purpose of giving light to the various parts of the inclines was concerned, but occurring, as they did, in close proximity to the corners of the tower, they constituted an effective source of weakness. It will be readily understood, therefore, that a crack which began at the lower window on one of the sides of the Campanile and extended as far as the last window but one, thus placing the various window openings in communication with one another, meant a very extensive solution of continuity—and this in a vertical direction—between two of the faces of the Campanile.

As luck would have it, this fissure, which was not very alarming in appearance, and from the nature of the case did not extend very rapidly, was not kept under proper observation by those responsible for the good preservation of the monument. In fact it is barely five years since the Board for the Preservation of Venetian Monuments—its attention having been called to the intrinsic, if not apparent, gravity of this fissure—took occasion to publish in its Annual Report the following note—a note which illustrates better than any words of mine its light-hearted method of dealing with the apprehensions then expressed: "One of the usual rumors whispers that the Campanile of St. Mark's must inevitably fall down, because some portions of the old wall have been picked up in the caretaker's rooms, the said portions being attributed to the extension of a crack. Now the caretaker's dwelling has been in its present state for about a century, as may be seen from the drawing by Cicognara (in his *Fabbriche più cospicue di Venezia*), and the fissure appears just as it is now in very early photographs of the Campanile; in other words, there has been no sign of this terrible extension of the fissure for many years." The choice of the factors on which this conclusion is based is sufficiently primitive! As a matter of fact, the moment the necessity or opportunity arose for silencing the voice of the alarmist, the Board, which has its offices within a few yards of the Campanile, ought to have made inquiry and published to the world the nature of the fissure which had given rise to anxiety, instead of contenting itself by quoting the authority of a picture which left the hands of the frame-maker a hundred years ago, and referring to an old photograph of half a century back. Still more strange appears the argument that because a crack has been in existence for a hundred years without any sign of increasing it is therefore to be regarded as harmless. As though the natural decay due to the lapse of time, and the unforeseen yet not impossible changes due to subsidence, shock or other causes, did not in themselves furnish good reason for refusing to adopt thus readily a conclusion of such a fatalistic nature.

A more prudent attitude in regard to this crack would have sufficed, and the adoption of some precautionary measure—such as the filling in of the windows situated on the line of fissure, in order to restore the solidarity of the two external walls of the Campanile that had become detached, and to prevent any change, however slight, in the general conditions of the building, due perhaps to some ill-considered innovation, or even to circumstances of a purely fortuitous and unforeseen character—would have put an end to that widening of the injury which in two days became threatening, on the third day showed that the evil was beyond remedy, and within the brief space of ninety hours led to a catastrophe. For while the defects observed in structures which have to withstand not only the purely static action of weights exercising pressure in a vertical direction, but also the dynamic effect of the thrust of arches or vaultings, may be a source of alarm from the moment of their appearance owing to their manifestly progressive character, it by no means follows that defects in structures which are not called upon to withstand any such thrusting action—as in the case of the Campanile of St. Mark's—should not be regarded with apprehension. For though they may not present those progressive characteristics which call for immediate remedial measures, they indicate none the less surely a condition of unstable equilibrium in the monument; and a day must come when some seemingly trivial cause proves sufficient to determine a catastrophe, and finds the general structure predisposed to second the first movement and aggravate it with phenomenal rapidity.

This was the case with the Campanile of St. Mark's. The determining factor in the catastrophe must, of a surety, have been some circumstance of trivial importance compared with the final effect produced, but this does not lessen the culpability and shortsightedness of those responsible. The recriminations which have accumulated during the last few days in the Venetian newspapers and in the interviews with persons more or less compromised by the disaster make one reluctant to enter on a more detailed examination of the catastrophe while an inquiry is still pending. There is, however, one inference which may fairly be drawn from the facts before us. The very multiplicity of the accusations and disclaimers and the eagerness with which responsibility is denied are in themselves conclusive evidence of the disorganization and inefficiency of those responsible for the preservation of monuments in Italy. For years past every one in Venice has been familiar with the endless antagonisms, friction, rivalry, and quarreling between the persons charged with the maintenance of the more important monuments. For years past they have witnessed the continual iteration of charges, impeachments and alarms. Time after time have ministerial committees intervened to put things right, with invariably illusory results. It is the men rather than the monuments who play the leading part in these disputes.

[Note.—The drawings accompanying this article are from Cicognara's "Fabbriche e i Monumenti cospicui di Venezia," published in 1838-40.]

Boiler Rivets should be carefully examined, according to a report of the Mutual Boiler Insurance Company, by the following cold tests; driving them down on an anvil with the head in a die, by nicking and bending back on themselves without developing serious cracks. In tests made by the company, steel rivets stood up well as a rule, but iron rivets did not and one brand of steel rivets proved very poor.

The Waste of Water in Washington is becoming a more serious matter than ever before, owing to the additional cost which filtration will soon impose on the management of the works and the need of constructing a new conduit very soon if the present rate of consumption is maintained. The supply is now about 193 gallons per capita daily, or double the amount there is any reason whatever for furnishing to a community so largely residential. Colonel Miller, who is in charge of the Washington aqueduct, draws special attention to this condition in his last report, but does not seem particularly hopeful that the only positive remedy, the use of meters, will be adopted very soon. It is difficult to understand why the people of Washington, who are noted for their complaints about high taxes, should oppose so bitterly this equitable means for reducing in no small way the cost of such an important article as water.

Water Supply System in the Maiden Lane Building, New York.

An eighteen-story steel-cage office building has just been finished with a front of 75 feet on Broadway and 110 feet on Maiden Lane. It is shaped like an irregular U in plan, with a 28x38-foot central light court and a smaller one at the side, as indicated in the typical floor plan. The water supply is received through a 4-inch service pipe from the Broadway and a 3-inch one from the Maiden Lane city mains. It is not filtered but is taken direct through a fish trap, by-passed meter, gate valves 4-inch pipe and two ball cocks, to a rectangular 2,000-gallon suction tank, made of ¼-inch steel with a ⅛-inch steel cover and a hinged door 2 feet square over the ball cocks.

A Lewis steam pump is installed for house and fire service and its 4-inch suction pipe is connected directly to the bottom of the tank. It is cross-connected to a special pump for the safe-lifting elevator, but is not connected to the boiler feed pumps. Its discharge riser delivers without a hush pipe through ball cocks in the 3,500-gallon steel roof tank, which is similar to the suction tank. The roof tank is provided with the usual safe, overflow and emptying pipes, and has a float which indicates the height of water on an engine-room index. It has a pressure pipe connected with a Ford regulating valve which controls the steam supply to the house pump and starts and stops it when the water in the tank reaches the limiting low and high levels.

The pump also delivers directly into the fire line, a 6-inch stand-pipe near the center of the building, which is connected at the upper end with the roof tank and has a 2½-inch valve and 100 feet of linen hose in the corridor of every story. A branch runs to the sidewalk and terminates there with a siamese coupling for fire engines. Check valves are set at the top and bottom of the stand pipe and next to the siamese coupling so that the fire pressure can not escape into the tank or house mains or back up on the pumps.

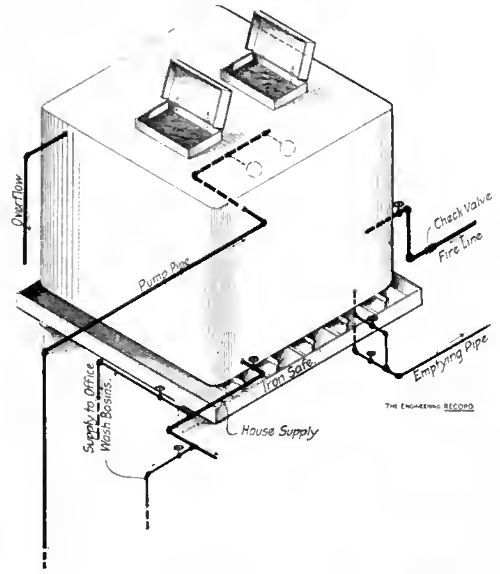
The 3-inch supply from the roof tank has a vertical 2-inch branch to the cellar, but its main connections are to the branches of a horizontal distribution main run in a U-shape parallel with the corridors above the suspended ceiling of the eighteenth story. This main provides for a down supply to all the cold water fixtures above the first story. It has ten 1½-inch risers to supply the vertical groups of office wash basins, the slop sinks and the toilet rooms above the first story. A 2-inch supply to the cellar has a branch to the hot-water tank and another to a header from which valved lines are run on the cellar ceiling to supply the fixtures in the basement and first story. The header is cross-connected with the street pressure supply to the boiler feed pumps, but is generally operated under tank pressure.

The hot-water tank is a ¼-inch horizontal steel cylinder 3 feet in diameter and 6 feet long. It is covered with asbestos and canvas and is suspended from the basement floor-beams. It was tested at the factory to 100 pounds pressure and contains an 80-foot coil of 2-inch galvanized iron steam pipe. Steam at the regular boiler pressure of about 125 pounds is admitted to the coil through a Davis thermostat set to shut it off automatically when the temperature of the water in the tank rises to 130 degrees. The hot-water outlet connects with a header from which five branches are run on the basement ceiling. One of them rises to the attic and supplies slop sinks, toilet-room wash basins and a private bath room; the others supply the fixtures in the first story and basement. All of them have return circulation pipes connected to the cold water inlet for the tank.

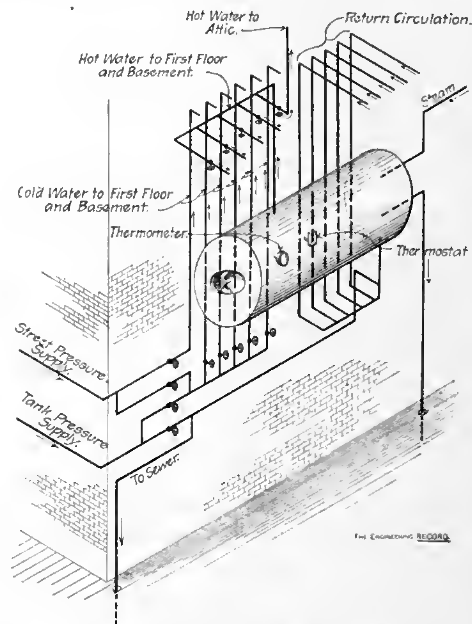
All of the cold-water supplies to the basement and first story and all of the hot-water supplies are valved near the hot water tank and the whole system can there be emptied into the sewer, but the different riser and distribution lines are not provided with separate emptying pipes. The wash-basin cold-water supplies from the attic distribution line terminate at the bottom with a reverse bend, and the short leg forms an air chamber about 3 feet high. These lines can be emptied through their lowest fixtures, but have no emptying valves or waste pipes. The exposed pipes at wash basins and in the toilet rooms are of brass, nickel plated; all other water pipes are of galvanized wrought iron or steel, standard weight, with cast and malleable iron beaded fittings. The ceiling pipes in the cellar and attic and the hot-water pipes throughout the building are protected by felt or asbestos insulation ½-inch thick and covered with canvas.

There are Chapman, Crane or Fairbanks gate valves on the hot and cold water supplies to all the toilet rooms, office basins and slop sinks, and all fixtures have air chambers. The branches to each fixture have angle valves of a special make with a key-handle engaging the valve stem inside a protecting socket so that they can be operated only by the engineer's wrench. They are carefully adjusted so as to throttle the pressure in the lower stories and reduce the flow through the faucets. There is a Pratt & Cady swinging check valve set in the return circulation header at the hot-water tank to prevent the cold-water supply from backing up in it.

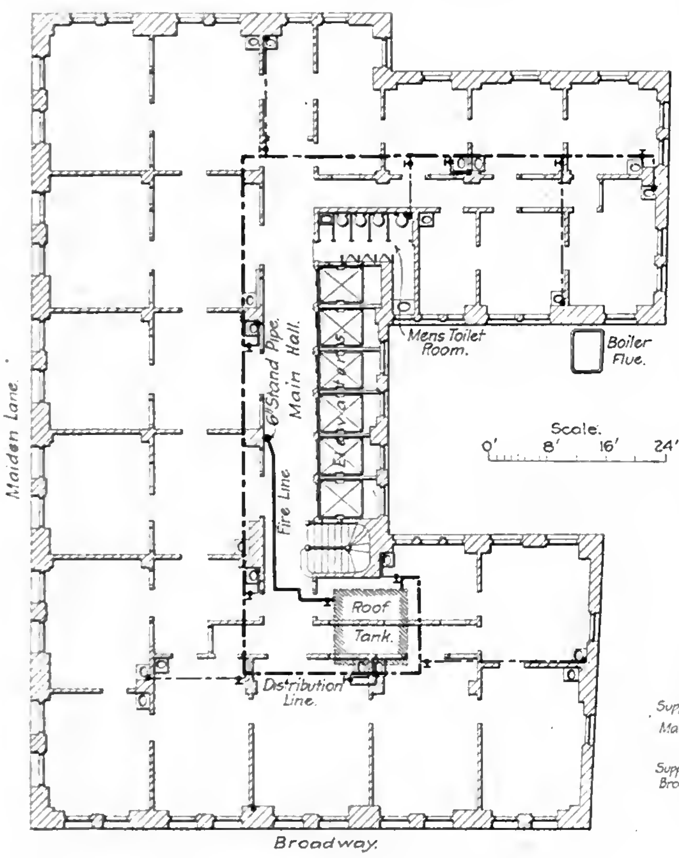
All the water pipes are carefully laid to grade to prevent the formation of air pockets and both hot and cold riser lines are vented from the highest point to the roof tank by pipes not seen in the general diagram. The cold-water risers are rigidly connected to the floorbeams, but the attic hot-water riser is divided into three sections by two horizontal expansion loops and is supported only at the middle points of these three sections. The average total daily consumption of water, in summer, is about 37,500 gallons including the supply to one of the three 300-horse-power boilers, which suffices to operate the plant when no steam heat and little electric light is required.



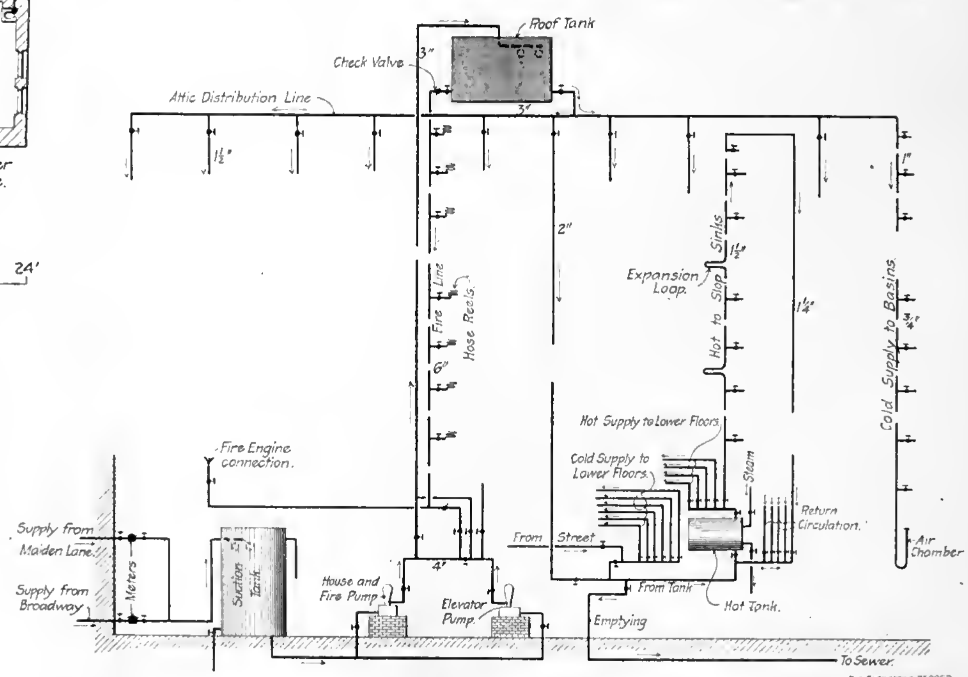
Roof Tank.



Hot-Water Tank Connections.



Typical Floor Plan, Maiden Lane Building.



General Diagram of Water Piping, Maiden Lane Building.

The office partitions are of course varied to suit tenants and in some cases the wash basins shown in the typical floor plan are omitted or are located in different places, and in the bank on the first floor there is a special toilet room for employees. One of the upper floors is occupied by the Broadway Building Company and here there is a private bathroom handsomely finished with white marble and plate glass and containing a porcelain bath tub and shower bath, a wash basin and closet. In the basement there is a café with kitchen plumbing, a barber's shop with hot and cold-water fixtures, and a public toilet room in the sidewalk vault. In the basement there is an engineer's toilet room with bath, closet and wash basins.

The toilet rooms have mosaic floor and tile wainscot 6 feet high with sanitary cove tile base board. The partitions are slabs of Tennessee marble 6 feet high which are set without standards, with cement joints on the floor. The doors have solid panels of polished oak and are mounted on spring hinges. The slop sink is set in an ante room which communicates with the toilet room through double swing spring half doors without latches.

Messrs. Clinton & Russell were the architects of the building and Col. J. H. Wells, of their staff, was the engineer. The George A. Fuller Company was the general contractor and Mr. D. M. Quay was in charge of the sanitary work. Messrs. Wells & Newton were subcontractors for the plumbing, of which Mr. J. E. Flynn was foreman.

A 440-Volt Plant will be installed for lighting the five new buildings of the University of Illinois at Champaign. Two-phase alternating current will be used, and each phase will be treated as a single-phase circuit operated on the three-wire system, the neutral wire being supplied with current from an auto-transformer. Although the 220-volt lamp is somewhat less efficient than the 110-volt lamp, the difference is expected to be of very little moment in this case, since the exhaust from the steam engine plant operating the generators is to be used in heating the buildings. The generating station contains two belted two-phase generators, one of 50 and one of 75 kilowatts, operated at 440 volts, to which will shortly be added an engine-type, revolving field, 120-kilowatt alternator, purchased from the Westinghouse Electric & Manufacturing Company.

The Selection of Gas Engines.

By J. D. Lyon.

Although gas engines of both the two and four cycle types are made and operated in this country, the great predominance of the four cycle poppet valve gas engine at the present time no doubt simplifies the matter of gas engine selection very materially, but beyond the question of type there are a number of other considerations which should be taken into account in order to obtain satisfactory results in any given case. One of the first and most important considerations should be to secure an engine suited to its work, and this seems to be a point frequently overlooked by users and ignored by manufacturers.

Buyers of steam engines usually decide upon the class of engine especially adapted to the requirements of the plant to be operated before asking for proposals from manufacturers, and as a rule the specifications are so worded as to prevent useless waste of time in considering proposals on engines not belonging to the class decided upon. Of the various general forms employed in steam engine construction, each is intended to render the engine a little better adapted to some particular class of requirements and there is no valid reason why the same should not be true of the gas engine. There are, no doubt, cases in which a high speed gas engine will fill the conditions better than one of slow speed, for instance, in a case of a basement electric plant, in which space is valuable and more than offsets the disadvantages inherent to high speed engines (no reflection upon this valuable class of engines is intended). Now the fact that this engine has proved the best possible selection for the plant in question does not indicate that it would be in every case as good for work of some other description, as, for instance, in a manufacturing plant in which skilled attendance is at a premium and the work is of rough and heavy character, subjecting the engine to severe shocks and strains.

By a course of natural selection the Corliss and other heavy duty slow speed steam engines have come to be used almost exclusively for a certain class of work, the lighter, higher speed automatic engine for another class, and the plain slide valve engine fills all the requirements of many users. This same process of selection will, probably, divide the various forms of gas engines into classes, which will become well known to users, and the result is likely to increase the reliability and enhance the reputation of the gas engine, especially for use in plants of considerable importance. At the present time, however, almost every builder of gas engines recommends the engine of his manufacture for power uses of any description, and while it is no doubt true that the engine will furnish power for almost any class of work, the fact remains that each type of engine will be found better adapted to certain kinds of work.

This renders it advisable for the prospective customer, who is without mechanical training, to secure the services of a competent engineer to aid him in the selection of a gas engine for any plant which requires a considerable amount of power, and the engineer's fees will be found to be a part of the investment which is likely to return the greatest dividends. A careful reading of the catalogues of various builders cannot but result in confusion of the mind of the man who is obliged to secure all his information on the subject from this source, since statements are frequently made in one catalogue which will be found flatly contradicted in another. It is probable that the writers of such statements are not intentionally guilty of attempting to mislead the reader, but that statements which are merely expressions of opinions or prejudices are given as facts.

There are certain main features which should be taken into account in forming a decision as to the form or class of engine which is most desirable for any given work, and these can only be arrived at by a careful consideration of the particular details of each case. There are, however, some points which apply very generally to gas engines as a class, and a few suggestions to the prospective user, or the engineer who finds himself called upon to assist some client in the selection of a gas engine, may be of value,

First of all it is advisable to examine a number of machines of the general form decided upon, and note carefully the manner in which they are doing their work, and this is a suggestion which, naturally, would occur to any one who had such matters to decide. A pleasing outline in the design of the engine should always be expected in a machine which has been designed by a really capable man. Sharp angles should not be of frequent occurrence in the castings, and all parts under strain should have large well rounded fillets at all such angles. The manner in which the main bearings are made, and in which they are adjustable, should be very carefully considered, as the bearings of the gas engine seem to give more trouble than those of the steam engine. They should not only be easily adjustable, but the metal with which they are lined should be so placed as to render the replacing of the lining easy. The crank shaft should be heavy enough so that the rim of the fly-wheel does not show any marked tremor or vibration at the time of explosion of the charge in the cylinder. In most cases accessibility of working parts should be a point to be given a good deal of importance. The auxiliary mechanism should be driven in such a manner as to reduce wear on gears and cams to a minimum, and should present no appearance of trappiness. The larger castings should have no small projections cast integral with them, and such parts as are necessary to be fastened on the larger castings should be bolted in place. An important point in connection with the valve mechanism is the manner in which the valves are lifted from their seats, especially the exhaust valve, which is exposed to the high temperature of the exhaust gases. This lift should be as nearly as possible in a straight line with the axis of the valve stem, since an uneven wear on the guides of the valve stems will invariably result in leakage of the exhaust gases past the valve stem, causing much annoyance from sticking of the valves. In engines of any considerable size these guides should be made in the form of a removable bushing, which can be replaced when it becomes worn to the extent of leakage. The ignitor should be of as simple construction as possible, and should always be made so as to produce ignition of the charge at the proper point in the cycle of the engine and to admit of an easy regulation of this point of ignition.

It is always well to inquire as to the cost of maintaining the ignition on any engine under examination, since this is one of the most important, and at the same time one of the most troublesome details in the gas engine. The parts of the ignitor should be strong, and so designed as to allow new parts to be very easily put in place, without extra work of fitting.

The combustion chamber should always be of such form as to present the largest volume with the smallest surface, and this surface should not be broken up by angles and pockets to any great extent. The larger the surface surrounding the combustion chamber the greater the loss of heat to the cooling water. The effect of breaking the combustion chamber up into distinct spaces connected by more or less restricted passages is to retard combustion with a serious loss of efficiency.

The water jackets should, of course, surround the cylinder head, cylinder, and as much as possible of the exhaust valve stem. The seat of the exhaust valve should be so arranged as to permit of easy renewal in engines of any considerable size.

A great diversity of opinion exists as to the best method of connecting cylinders on horizontal engines to their frames. The same is also true of a great many of the details in connection with the engine, but the suggestions given above may be applied equally well to any type, since the same general conditions hold good in all. There are, no doubt, many other features, which would be well worthy of careful consideration. Upon these the prospective user should form his judgment from a careful examination of plants in use, and a judicious questioning of the users.

Trade Publications.

The Hayden & Derby Mfg. Co., 85 Liberty St., New York, is interested exclusively in making injectors, ejectors and jet apparatus. It has issued a new catalogue describing its line, which is particularly explicit in the portions relating to automatic and double-tube injectors. The method of selecting the proper type and size for a given service is explained, and there are useful suggestions concerning the causes that may injuriously affect the operation of an injector.

A valuable explanation of the appliances used in the transmission of power by wire rope, the selection of a plant for a given service and the method of erecting it, is given in a book prepared by the John A. Roebling's Sons Co., Trenton, N. J. There are a number of useful tables of the horse-power transmitted under different conditions and of the properties of rope used for this purpose, together with many illustrations and brief descriptions of installations.

The United States Wood Preserving Co., 29 Broadway, New York, has issued a pamphlet by Mr. F. A. Kummer describing the advantages of creo-resinate wood pavements. The blocks treated by this company's process have now been in use long enough to demonstrate their resistance to wear and their effect on horses, subjects which are discussed in the pamphlet in a number of letters.

The Hunt system of industrial railways for shops and factories is well known, but in case a reader unacquainted with its peculiarities is desirous of obtaining a general understanding of them, he will find the information given pictorially in a pamphlet of views taken in a number of famous shops, just issued by the C. W. Hunt Co., Allen St., West New Brighton, N. Y.

The new bulletins of the Fort Wayne Electric Works, Fort Wayne, Ind., are as follows: No. 1,025, direct-current belted generators with capacities of 20 to 400 kilowatts and various speeds; No. 1,030, single-phase generators in capacities from 37½ to 300 kilowatts at 60 cycles and 33 to 400 kilowatts at 140 cycles; No. 1,032, direct-current belted motors for slow, medium and moderate speeds and rated at 25 to 105 horse-power. All the bulletins are finely illustrated and contain full tables of the dimensions and capacities of the apparatus described.

The Keystone Valve & Mfg. Co., 2626 Carson St., Pittsburg, has prepared a catalogue of straight-way, three-way, four-way and locomotive blow-off valves designed specially for hydraulic and compressed air service, boiler blow-offs and like uses. A quarter turn of the operating lever gives a full opening of the valve.

The H. W. Johns-Manville Co., New York, has issued a pamphlet concerning the Manville fire extinguisher. This is a tube filled with a powder which, when sprinkled on the base of a fire, generates carbon di-oxide and thus extinguishes or checks the flames.

Personal Notes.

Mr. G. H. Stevenson has been reappointed city engineer of Lafayette, Ind., for a term of two years.

Mr. R. M. Ellis has resigned his position as superintendent of the Vicksburg, Miss., Electric railway to become superintendent of the Natchez, Miss., Electric Railway Co., and Mr. Walter Mattingly has been appointed to succeed him.

Mr. Howard L. Ingersoll has been transferred to the Middle Division of the New York Central & Hudson River Railroad as resident engineer and Mr. Wm. T. Dorrance has been appointed acting resident engineer of the Eastern Division.

The following candidates for different grades of membership in the American Society of Civil Engineers were announced elected September 3: Members—W. E. Angier, resident engineer, Southern Illinois & Missouri Bridge Co., Thebes, Ill.; F. T. Bancroft, Joy & Bancroft, Detroit; O. W. Childs, chief engineer, Stupp Bros. Bridge & Iron Co., St. Louis; F. W. Cohen, engineer of erection, Pennsylvania Steel Co., Harrisburg, Pa.; S. E. Coombs, chief engineer, Southern Missouri & Arkansas and Cape Girardeau & Northern Railroad, Cape Girardeau, Mo.; W. W. Crehore, Structural Engineering Co., New York City; G. M. Eldridge, superintendent, Tampa Water-Works Co., Tampa, Fla.; Elliot Holbrook, chief engineer, Kansas City Southern Ry., Kansas City, Mo.; E. T. E. Lansing, city engineer, Little Falls, N. Y.; W. N. McDonald, assistant engineer, Dept. of Streets, Havana, Cuba; O. M. Eidlitz, New York City; H. A. E. C. von Schon, Sault Ste. Marie, Mich. Associate members—R. I. D. Ashbridge, first assistant engineer, Improvement, Extension and Filtration of Water Supply, Philadelphia; M. C. Bland, contract manager, American Bridge Co., Cleveland, O.; Abraham Gideon, assistant engineer, Dept. of Sewers, Havana, Cuba; J. T. Henderson, assistant engineer, Connecticut River Bridge & Highway Comm., Hartford, Conn.; F. D. Hughes, assistant engineer, Midland Bridge Co., Kansas City, Mo.; G. A. Noska, assistant engineer to George B. Post, New York City; H. VB. Osbourn, assistant engineer, Improvement, Extension and Filtration of the Water-Supply, Philadelphia; J. G. Peck, bridge engineer, State Engineer's office, Albany, N. Y.; E. E. Pettee, with J. R. Worcester, Newtonville, Mass.; J. W. Rickey, engineer, St. Anthony Falls Water-Power Co., Minneapolis, Minn.; L. J. Riegler, with Pennsylvania Co., Allegheny, Pa.; G. T. Roberts, assistant engineer, Bureau of Engineering, Buffalo, N. Y.; F. N. Sanders, assistant engineer, State Engineer's office, Albany, N. Y.; M. H. Wright, roadmaster, Louisville & Nashville R. R., Nashville, Tenn.; G. C. Bartram, Boston, Mass. Juniors.—F. L. C. Bond, New York City; H. G. Burrowes, Brooklyn, N. Y.; W. S. Getchell, Denver; R. A. McCulloch, Orange, N. J.; Rudolph Quanz, West Hoboken, N. J.; C. L. Richardson, New York City; A. L. True, Portland, Me.

The Society of German Engineers had 16,159 members at the end of 1901, according to a recent report. Its weekly journal, the "Zeitschrift," had about 1,800 pages during the year, and the contributions sent to the editor were far more numerous than the limits of the publication could accommodate. The directors report that they have arranged for the writing of a treatise on the steam engine and another on its history.

The New England Water-Works Association will hold its twenty-first annual convention at the Hotel Brunswick, Boston, Sept. 10, 11 and 12. The papers and addresses are as follows: "Duties of Municipalities Regarding Water Supplies," by Hon. J. O. Hall, Quincy; report of committee on "Standard Specifications for Cast-Iron Pipe," Mr. Freeman C. Coffin, chairman; a talk with lantern slides on recent work done by the Metropolitan Water and Sewerage Board, Mr. F. P. Stearns; "The Water Supply of Nashua," by Mr. Horace G. Holden; report of the committee on the "Apportionment of Charges for Private Fire Protection, and the Means of Controlling the Supply Thereto," Mr. Byron I. Cook, chairman; "A New Turbidimeter," by Mr. Charles Anthony, Jr.; "The Removal of Color and Odor from Water," by Mr. H. W. Clark; "The Physical Properties of Water," by Mr. Allen Hazen; report of the committee on "Uniform Statistics," Mr. Joseph E. Beals, chairman; "Recent Investigations in Purification Methods," by Prof. L. P. Kinnicutt; "What an Engineer Saw in Venice," by Mr. Desmond FitzGerald; "Twenty Years After—a Retrospect," by Mr. R. C. P. Coggeshall.

Dampness in Masonry Vaults in fortifications is a source of frequent and serious trouble. In a battery at Pensacola the electric plant is under one of the gun platforms and was continually wet during inclement weather. The remedy adopted at this place has been described as follows by Lieut. Lewis H. Rand, Corps of Engineers, in local charge of the work: To remedy dampness in dynamo and storage-battery rooms, an oil coating was applied to the gun platform under which they are. An asphalt coating would be cut to pieces by the wheels of the ammunition trucks. A mixture of resin and boiled linseed oil in the proportion of 1 to 3 was applied. The platform was first carefully swept and cleaned; then clay forms one-half inch high were constructed by laying 1½-inch planks in the desired positions and building up against their edge the dampened clay to a thickness of about 3 inches; after the clay had dried and hardened the planks were removed. Diagonal rectangles, in checkerboard style of about 36 square yards each, were first treated. Twenty gallons of the mixture in a 55-gallon caldron were heated to a point such that the mixture was just short of boiling over, when it was poured out on the rectangle and spread with brooms to cover the entire surface. Warm, clear weather in a dry spell, so that the concrete might be as dry and absorbent as possible, was chosen for the work. After standing 24 hours the forms were removed and replaced for the uncoated rectangles with a lap of about 12 inches. After these were taken up the laps were again given a thin coating, simply poured on, as was also done to the steps and other irregular places where forms could not be constructed. After standing for some two weeks the thick unabsorbed resin was scraped off. The improvement in the dynamo room has been very noticeable, although the dripping water is not completely stopped. A coating was given over about 170 square yards at a total cost of about $70, and using altogether about 75 gallons of linseed oil and 25 of resin oil.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvii, xviii and xxvii.

WATER.

South McAlester, Ind. Ter.—Engr. Chester B. A. Davis, 10 Wall St., New York, N. Y., with branch office at San Antonio, Tex., writes that the estimate of cost of proposed water works is $194,000 and for a sewerage system $50,000. Bonds are yet to be voted.

Philadelphia, Pa.—Bids will be received by the Dept. of Pub. Wks., Bureau of Water, until Sept. 23, for preliminary filters for the lower Roxborough Station. Wm. C. Haddock, Dir.

Pierce, Neb.—Bids will be received by L. R. Hertert, Village Clk., until Sept. 16 for a steel tank, 22 ft. in diameter and 30 ft. high, with a conical steel roof and hemispherical bottom, on a steel tower 80 ft. high, with concrete foundations. Arnold C. Keonig, Engr., N. Y. Life Bldg., Omaha, Neb.

El Paso, Tex.—Bids will be received until Oct. 22 by J. A. Escajeda, City Clk., for supplying the city and its inhabitants with water for a period of 35 years; said water to be obtained from the "Mesa," near Ft. Bliss Military Reservation, near El Paso.

Golden, Colo.—Bids are wanted Sept. 15 for constructing a gravity system of water works. W. H. Carter, City Clk.

Matagorda, Tex.—Engr. Chester B. Davis, 10 Wall St., New York, N. Y., with a branch office at San Antonio, Tex., writes that a pumping plant will soon be required for rice irrigating works; capacity, 60,000 gals. per min., 30-ft. lift; water to be taken from the Colorado River in Matagorda Co., Tex.; initial area to be irrigated, 8,000 acres; ultimate area, 75,000 acres; estimated cost, $225,000.

Coeur d'Alene, Idaho.—The water works and electric light plant owned by Clem King, of Couer d' Alene, and Jas. Monaghan, of Spokane, Wash., are stated to have been destroyed by fire Aug. 26.

Lexington, Mass.—A press report states that a committee of 5 has been appointed to investigate the advisability of introducing the metropolitan system into the town to replace the present supply.

Pauls Valley, Ind. Ter.—Engr. Chester B. A. Davis, 10 Wall St., N. Y. City, N. Y., writes that the estimated cost of the proposed water works is $65,000. Part of the bonds have been authorized and the work of sinking a deep well will be contracted for in about 3 weeks. Contracts for the rest of the work may be held back until results of the well test are known.

Laramie, Wyo.—The Red Lands Ditch Co. has been incorporated, with a capital of $8,000, by John Clifton, Novia S. Beavers and others, to build an irrigation canal 13 miles long to take water from Sheep Creek, a tributary of the Little Medicine River. The company will have its general offices at Laramie and Little Medicine.

Tabor, Ia.—J. J. Dunnegan, of Shenandoah, is reported to have secured the contract for constructing water works here, for $6,000.

Glenwood, Pa.—A press report states that the Baltimore & Ohio R. R. Co. will construct a water station at Glenwood, at a cost of $30,000. J. M. Graham, Ch. Engr., Baltimore, Md.

New Florence, Pa.—The New Florence Water Co. is reported incorporated, with a capital of $10,000. D. S. Hoover and W. W. Grove, of New Florence, are among the directors.

Whatcom, Wash.—K. Sarset is stated to have secured the contract for laying a new water main, for $7,000.

Edmonds, Wash.—The Edmonds Spring Water Co. is reported to have been formed, with a capital of $15,000.

Troy, N. Y.—Water works bonds amounting to $578,125 are stated to have been sold on Aug. 29.

Ft. Morgan, Colo.—The Town Clk. writes that the proposition to construct water works at a cost of $40,000 is under consideration.

Fayette, Ia.—The citizens are stated to have voted to issue bonds for water works.

Long Branch, N. J.—A press report states that the new Monmouth Water Co. has petitioned the Long Branch Comrs. for permission to incorporate the Home Water Co. for the purpose of laying pipes and doing business here.

Shelbina, Mo.—The proposition to issue water works bonds is reported to have carried at a recent election.

Shenandoah, Va.—The item appearing in last week's issue under Shenandoah, Pa , should have been Shenandoah, Va.

Hagerstown, Md.—It is stated that the Washington County Water Co., which supplies Hagerstown, will tap the Antietam Creek where the mains cross the stream. A pump with a daily capacity of 800,000 gals. will be put in at once.

Rockville, Md.—The Mayor and Council are stated to have decided to employ Engr. Fink, of Washington, D. C., to superintend the installation of the new pumping machinery for the two wells.

Kansas City, Mo.—It is stated that Wm. Goodwin, Supt. Water Dept., will recommend to the Bd. of Pub. Wks. an extension of the 16-in. water main in St. Louis Ave., a distance of about 2,800 ft., at a cost of about $6,000.

Lee, Ill.—The question of establishing water works is reported to be under consideration.

Geary, Okla. Ter.—The citizens are stated to have voted to issue $27,000 bonds for water works.

Livingston Manor, N. Y.—A press report states that the Livingston Manor Water Co. has under consideration the construction of a reservoir, near Marguerite Falls. W. H. Cowan, Pres., Montgomery, N. Y.

Cohoes, N. Y.—It is stated that about $40,000 will be expended in improving the water works.

Minneapolis, Minn.—The Custodis Chimney Co., of Chicago, Ill., is stated to have secured the contract for erecting a 200-ft. brick chimney 7½ ft. interior diameter, for the Northeast Minneapolis pumping station, at $9,247.

Toronto, Ont.—City Engr. Rust is stated to have recommended the installation of a 15,000,000-gal. pumping engine.

Oakland, Cal.—A press report states that the Com. of Five of the Water Supply will shortly proceed to make a thorough investigation of the water resources available for Oakland. Mr. Chamberlain is Chmn. of the Com.

Dallas, Tex.—Engr. Chester B. A. Davis, 10 Wall St., New York, N. Y., with branch office at San Antonio, writes that this city has just voted $100,000 bonds for water-works improvements, but it is probable contracts aggregating $150,000 or more may be entered into. A large portion of this will be expended in connecting the new impounding reservoir—capacity 1,000,000,000 gals.—with the settling basins and the pumping station; the remainder in improving and extending the distributing system. Plans not yet completed.

New Bremen, O.—A press report states that Engr. John P. Force, of Columbus, estimates the probable cost of water works for New Bremen at $27,000.

Grinnell, Ia.—Bids are wanted Sept. 12 by the Grinnell Water Co. for a power pump, cast-iron pipe, standpipe, etc., as advertised in The Engineering Record.

Weiser, Idaho.—Bids are wanted Oct. 3 for furnishing material for a water works and electric light system. Stewart H. Travis, City Clk.

Blairsville, Pa.—Bids will be received by E. M. Evans, Chmn. Water Com., until Sept. 12, for furnishing material and making improvements to the water work, as advertised in The Engineering Record.

Eden Valley, Minn.—Bids will be received by W. R. Salisbury, Village Recorder, until Sept. 27 for constructing water works.

Northampton, Mass.—Water works bonds amounting to $50,000 were sold Aug. 29.

Dallas, Ore.—H. V. Gates, of Hillsboro, is stated to have submitted a proposition to City Council to install and operate water works. He asks the city for a $12,000 bonus and a 20-year franchise.

Dickson, Tenn.—The citizens are stated to have voted Aug. 28 to issue $25,000 bonds for the construction of water works.

Lancaster, Pa.—The Special Water Com. of City Council is stated to have prepared an ordinance for the construction of a new force main and the erection of another standpipe, to improve the city's water supply. The people will be asked to approve a loan of $145,000 to do the work.

Jesup, Ia.—The citizens are stated to have voted Aug. 25 to construct water works, to cost about $5,000.

Joliet, Ill.—The following bids are reported received Aug. 25 for constructing reservoir: Jas. H. Roche, Chicago, $18,753; McEwen Bldg. & Mfg. Co., Chicago, $13,681; Wm. Tunny, No. Center St., $13,460.

Paulsboro, N. J.—Winfield S. Thompson is reported interested in a company which proposes constructing water works here, at a cost of about $16,000.

Westerville, O.—G. H. Mayhugh, Secy. Water Wks. Trus., writes that T. C. Brooks & Sons, of Jackson, Mich., have secured the contract for constructing water works, bids for which were opened Aug. 19; contract reported to amount to $23,700.

W. Alexandria, O.—Bids will be received by the Bd. of Water Wks. Trus. until Sept. 16 for constructing an extension to the water works system. Work to include, approximately 2,500 ft. of 4 to 8-in. pipe, 3,200 lbs. of special castings, 5 fire hydrants, with necessary valves, valve boxes, etc. L. M. Derby, Clk.

Oakland, Cal.—Mayor Barstow is stated to have signed the ordinance appropriating $40,000 for the reconstruction of 12th St. dam. City Engr. F. C. Turner is reported to have completed the plans for this improvement, and the contract will be let at once.

Anaheim, Cal.—The Fairview Water Co. has been incorporated, with a capital of $5,000. Directors: E. A. Sparkes, L. A. Evans, and others, of Anaheim. Principal place of business is Anaheim.

Whittier, Cal.—N. W. Stowell, of Los Angeles, is stated to have purchased from the East Whittier Land & Water Co. its pumping plant, 14 miles of irrigation ditch and 126 acres of water-bearing land. It is reported that the new owners will expend $40,000 in improvements, it being their intention to extend the ditch so as to cover the entire Lahabra Valley.

Havre de Grace, Md.—The Crystal Springs Water Co. is reported incorporated, with a capital of $60,000, to construct water works. Wm. H. Brown and Geo. R. Carver are among the incorporators.

Fultonville, N. Y.—J. M. Johnson is stated to have submitted a proposition to the Village Trus. to construct water works.

Wildwood, Pa.—A press report states that the Baltimore & Ohio R. R. Co. will construct a water and coaling station at Wildwood, to take the place of the Glenshaw and Bakerstown stations. J. M. Graham, Ch. Engr., Baltimore, Md.

Portland, Ore.—Local press reports state that about $75,000 will be expended for laying new water mains on the East Side.

Wagner, S. D.—W. G. McDonald, Town Clk., writes that the citizens have voted to issue $2,000 bonds for sinking an artesian well.

Oakcliff, Tex.—At a citizens' meeting Aug. 28 a committee is stated to have been appointed, with E. G. Senter as Chmn., to investigate the question of procuring a good water supply and a system of fire protection for Oakcliff.

Portsmouth, O.—Henry Scott, Jr., Secy. Water Works Trus., writes that no bids were received Sept. 2 for furnishing labor and material and installing an intake crib in the Ohio River. The Board will ask all parties to whom plans and specifications were sent to make bids; if no bids are then received they will in all probability construct crib and make necessary repairs themselves, under the supervision of the consulting engineers.

Sherman, Tex.—The citizens are stated to have voted on Aug. 29 to issue $35,000 water bonds and $15,000 sewerage bonds.

Freehold, N. J.—The Avon Water Co. and Well Co. are stated to have been consolidated and reincorporated as the Monmouth Water Co., with a capital of $1,000,000, and will furnish water for a number of towns in Monmouth County. Jas. Steen, Secy., Eatontown; Jas. Bray, Treas., Point Pleasant.

Richmond, Va.—The Common Council has passed an ordinance giving the Mayor authority to sign a contract with the Chesapeake & Ohio R. R. whereby the city obtains a right to run flumes and water raceways through certain property of the company in return for which the railroad is given a right to construct either a double or single track railway upon the bank and dam of the proposed settling basin. It is stated that the next move in the direction of clearer water for Richmond will be the consideration of a resolution providing ways and means for obtaining the $350,000 which will be required to construct the basin.

Bozeman, Mont.—It is stated that bids are wanted at once by the Bozeman Creek Reservoir Co. for a dam to cost $10,000. F. W. Bull, Secy.; C. M. Thorpe, Engr. in Charge.

Edmonton, Alberta, N. W. T.—It is stated that bids are wanted Sept. 17 for a compound duplex pumping engine of 600 gal. per minute, 2 centrifugal pumps of 600 gal. per minute, and two 20-H.-P. steam engines. Willis Chipman, Ch. Engr., 103 Bay St., Toronto, Ont.

Atlantic City, N. J.—Van Sant & Boegm, Atlantic City, have been awarded the contract for taking up old 20-in. submerged ball-joint pipe with saddles and piles under Beach Thoroughfare at $2.90 per lin. ft., and for laying new line at $7.90 per lin. ft. or $9.25 with 5-yr. guarantee. Kenneth Allen, Engr.

Kirkwood, Mo.—Bids are wanted Sept. 16 for furnishing material and constructing a water works distributing system. W. M. Daly, Mayor. Owen Ford, Consulting Engr., 710 Security Bldg., St. Louis, Mo.

Palo Alto, Cal.—The citizens are stated to have voted Aug. 30 to issue $28,000 bonds for extending the water works and $12,000 for the electric light plant.

Biloxi, Miss.—Engrs. Kirkpatrick & Johnson, write that the time for receiving bids for 7 miles of cast-iron mains has been extended from Sept. 9 to Sept. 16.

Saginaw, Mich.—J. A. Bacon, in his report to the Bd. of Pub. Wks., states that for supplying the west side with water, 16 wells would be needed, the cost of which would be $18,000.

Kansas City, Mo.—The following bids are reported opened Sept. 1 for a pump for Turkey Creek station: Holly Mfg. Co., Lockport, two types of 15,000,000-gal. pump, $148,000 and $163,000, 18 mo. time; Henry R. Worthington, New York, 10,000,000-gal. pump, $73,000, at once; Barr Pumping Co., Phila., 15,000,000-gal. pump, $115,500, 12 mo. time.

SEWERAGE AND SEWAGE DISPOSAL.

Vincennes, Ind.—Frank Joyce, Asst. City Engr., writes that bids will be received until Sept. 22 for 2,660 ft. of 24x30-in. pipe sewer.

Marshall, Mich.—Bids will be received by E. D. Dickinson, Co. Drain Comr., until Sept. 11 for cleaning out, deepening, widening and extending drain known as "Shultz & Davidson Drain."

Port Huron, Mich.—Bids will be received by R. D. O'Keefe, Supt. Pub. Wks., until Sept. 12 for constructing a main sewer in Beard and 20th Sts.

Eaton, Colo.—Bids are wanted Sept. 20 for constructing a sewer system. Wm. L. Petrikin, Chmn. Com.

Iola, Kan.—Bids are wanted Sept. 11 for constructing sewer outlet, septic basins and sewer mains and laterals in Dist. No. 1. J. H. Harris, City Engr.

Trenton, N. J.—Bids are wanted Sept. 9 for constructing sewers in portions of several streets. C. Edw. Murray, City Clk.

Norristown, Pa.—Bids are wanted Sept. 15 for constructing storm sewers, as advertised in The Engineering Record.

South McAlester, Ind. Ter.—See "Water."

Cincinnati, O.—J. B. Washburn is stated to have secured the contract for a sewer in Quebec and Jonte Aves., for $38,323.

Wakefield, Mass.—A press report states that at a special town meeting Aug. 25 $60,000 was appropriated for the Metropolitan Sewerage System, making a total thus far of $285,000, and the work is only about half finished.

Columbus, O.—The Dirs. of Pub. Wks. are stated to have recommended to Council the early construction of main trunk sewers on the West Side. The money for this improvement will be secured from the sale of $175,000 bonds authorized under the Longworth act. About $100,000 will be spent on the West Side and the balance in extending the sewer system on the South Side.

Jersey City, N. J.—Henry Byrne, 548 Montgomery St., is stated to have secured the contract for constructing sewers in Academy and Newkirk Sts., Baldwin Ave. and other streets in the hilltop section, for about $42,288.

Wyoming, O.—Riggs & Sherman, of Toledo, are reported to have been selected to prepare plans for a sewerage system.

Brooklyn, N. Y.—Ch. Engr. H. R. Asserson, of the Dept. of Sewers, states that bids will be advertised in about 20 days for building a 4-ring brick sewer mostly in tunnel, 6,200 ft. long and 13 ft. internal diameter, from 92nd St. and New York Bay to 11th Ave., including 425 ft. of extension into the bay on pile grillage foundation. In order to determine the character of the geological formations, level of ground water, etc., prospective bidders will be allowed to sink test wells or make boring at their own expense, as the several strata to be passed through are not to be guaranteed in any manner by the city. Estimated cost of this work, $665,000.

Eugene, Ore.—Mummey Bros. are stated to have secured the contract for a 16-in. sewer from the main sewer of 15th St. in the alley between Oak and Pearl Sts., for $6,200.

Antigo, Wis.—Harding, Nelson & Johnson, of Racine, are stated to have secured the contract for constructing a sewer system at Antigo, for $19,000.

Berkley, Va.—The following bids were opened Aug. 21 by the Improvement Bd., for 28,000 ft. pipe sewer, 4 to 15 in. in diam., including 40 manholes, 12 catch-basins and 22 flush tanks; trench averaging 7 ft. deep in earth: Wolford Evans Plumbing Co., Newport News, Va., $27,803; Southern Pavg. & Constn. Co., Chattanooga, Tenn., $27,712; A. L. Patterson & Co., Rome, Ga., $23,301; Guyla & Co., Chattanooga, Tenn., $22,561.

Pittsburg, Kan.—W. W. Cook & Son, Junction City, Kan., have been awarded contract for 16,617 ft. pipe sewer, 15 to 18 in. in diam., including 31 manholes and 1 flush tank, trench averaging 12 ft. deep in clay, gravel and rock; total, $22,700 in city; $3,300 outside city.

Portland, Me.—Bids are wanted Sept. 10 for constructing a portion of Alms House Valley sewer. Address Geo. N. Fernald, Comr. of Pub. Wks.

Allegheny, Pa.—Bids are wanted Sept. 9 for constructing lateral sewers in portions of several streets. D. L. Fulton, Dir. Dept. Pub. Wks.

Dallas, Tex.—The citizens are stated to have voted on Aug. 26 to issue bonds for new sewers.

Brooklyn, N. Y.—Bids will be received by J. Edw. Swanstrom, Boro. Pres., until Sept. 17, for furnishing material and constructing sewer crossings under Atlantic Ave. Improv., Subway, at Howard, Saranac, Rockaway and Hopkinson Aves., and Eastern Parkway Extension. Engr.'s estimate, 2,300 lin. ft. of 30-in. brick sewer, 294 ft. of 12 to 24-in. vitrified stoneware pipe sewer, 144 ft. of 18 and 24-in. cast-iron pipe sewer, 30 manholes, 22,000 ft. B. M. foundation planking, 430,000 ft. B. M. sheeting and bracing, etc. Bids will also be received at the same time for furnishing material and constructing sewers in 60th St. and in 19th Ave. Engr.'s estimate, brick sewer 15 ft. 162-in., 4,015 ft. 156-in., 660 ft. 144-in., 60 ft. 78-in., 50 ft. 36-in. and 100 ft. 30-in.; 350 ft. of 12 to 24-in. vitrified stoneware pipe sewer laid in concrete, 21 manholes, 16 receiving basins, 680,000 ft. of B. M. foundation planking, 2,300,000 ft. B. M. sheeting and bracing, etc.

Youngstown, O.—It is stated that bids are wanted Sept. 20 for constructing a sewer in a portion of South Ave. C. E. Cross, Clk.

Ft. Keogh, Mont.—See "Government Work."

Monticello, Ind.—It is stated that bids are wanted Sept. 12 for constructing sewer No. 14. W. J. Gridley, Town Clk.

Sherman, Tex.—See "Water."

Plainfield, N. J.—Jas. Maybury & Son, Passaic, N. J., on the basis of bids opened Sept. 2, has been awarded the contract for 25,855 ft. 8-in. pipe sewer in trench 7 to 14 ft. deep, excavated mostly in sand; total, $15,745. The work includes 29 manholes, 1,000 branches and 18 flush tanks.

Monticello, Ind.—Simons & Mikesell, Quincy, Ill., are reported to have received contract for Jefferson St. sewer at $13,554.

Mobile, Ala.—The following bids are reported received Aug. 28, by Bd. of Pub. Wks. for 21,659 ft. of 10 to 30-in. storm sewers, including 25,000 ft. 6-in. house connections, 1,500 ft. of 5-ft. brick sewer and 2,150 ft. 4x7-ft. covered canal: A. L. Patterson & Co., Macon, Ga., $86,499; Thos. Wagner, Mobile, Ala., $79,423; Jett Bros., Mobile, Ala., $86,938; Gilsonite Construction Co., St. Louis, Mo. (awarded contract), $78,258; T. W. Nicol & Co., Mobile, Ala., $115,752; Guild & Co., Chattanooga, Tenn., $105,001; Grasser Construction Co., New Orleans, La., $123,460.

Brooklyn, N. Y.—The following bids were opened Aug. 27 by J. Edw. Swanstrom for sewers in Ave. G. Flatbush and other streets:

Items.	Cunningham & Kearns.	John J. Creem.	John McNamee.
Brick sewer:			
90-in., 3,260 ft.	$27.00	$26.50	$20.00
84-in., 5,660 ft.	26.00	24.00	19.00
66-in., 815 ft.	20.00	10.50	10.00
60-in., 1,380 ft.	9.30	5.10	6.50
54-in., 1,320 ft.	8.60	4.50	5.40
48-in. egg-shaped, 630 ft.	7.00	4.00	5.00
42-in., 1,135 ft.	6.60	4.00	4.50
36-in. egg-shaped, 805 ft.	6.30	3.75	4.50
36-in., 140 ft.	6.30	3.75	4.75
Vit. pipe in concrete:			
24-in., 260 ft.	4.00	4.00	4.00
18-in., 780 ft.	3.00	2.50	3.00
15-in., 350 ft.	2.50	2.00	2.10
12-in., 3,500 ft.	1.00	.80	.50
Manholes, 94	40.00	25.00	32.00
Receiving basins, 49	100.00	90.00	95.00
Plank, 895 M. ft.	30.00	25.00	25.00
Sheeting, 1,800 M. ft.	25.00	.01	21.00
Piles, 108,000 ft.	.30	.17	.15
Sheet piling, 116 M. ft.	40.00	45.00	45.00
Pine and spruce, 48 M. ft.	40.00	45.00	40.00
Frame building	1,000.00	350.00	400.00
C. I. sluice gates, 2	400.00	250.00	200.00
Concrete, 350 cu. yds.	7.00	8.00	6.50
Steel lime tank	500.00	100.00	160.00
Cypress tank, 3,000-gal.	500.00	100.00	175.00
C. I. and bronze syphons, 8	400.00	150.00	100.00
Oil engine, 8-H.-P.	3,000.00	2,000.00	1,300.00
Totals	$434,031	$317,262	$313,550

Brooklyn, N. Y.—The following bids were opened Aug. 27 by J. Edw. Swanstrom, Boro. Pres., for a sewer in Bedford Ave.: A, DeWitt C. Bouker; B, Robert Carter; C, Cunningham & Kearns; D, John McNamee; E, John J. Creem; F. John O'Grady; G, Jas. H. Holmes & Co.; H, John J. Cashman; I, Henry Hesterberg:

	Brick sewers.						Vitrified pipe.							
	96-in., 1,370 ft.	84-in., 695 ft.	78-in., 2,460 ft.	60-in., 4,460 ft.	48-in., 270 ft.	36-in., 540 ft.	18-in., 50 ft.	15-in., 250 ft.	12-in., 210 ft.	69 Manholes.	44 Rec. basins.	Planking, 250 M. ft.	Sheeting, 1,200 M. ft.	Totals.
A..	$20.00	$15.00	$15.00	$10.85	$6.00	$4.25	$2.30	$1.75	$1.30	$32	$98	$1	$1.00	$136,977
B..	23.41	20.00	18.77	8.17	6.66	5.51	3.11	3.11	3.11	33	105	30	30.00	185,531
C..	24.60	19.60	19.60	8.20	6.60	5.50	4.00	3.00	2.50	40	100	30	25.00	183,599
D..	20.00	16.00	16.00	6.50	5.50	4.75	3.25	2.50	1.75	32	95	24	21.00	149,818
E..	20.00	16.75	15.50	5.75	4.00	3.50	3.00	2.00	1.75	25	90	17	.01	116,866
F..	18.00	16.00	14.00	7.00	6.00	4.50	3.00	2.50	1.50	30	100	18	18.00	139,325
G..	17.75	13.50	9.50	5.75	4.50	4.00	2.45	1.75	1.35	23	87	17	18.00	118,979
H..	23.78	19.36	20.46	8.27	6.18	5.22	3.44	3.08	2.20	30	90	23	23.00	178,661
I...	22.70	15.75	15.75	6.80	4.85	4.25	3.00	3.00	2.00	27	100	20	.01	126,228

BRIDGES.

Chillicothe, O.—Press reports state that the officials of the Norfolk & Western R. R. intend building a steel bridge, with triple girders, across Scioto River in this city. The contract for the masonry has been awarded. At Kinnick, it is stated that the company intends building a 290 ft. span bridge, with seven 48-ft. girders of trestle. It is also stated that at Ashville and Sciotoville, bridges are to be built in the near future. C. C. Wentworth, Bridge Engr., Roanoke, Va.

Pontiac, Mich.—It is stated that the city contemplates constructing a concrete bridge, 61 ft. wide and 30-ft. span. Wm. J. Fisher, City Engr.

Milwaukee, Wis.—Chas. J. Poetsch, City Engr., has been directed to prepare plans for a steel viaduct 1 mile long to be built at 27th St.

City Engr. Poetsch estimated the cost of constructing the Jones Island bridge at Washington St. at $150,000.

Richmond, Va.—Local press reports state that the Citizens' Rapid Transit Co. has had plans prepared for a viaduct to be built at Marshall St., at a probable cost of $125,000.

Pekin, Ill.—The Com. on Bridges will, according to local press reports, recommend to the City Council the building of a steel bridge in this city at a cost of $24,000.

Ottawa, Ont.—The building of a bridge across Rideau Canal at Concession St. is again being agitated.

Navarre, O.—The Canton-Akron R. R. Co. has petitioned the Co. Comrs. for permission to construct a bridge at Navarre.

Grand Rapids, Mich.—Plans and specifications for the piers and abutments for the Wealthy Ave. bridge are to be prepared at once, and the contract let as soon as plans are completed. It is stated that the bridge at Bridge St. will not be constructed until next spring.

Barbourville, Ky.—The Brackett Bridge Co., Cincinnati, O., is reported to have secured the contract to construct a bridge in Knox Co., across Cumberland River, for $11,800.

St. Charles, Ill.—E. H. Arnold is stated to have secured the contract to construct a bridge at Main St. for $12,000.

Springfield, Mass.—The War Dept. has issued an order directing the City of Springfield to either raise the 4th span of South-end bridge or place a 70-ft. draw in the bridge.

Picton, N. J.—The Lehigh Valley R. R. Co. has granted permission to the Plainfield & Elizabeth Trolley Co. to construct a bridge across the tracks at Picton.

Victoria, B. C.—Bids are wanted Oct. 13 for the Point Ellice Bridge, as advertised in The Engineering Record.

Yellowstone Park, Wyo.—See "Government Work."

Tarentum, Pa.—F. M. Ross writes that bids will be received until Sept. 15 for building a combined street railway and highway bridge for the Tarentum Traction Passenger Ry. Co. over the West Penn R. R. Probable cost, $50,000. Knoff & Milholland, Engrs.

Clayton, Mo.—Bids will be received until Sept. 15 by Wm. Elbring, Comr. of Roads & Bridges, for constructing 3 steel bridges in St. Louis Co.

Cedar Falls, Ia.—It is stated that the Chicago Great Western Ry. intends to build a steel girder bridge across Dry Run in the south part of the town. F. R. Coates, Ch. Engr., St. Paul, Minn.

Seattle, Wash.—The Bd. of Pub. Wks. is stated to have rejected bids for building the Latona bridge, the lowest bid being $5,000, which was considered by Engr. Thomson to be $1,000 too much.

South Bend, Ind.—Local press reports state that the Co. Comrs. will have plans and specifications prepared at once for a bridge to be built at Mishawaka over the St. Joseph River near the Barbee Creek culvert on 2d St.

Chicago, Ill.—The Drainage Bd. is reported to have authorized the expenditure of about $13,000 as "extra work" in building a temporary bridge at Harrison St. by the present contractor.

San Diego, Cal.—City Engr. d'Hemmecourt is reported to have prepared plans for 4 styles of bridges to span the San Diego River on the Poway Road, as follows: Pile bridge, to cost $7,942; wooden truss bridge, 50-ft. spans, to cost $9,621; combination wood and iron bridge, 162-ft. spans, to cost $22,823; combination bridge, 100-ft. spans, to cost $20,333; steel bridge, 140-ft. spans, to cost $31,823; steel bridge, 100-ft. spans, to cost $30,450.

Canisteo, N. Y.—Press reports state that the Town Bd. has issued $9,000 in bonds to be expended on bridges.

Joplin, Mo.—The Co. Court has authorized the Bridge Comr. to receive bids for a bridge across Turkey Creek on the Tuckahoe road.

Reading, Pa.—Press reports state that the bridge over the Schuylkill has been estimated to cost $30,000.

Angola, Ind.—The Goshen & Indiana Traction Co. is reported to be taking steps toward building bridges between Orlund and Lake James and across the Pigeon River at Ontario, La Grange Co. J. A. Van Osdol, Secy., Anderson, Ind.

Reading, Pa.—Bids will be received until Sept. 23 at the office of T. L. Eyre, Supt. of Pub. Grounds & Bldgs., Harrisburg, for rebuilding the substructure and superstructure of the bridge across Schuylkill River, in Ontelaunee Township, about 5½ miles north of Reading.

Santa Rosa, Cal.—The Bd. of Superv. is stated to have altered the plans for the bridge across Russian River at Markhams and awarded the contract to the San Francisco Bridge Co. The bridge will have two 200-ft. spans of steel and wood, and the cost will be, according to reports, about $21,000.

Berryville, Va.—The Bd. of Superv. has been requested by citizens of Clarke Co. to prepare plans for bridges over the Shenandoah River at Castleman and Berry's ferries. It is stated that $10,000 will be needed for the work.

Solon Springs, Wis.—The town of Nebagemain has been petitioned to construct a bridge across Lake St. Croix at this place.

West Chester, Pa.—Geo. T. James, Jos. Milus, J. O. Houck and others are reported interested in building a bridge over the south branch of French Creek, between the townships of East Nantmeal and Warwick.

White Haven, Pa.—Bids are wanted Sept. 23 for rebuilding the superstructure and substructure of the bridge across Lehigh River, at White Haven. Estimated cost, $38,000. T. L. Eyre, Supt. of Pub. Grounds & Bldgs., Harrisburg.

Chicago, Ill.—A. R. Porter, Clk. Trus. Sanitary Dist. of Chicago, writes that the opening of bids for constructing the superstructure and substructure of the 18th and Loomis St. bridges has been postponed until Nov. 5. Bids were to have been opened Sept. 3, as advertised in issue of The Engineering Record, July 19.

Doylestown, Pa.—Bids will be received by the Co. Comrs. until Sept. 15 for constructing a stone bridge in Nockamixon Township, at White's Mill. Bids will also be received by the Co. Comrs. until Sept. 20 for constructing a steel bridge across Poquessing Creek, between the city of Philadelphia and Bensalem Township. Elmer E. Funk, Clk.

Montesano, Wash.—It is stated that bids are wanted Sept. 15 for constructing a highway bridge over Porter Creek, consisting of a 64 ft. span, on pile abutments and 144 ft. of approaches. W. D. Campbell, Co. Clk.

Harrisburg, Pa.—Bids will be received until Sept. 23 at the office of T. L. Eyre, Supt of Pub. Grounds & Bldgs. for rebuilding the superstructure and substructure of the following bridges: 1 across Sugar Creek, at East Troy; 1 across Towanda Creek, Masontown; 1 across Wyalusing Creek, at Wyalusing; 1 across Lycoming Creek, near Fields Station, Lewis Township, 1 across Loyalsock Creek, Plunkett Township, Lycoming Co.; 1 across Lehigh River, Bowmanstown; 1 across Lackawanna River, Boro. of Old Forge, Lackawanna Co.; 1 across Tionesta Creek, 9 miles from Tionesta; 1 across Susquehanna River, at Tunkhannock; 1 across Tunkhannock Creek, at Dixon; 1 across Tuscarora Creek, Juniata Co.; 1 across West Branch of the Susquehanna River, near Curwensville; 1 across Red Bank Creek, at Brookville; 1 across Elk Creek, in Hillsgrove Township, Sullivan Co.; 1 across Lackawaxen Creek, 2 miles west of Honesdale, and 1 at Honeadale.

Wilkesbarre, Pa.—Bids will be received by the Co. Comrs. until Sept. 13 for constructing several small county bridges. Geo. R. McLean, Co Compt.

Terre Haute, Ind.—Bids will be received until Sept. 18 at a joint session of the Comrs. of Virgo and Sullivan Counties, at the office of Jas. Soules, Co. Aud. of Virgo Co., for constructing Allen bridge, 50-ft. span and 14-ft. roadway, and Dwyer bridge, 40-ft. span, 11-ft. roadway.

Washington, D. C.—Local press reports state that the construction of 2 landing bridges at the proving grounds at the Navy Yard are being considered. Probable total cost, $60,000.

Grand Rapids, Wis.—The Modern Steel Structural Co., of Waukesha, is reported to have secured the contract to construct a bridge in this city for $15,437.

Rockdale, Ia.—W. J. Harrahan, Ch. Engr. of the Illinois Central Co., is reported to have asked the Bd. of Superv. for permission to construct a viaduct at Rockdale.

Greenlane, Pa.—It is stated that plans and specifications are being prepared for a bridge to be built at Snyder's Mill, between Greenlane and Perkiomenville.

Philadelphia, Pa.—Bids will be received until Sept. 20 for bridge work as follows: bridge on line of Frankford Ave., between Philadelphia and Bucks Counties; work on west approach of bridge on Frankford Ave., in Philadelphia Co.; and abutment and piers of west approach to proposed Passyunk Ave. bridge over Schuylkill River. Wm. C. Haddock, Dir. Dept. Pub. Wks., Bureau of Surveys.

PAVING AND ROADMAKING.

Greenville, Miss.—Robt. Somerville, Asst. Chief Engr., Bd. Mississippi Levee Comrs., writes that Sessions & Cary, Greenville, were awarded contract for 800,000 cu. yds. levee work at 22 cts. per cu. yd.

Des Moines, Ia.—J. C. Likes is reported to have been awarded contract for about 11,097 sq. yds. brick paving on E. Lyon St., at $1.69 per sq. yd. O. P. Herrick bid $1.59 on condition that work was done in 1903.

Detroit, Mich.—Jas. Hanley is reported lowest bidder for resurfacing with sheet asphalt according to bids opened Aug. 25, as follows: Smith Ave., $2.10 per sq. yd., total, $18,220; Milwaukee Ave., $2.12 per sq. yd., total, $6,544; Horton Ave., $2.105 per sq. yd., total, $16,656.

Allegheny, Pa.—Bids are wanted Sept. 9 for grading, paving and curbing on portions of several streets. D. L. Fulton, Dir. Dept. Pub. Wks.

Youngstown, O.—Bids will be received by the City Comrs. until Sept. 13 (readvertisement) for paving a portion of Holmes St. C. E. Cross, City Clk.

Mays Landing, N. J.—The Special Road Com. of the Co. Bd. of Freeholders is stated to have decided to recommend to the Bd. the proposed route through Chelsea Heights as the site of the new turnpike. Co. Engr. Albertson estimated the new road will cost about $90,000. The foundation of the highway will be of gravel. The road later will probably be covered with macadam.

Dallas, Tex.—The citizens are stated to have voted Aug. 26 to issue $25,000 bonds for street improvements.

Peekskill, N. Y.—Bids will be received by the Bd. of Village Trus. until Sept. 16 for paving with brick on a 5-in. concrete foundation on portions of 3 streets. Albert E. Cruger, Clk.

New York, N. Y.—Bids will be received by the Comrs. of Parks, Wm. R. Wilcox, Chmn., until Sept. 11 for improving Crotona Parkway, from 175th to 182d Sts. Engr.'s estimate, 13,500 cu. yds. earth excavation, 7,500 cu. yds. rock excavation, 1,000 cu. yds. filling in place, 28,800 sq. yds. telford macadam pavement, 3,950 sq. yds. of asphalt walks, 14 receiving basins, etc.

Bids will be received until Sept. 11 by Jacob A. Cantor, Boro. Pres., for regulating and repaving with asphalt blocks on macadam foundation, or with a bituminous macadam pavement, 7th Ave. from 110th to 153d Sts. Engr.'s estimate, 100,400 sq. yds. of asphalt block or bituminous macadam pavement, 1,100 sq. yds. of old stone block pavement to be relaid in approaches, etc.; 17,500 lin. ft. of old curbstone redressed, rejointed and reset on concrete foundation; 5,500 lin. ft. of new curbstone furnished and set on concrete foundation, etc. Bids will also be received at the same time for regulating and repaving with asphalt on present pavement relaid as foundation on Henry St., between Rutgers and Grand Sts. Engr.'s estimate, 9,100 sq. yds. of asphalt pavement including binder course, 9,200 sq. yds. of old stone pavement to be relaid as foundation or in approaches, etc.; 4,400 lin. ft. of new curbstone furnished and set, etc.; also for similar work on portions of 63d and 102d Sts., requiring about 3,040 sq. yds. of asphalt pavement, including binder course, and 3,040 sq. yds. of old stone pavement to be relaid as foundation or in approaches, etc.

Trenton, N. J.—Bids are wanted Sept. 9 for paving with sheet asphalt on a concrete base on a portion of So. Broad St. C. Edw. Murray, City Clk.

Fremont, O.—Bids will be received by the Council's Improv. Com. until Sept. 29 for grading, draining and macadamizing a portion of State St. E. Schwartz, Chmn.

Moline, Ill.—Bids will be received by the Bd. of Local Improv. until Sept. 12 for grading, curbing and paving with asphalt on portions of 5th Ave. and 7th St., requiring in all about 7,412 sq. yds. of asphalt paving and 4,577 lin. ft. of curbing; estimated cost, $20,123. Bids will also be received at the same time for grading, curbing and paving with asphalt on 11th St., requiring 1,056 sq. yds. of paving and 704 lin. ft. of curbing; estimated cost, $3,040. Henry G. Paddock, Secy.

Kenosha, Wis.—Bids will be received by the Street Assessment Com. until Sept. 13 for furnishing material and grading, curbing and paving with vitrified brick on a crushed stone foundation, on N. Main and Main Sts. Chas. H. Pfennig, Chmn.

Louisville, Ky.—The Bd. of Pub. Wks. is stated to have ordered Transit, Woodbine and Elwood Aves. paved with asphalt.

Paterson, N. J.—The St. Com. of the Bd. of Aldermen on Aug. 28 decided to recommend to the Bd. that the City Council be instructed to prepare an ordinance for the issue of $60,000 bonds to be used to repair the streets.

Reading, Pa.—The Select Council has passed an ordinance providing for the paving of portions of Cherry, Chapel Terrace and 13th Sts. with vitrified block.

Wapakoneta, O.—The citizens are stated to have voted Aug. 25 to issue $30,000 bonds for improving the streets and highways.

Pekin, Ill.—It is stated that S. 4th St. will be paved with asphalt.

Nashville, Tenn.—The Mayor is stated to have signed ordinances providing for the paving of Broad St. and West End Ave., at a cost of about $28,000, and for the paving of Summer St. and other So. Nashville Sts. with bitumen macadam at a cost of $39,400.

Aberdeen, S. D.—A grade survey is being made preparatory to the construction of a system of surface drainage, in connection with the paving of the business part of the city. M. P. Stroupe, City Aud. E. W. Van Meter, City Engr.

Niles, Mich.—John Nagle, Chmn. St. Com., writes that C. H. Defrees, of South Bend, Ind., has secured the contract for paving Main St. with Metropolitan brick at $1.65 per sq. yd.

Cincinnati, O.—F. H. Kirchner & Co., 8th and Blum Sts., are stated to have secured the contract for improving Beekman St. with granite block for $29,636.

Elgin, Ill.—A petition is being signed for the paving of National St. and Grove Ave. with asphalt.

Lafayette, Ind.—The Town Bd. is stated to have decided to pave State St. with asphalt.

Schenectady, N. Y.—The contract for paving Hulett St. with sheet asphalt is stated to have been awarded to the Schenectady Contracting Co. for $16,360.

Trenton, N. J.—The Council is stated to have passed an ordinance providing for the paving of Warren, Hanover and Bank Sts. with sheet asphaltum.
The Barber Asphalt Co. is stated to have secured the contract for paving E. State St. with sheet asphaltum for $31,849.

Joplin, Mo.—Chas. F. Schilling, of St. Louis, is stated to have secured the contract to macadamize the Big Bend road for $13,000.

Fall River, Mass.—The Park Comn. is reported to have awarded the contract for supplying and setting granolithic pavement in the South Park to Warren Bros., of Boston, at $1.34 a sq. yd.

Indianapolis, Ind.—The Bd. of Wks. is reported to have under consideration the resurfacing of Washington St. with asphalt; also an asphalt pavement for 13th St.

Brazil, Ind.—Cloud, Carr & Monical are stated to have secured the contract for building gravel roads in Washington Township, for $43,477.

Paris, Ill.—A press report states that Thompson & Case, of Peoria, have secured the contract for paving E. Wood St. for $25,320.

Saybrook, Conn.—Leonard Blondel, of Stamford, is stated to have secured the contract for 2,864 lin. ft. of macadamized highway, for $5,200.

Lewiston, Idaho.—Chas. S. McDonald, City Clk., writes that it was voted Aug. 28 to issue $10,000 street improvement bonds.

Memphis, Tenn.—Local press reports state that the Memphis St. Ry. Co. will soon let contracts for its share of proposed asphalt paving, which it is reported will be about $160,000. F. G. Jones, Mgr., Memphis.

Bayonne, N. J.—Jas. J. Coogan is stated to have secured the contract for macadamizing 34th St. bet. Aves. A and E, for $12,784.

St. Paul, Minn.—City Engr. Rundlett estimates the cost of paving 9th St. from Smith Ave. to Bway., a distance of 12 blocks, with brick $40,257, asphalt $47,616, and sandstone $52,369.

Norwich, N. Y.—A petition is stated to have been presented to the Village Trus. for the paving of Birdsall St. with brick.

New York, N. Y.—Bids will be received until Sept. 15 by Louis F. Haffen, Pres. Bronx Boro., for paving with asphalt on a concrete foundation a portion of Dawson St., and for repaving with asphalt on present block pavement portions of several streets. Engr.'s estimate, 17,130 sq. yds. of asphalt, 14,150 sq. yds. of old stone pavement to be relaid as foundation and in approaches, etc.; for paving with granite block on a sand foundation on portions of several streets. Engr.'s estimate, 18,395 sq. yds. of granite block pavement; for regulating and grading, setting curbstone and flagging the sidewalks on portions of numerous streets. Engr.'s estimate, 62,980 cu. yds. of earth excavation, 78,980 cu. yds. of rock excavation, 228,025 cu. yds. of filling, 205,390 sq. ft. of flagging, 56,960 lin. ft. of new curbstone, etc.

Boston, Mass.—Bids will be received by the City Engr. until Sept. 10 for constructing a telford macadam roadway in Oakland St., and gravel roadways in connecting ways.

Hamden, Conn.—Bids are wanted by the Bd. of Selectmen until Sept. 11 for constructing a macadam road and grading sections of roads in this town. W. F. Downer, 1st Selectman.

St. Clair, Mich.—Bids were opened Aug. 25 for paving, the lowest bidders being B. D. Bartow, Port Huron, Mich., vitrified brick on stone concrete at $1.73; total, $21,249; and vitrified brick on gravel concrete at $1.63, total $20,138; Barber Asph. Co., Detroit, bituminous macadam, total $21,718.

Lowell, Mass.—The Merrimack Pavg. Co. is reported to have received contracts Aug. 27 for asphalt paving at $2.95 per sq. yd., and the Warner-Quinlan Co. at $2.96 and $2.97, both with 10-yr. guarantees.

Milwaukee, Wis.—Mayor Rose is stated to have approved the ordinance providing for the issue of $100,000 bonds for street improvements.

Banksville, Pa.—Bids will be received by the Comrs. of Union Township until Sept. 13 for improving Simmons Road by grading, macadamizing and constructing sewers. 750 cu. yds. of grading, 3,850 sq. yds. of macadamizing, 858 lin. ft. of 12, 24 and 36-in. sewers, etc. Address, Thos. Hartley, Secy., Banksville, Pa.

Dunkirk, N. Y.—The Council has decided to pave 3d and Lion Sts.

South Bend, Ind.—A. J. Hammond, City Engr., writes that bids will be received Sept. 22 for 3,470 sq. ft. of cement walk on Hydraulic Ave. and for 19,860 sq. ft. of cement walk and 2,458 lin. ft. of cement curb on Notre Dame St., and 237 sq. yds. of sheet or rock asphalt or bituminous macadam on City Hall alley.

Lawrence, Kan.—John Ritchie & Wm. Bradbury, Topeka, Kan., have been awarded the contract for about 10,000 sq. yds. macadam pavement, 8-in. deep, at 44½ cts. per sq. yd., on basis of bids opened Sept. 2.

Ilion, N. Y.—Bids are wanted Sept. 10 for 2,500 sq. yds. of brick paving on a concrete foundation, and 1,500 lin. ft. of stone curbing, as advertised in The Engineering Record.

Mobile, Ala.—The following bids are reported received Aug. 28 by the Bd. of Pub. Wks.: Brick Paving—Southern Pav. & Cons. Co., Chattanooga, Tenn., $38,908; Gilsonite Cons. Co., St. Louis, Mo., $40,952; White & Eichel, Evansville, Ind., $41,789. Asphalt Paving—R. B. Parke & Co., Louisville, Ky., $78,922; Green River Asphalt Co., St. Louis, Mo., $72,877; Louisiana Improvement Co., New Orleans, La., $82,994; Southern Paving & Cons. Co., Chattanooga, Tenn., $75,056.

Camden, N. J.—L. E. Farnham, City Engr., writes that the Vulcanite Pavg. Co., Philadelphia, has been awarded contracts for which bids were opened Sept. 2, for asphalt paving with 1½-in. top, 1-in. binder, 6-in. natural concrete at $2.30 on a 10-yr. guarantee; Wm. H. Sherman, for granite blocks on sand for $1.48 per sq. yd.; and B. F. Sweeten & Son, for Johnsonburg vitrified blocks on 4-in. Portland concrete for $2.23 with 5-yr. guarantee.

Chanute, Kan.—The following bids are reported opened Aug. 18 for vitrified brick pavement: O. C. Chaplu, Leavenworth, $28,250; Hanley & McGuire, Leavenworth, $26,843; John Ritchie, Topeka, $26,560; W. M. Edwards, Kansas City, $26,419; R. S. Gilfillen, Ft. Scott, $26,136; Ramsey & Ramsey, Topeka, $25,430; W. A. Stucky, Coffeyville, $22,958; Steven Schnite, Ft. Madison, Ia. (awarded contract), $22,180.

Oneida, N. Y.—Chas. H. Bartow & Co., Columbus, O., are reported to have received contracts for paving Main St. and Lenox Ave., with Mack brick at $2.29 per sq. yd.; total, $118,567. The work includes 21,920 sq. yds. for the city and 17,260 sq. yds. for the Oneida Ry. Co. The rest of the bids, which were opened Aug. 21, are as follows: Denniston & Co., Syracuse, Corning blocks, $113,410; Hickory Run, $123,611; Mack, $125,947; Metropolitan, $118,735; Miller & Co., Oneida, Penn. Clay Co.'s brick, $114,178; Mack, $124,756; Metropolitan, $116,519; Callanan Road Improvement Co., Albany, Penn. Clay Co., $118,703; John W. Bustin, Hickory Run, $117,894; Metropolitan, $120,981; Chas. H. Bartow & Co., Mack wire cut, $117,894.

Denver, Colo.—The following bids were opened Aug. 25 by Bd. Pub. Wks. for work in Capitol Hill Improvement Dist. No. 3: The Colorado Co., $91,473; Western Realty & Pavg. Co., $86,485; Thos. J. Tully (awarded contract), $84,913; Chas. Connor, $97,310; R. P. McDonald, $91,596, all of Denver. The detail of successful bid is as follows: 53,100 cu. yds. grading, at 25 cts.; 80 M. ft. lumber, at $28; 66,200 ft. sandstone curb, at 97 cts.; 490 ft. sandstone curb in short lengths, at $1.15; 1,640 lin. ft. granite, short lengths, at $2; 7 inlets reconstructed, at $50; 2,200 ft. old curb, at 45 cts.

Fulton, N. Y.—The following bids were received Aug. 25 by Bd. Pub. Wks. for macadam paving: A, Walter Bradley & Co., Fulton; B, Robt. W. Henson, Geneva (awarded contract); C, W. J. Dwyre, Syracuse; D, E. H. Denniston & Co., Syracuse:

	A	B	C	D
Brk. pave, 2,000 s. y.	$2.25	$2.35	$2.25	$2.22
Trap rock, 5,600 s. y.	1.45	1.35	1.80	1.82
Stone curb, 4,000 ft.	.80	.85	.65	.91
Protect. cb., 100 ft. .	.50	.65	.30	.51
Catch basins, 4.....	50.00	25.00	50.00	60.00
C. I. inlets, 8......	15.00	20.00	15.00	32.00
Cast iron pipe:				
10-in., 150 ft.....	2.00	1.25	2.00	1.71
6-in, 60 ft.......	1.50	.77	1.50	.95
Vit. sewer pipe:				
10-in., 100 ft.....	1.00	.50	1.00	.50
8-in., 75 ft.......	.60	.35	.60	.45
6-in., 200 ft......	.60	.35	.60	.30
Gut. stone, 4,000 ft.	.50	.53	.27	.35
Totals	$18,851	$18,490	$19,272	$20,681

POWER PLANTS, GAS AND ELECTRICITY.

Battle Lake, Minn.—Bids will be received by the Village Council until Sept. 22 for $5,000 bonds, said bonds to be used to construct an electric light and water power plant. John J. Rudh, Pres.

Pagosa Springs, Colo.—Gilbert Wilkes & Co., 251 Coronado Bldg., Denver, is to construct an electric light plant in connection with the water works here. The water works are now being constructed.

Verndale, Minn.—H. Lyons, Village Recorder, writes that the citizens voted Aug. 18 to issue $7,000 bonds for an electric light plant.

Coeur d'Alene, Idaho.—See "Water."

Guthrie, Okla. Ter.—Fredk. G. Bonfils, of Denver, is stated to have petitioned the City Council for a franchise to establish an electric and gas plant and an electric railway, to cost in all about $150,000.

New Haven, Conn.—The Riter-Conley Mfg. Co., of Pittsburg, Pa., and C. W. Blakeslee & Sons, of New Haven, are reported to have secured the contract for the steel gas reservoir to be erected on East St. for the New Haven Gas Light Co.; total cost of work is about $200,000.

Council Bluffs, Ia.—It is stated that the Citizens Gas & Electric Co. will expend about $15,000 improving its gas plant.

Cincinnati, O.—Plans for a new distributing station and light plant to be erected on Charles St. and Central Ave. are stated to have been submitted to the Building Inspector by the Cincinnati Gas & Electric Co. It will cost $60,000 and will be of brick and steel.

Leadville, Colo.—A press report states that a new company, to be known as the Leadville District Ry. & Power Co., will construct an electric light plant here. T. W. Kloman, of New York, N. Y., is reported interested.

Hudson, O.—The Council is stated to have granted Goeppinger & Backman, of Youngstown, a franchise for an electric light plant.

Duluth, Minn.—City Engr. Patton is stated to have submitted to the Council his preliminary report of the cost of installing a municipal and commercial lighting plant. He estimates the cost, figuring that the city would use a maximum of 500 arc lights on the streets, at $150,000. The figures are based on an aerial system, except in the center of dense population, where the wires would be placed underground.

Parnassus, Pa.—The Parnassus Electric Light, Heat & Power Co. is reported incorporated, with a capital of $1,000.

Winnsboro, S. C.—W. B. Smith Whaley & Co., of Columbia, are stated to have been selected to prepare plans for an electric light plant.

Rome, Ga.—The City Council is stated to have passed a resolution requesting the City Attorney to prepare a bill for the Legislature to authorize the issue of $15,000 bonds for the construction of an electric light plant.

Flandreau, S. D.—It is stated that the Practical Gas Works, of North Chicago, Ill., will construct a gas plant here.

Harrisville, Mich.—The citizens are stated to have voted to issue $4,500 bonds for an electric light plant.

Miller, S. D.—Lewis Kellough is reported interested in the construction of an electric light plant.

Storm Lake, Ia.—City Clk. W. C. Edson writes that on Aug. 25 it was voted to grant franchises to A. W. Unger for a gas plant and to Storm Lake Electric Light & Power Co.

Lathrop, Mo.—The citizens are stated to have granted J. D. Guyton a franchise for an electric light plant.

Pana, Ill.—T. C. Reed, of Casey, Ill., is stated to have secured the contract for constructing an electric light plant for $16,000.

Carberry, Man.—It is stated that E. S. Harrison, of Winnipeg, proposes constructing an electric light plant and telephone system in Carberry.

Odell, Ill.—Foster & Thompson, of Pontiac, are stated to have made a proposition to the Village Trus. to furnish Odell with electric lights and also to pump the water.

Marion, O.—H. E. Bradner is stated to have petitioned for a franchise for a hot water and steam heating system.

Cleveland, O.—The Co. Comrs. are stated to have granted the East Ohio Gas Co. a perpetual franchise to lay gas pipes through the county.

Palo Alto, Cal.—See "Water."

Washington, Ia.—The Electrical Equipment Co., of Chicago, Ill., is stated to have secured the contract for constructing a municipal electric light plant, at $12,510.

Johnstown, Pa.—The City Council has granted franchises to the Consumers' Light, Heat & Power Co. and to the Citizens' Light, Heat & Power Co.

Williamsburg, Va.—A press report states that an electric plant will be erected at William and Mary College, to cost about $5,000.

Weiser, Idaho.—See "Water."

Depew, N. Y.—The Village Trus. are stated to have granted a franchise to the Depew & Lancaster Gas Co.

Lancaster, O.—It is stated that bids are wanted Sept. 18 for $40,000 bonds, the proceeds to be used to erect a natural gas pumping plant. M. T. Michling, City Clk.

Taylorville, Ill.—The Council is stated to have decided to construct an electric light plant, under the direction of Owen Ford, of St. Louis, Mo., at a cost of about $18,000.

ELECTRIC RAILWAYS.

St. Louis, Mo.—The Central Rapid Transit Co. is stated to have petitioned the Co. Comrs. at Clayton for a franchise to construct an electric railway on the Olive St. road between St. Louis and Creve Coeur Lake. John H. Blessing, Pres.

Salem, Ark.—The Salem & Eastern R. R. Co. has been incorporated, with a capital of $5,000, to construct an electric railway from Salem to a point on the Frisco R. R. Incorporators: R. A. Youngblood and H. F. Northcutt.

Toledo, O.—Jas. J. Robison, cashier of the Ohio Savings Bank & Trust Co., representing the Toledo, Angola & Western Ry. Co., is stated to have secured a franchise from the Co. Comrs.

Guthrie, Okla. Ter.—See "Power Plants, Gas and Electricity."

Santa Cruz, Cal.—Engr. D. M. Murphy is stated to have completed the survey for the Del Monte & Pacific Grove Electric Ry., and is now running a preliminary survey to Capitola from Santa Cruz.

Danville, Ill.—The Danville, Paxton & Wilmington Electric Ry. Co. is reported incorporated by J. W. Dale, of Danville, Chas. Bogardus and J. P. Middlecoff, of Paxton, and others.

Eddystone, Pa.—The Boro. Council is stated to have granted the Chester Traction Co. a right of way for a branch line from the Darby division over Eddystone Ave. to connect with the Southwestern cars. A. G. Jack, Supt., Chester.

Hamilton, O.—The Ohio & Indiana Ry. Co. is reported incorporated to construct a line from Hamilton to Richmond, Ind.

Aurelius, N. Y.—The Council is stated to have granted the Auburn City Ry. Co. a franchise to extend its line through Aurelius. D. A. Dyer, Jr., Supt., Auburn.

South Glens Falls, N. Y.—The Hudson Valley Ry. Co. is stated to have made a contract with Daniel H. Cowles to build the proposed South Glens Falls-Saratoga trolley line. The contract does not provide for the overhead work, which the company will do itself.

Volney, N. Y.—G. Adolphus Manz, of Syracuse, is stated to have petitioned the Highway Comrs. for a franchise to construct an electric railway from Volney to Fulton and Scriba.

Toledo, O.—The People's Rapid Transit Ry. Co., of Toledo, is reported interested in the construction of another interurban line to start at Toledo, running through Napoleon, Defiance, Paulding, Van Wert, Celina and Greenville. The road will connect at Greenville with the Dayton & Western.

York, Pa.—The York County Traction Co. is reported to have ordered surveys for two new routes, one extending from York to Wrightsville, the other from York to Hanover. J. F. Dusman, Mgr., York.

Wabash, Ind.—The City Council is stated to have granted a franchise to the Ft. Wayne & Southwestern Traction Co.

Philadelphia, Pa.—A permit is stated to have been granted by the Bd. of Highway Superv. to the Philadelphia Rapid Transit Co. to lay tracks for an extension of its lines in the southern section of the city

Herkimer, N. Y.—The Highway Comrs. are stated to have granted a franchise to the Utica & Mohawk Valley R. R. Co. to construct a line on the north side of the river between Little Falls and Herkimer. C. L. Allen, Gen. Mgr., Utica.

Canastota, N. Y.—The Village Trus. are stated to have granted a franchise to the New York & St. Louis Trolley Co. C. J. Parker, of Canastota, is reported interested.

Reading, Pa.—A press report states that plans are being prepared for an electric plant to be constructed by the Reading Ry. Co. at Kissinger's Dam, on the Schuylkill, in this city. Electricity will be generated by large turbine wheels.

Duquesne, Pa.—The Duquesne Traction Co. is reported incorporated, to construct a railway on the hill district in the residence section of the town and extend through a part of Mifflin Township to Lincoln Place. The promoters are Dan. G. Donovan and I. Lincoln Jones, of McKeesport, and John Crawford, of Duquesne.

North Yakima, Wash.—The Yakima Valley Central Ry. is reported incorporated, by J. F. McNaught, O. A. Fechter and others, to construct an electric railway from this city down the valley to Sunnyside and to connect other points with North Yakima.

Beaumont, Tex.—Harry K. Johnson, of Natchez, Miss., is about to petition for a franchise for a single track electric railway from Beaumont to Port Arthur, a distance of about 17 miles.

Woods Hole, Mass.—The Cape Cod St. Ry. Co. is reported to have been organized, with Walter O. Luscombe as Pres. and Geo. E. Dean, Secy. Work on the construction of the line will probably begin about Nov. 1.

St. Louis, Mo.—Two bills granting franchises for electric elevated street railways to run through the central, northern and southern portions of the city were introduced in City Council Aug. 29. One granting a franchise to the Park Elevated Ry. Co., the other to John R. Dwyer, 4936 Lindell Boule., and associates.

Springfield, Ill.—The Springfield & Central Illinois Ry. Co. has been incorporated, with a capital of $200,000, to construct a line from Springfield to Decatur; a southern branch from Springfield to Carlinville, and a western branch from Springfield to Jacksonville. Incorporators: St. John Boyle, Louisville, Ky.; and C. K. Minarty and David McKeown, Springfield.

Adrian, Mich.—Preliminary surveys are stated to have been completed by the Adrian, Jackson & Electric Ry. for a line between Adrian and Vandercook's Lake. The line will be about 37 miles in length.

Georgetown, Ill.—It is stated that the Terre Haute St. Ry. Co., of Terre Haute, Ind., is to build a line to Georgetown, Ill., to connect with the new interurban road from Danville. The distance from Terre Haute is 45 miles. The company is also stated to have secured a franchise to construct a line in Dana, Ill.

Richmond, Va.—See "Water."

Dallas, Tex.—The City Council has granted A. K. Bonta a franchise to construct an electric railway on N. Harwood St.

Rochester, N. Y.—The State R. R. Comrs. have granted the Rochester, Syracuse & Eastern R. R. Co. permission to construct its line. Clifford D. Beebe, Gen. Mgr., Syracuse, states that he length of proposed line will be about 91 miles, and the power plant will have a capacity of between 6,000 and 7,000 H.-P.

Elizabethtown, Ky.—S. Lambert, of White Mills, Ky., is reported interested in the construction of an electric railway from Elizabethtown to Millerstown.

Little Falls, N. Y.—The Highway Comrs. are stated to have granted a franchise to the Utica & Mohawk Valley R. R. Co. C. Loomis Allen, Gen. Mgr., Utica.

RAILROADS.

St. Louis, Mo.—M. W. Wambaugh, Ch. Engr. Missouri & Southeastern Const. Co., writes that the contract for grading, masonry and timber bridging on 32 miles of heavy work near St. Louis, has been awarded to McArthur Bros. Co., of Chicago, Ill.

Sligo, Mo.—The Sligo & Eastern Ry. Co. is reported incorporated, with a capital of $120,000, to construct a railroad from Sligo to Dillard.

Euclid, Pa.—A press report states that the Pittsburg, Bessemer & Lake Erie R. R. Co. has asked for bids for the construction of a coal road from the main line at Euclid to Pfaff's mines. The road will be about 18 miles long, and on it will be a 1,000-ft. tunnel. It will cost about $1,500,000. H. T. Porter, Ch. Engr., Pittsburg.

Ironton, Mo.—The Granite R. R. Co. has been incorporated, with a capital of $30,000, to construct a railroad 3 miles in length in Iron County. Incorporators: F. P. Ake, Ironton; A. J. Sheehan, Graniteville, and others.

Tuskegee, Ala.—It is stated that the Tuskegee R. R. Co. has been incorporated, with a capital of $75,000, to extend the short line connecting Chehaw and Tuskegee into the business district of Tuskegee. Incorporators: E. T. Varner, G. W. Campbell, and others, all of Tuskegee.

Washington, Pa.—A press report states that the Wabash R. R. Co. will construct a line through Washington. W. S. Lincoln, Ch. Engr., St. Louis, Mo.

Connellsville, Pa.—A charter has been granted to the Connellsville Central R. R. Co., with a capital of $120,000, to construct 12 miles of railroad in the new Klondike coke region of Southwestern Fayette County. Incorporators: Herbert Depuy and John H. Hillman, of Pittsburg, and others.

Blue Ridge, Ga.—Marrill Skinner of Blue Ridge; W. V. Brownlee, Mineral Bluff; W. D. Smith, of Morgantown, and others, are reported to have petitioned for a charter for a railroad to run through North Georgia, Tennessee and South Carolina under the title of the Tennessee, Georgia & South Carolina R. R. Co.

Franklin, N. C.—The Carolina & Tennessee Southern Ry. Co. has been incorporated, with a capital of $300,000, to construct a railroad from Franklin, along the valley of the Little Tennessee River, through Macon, Graham and Swain Counties to the Tennessee line near where it is crossed by the Little Tennessee River. This is a movement by the Southern Ry. to complete a through line from Knoxville, Tenn., to Charleston and Savannah. A road is now building from Toccoa, Ga., to Franklin and another from Mayesville, Tenn., to the North Carolina line. These, with the road proposed by the new company, completes connections for Knoxville, Charleston and Savannah. Col. A. B. Andrews, W. W. Finley and F. H. Busbee are among the directors.

Baton Rouge, La.—Benj. R. Meyer, R. A. Hart, and others, are reported interested in the construction of a railroad from Baton Rouge to Opelousas and thence to Texas.

Columbus, Ga.—It is stated that the Columbus, Eufaula & Gulf Ry. will extend from Columbus to St. Andrews Bay, Fla. The new road will be 190 miles in length.

Toronto, Ont.—Bids will be received until Sept. 27 by P. E. Ryan, Secy.-Treas. of the Temiskaming & Northern Ontario Ry. Comn., for constructing the Temiskaming & Northern Ontario Ry. (Ontario Government Ry.), including clearing right of way, bridging, grading, ballasting and track laying, from North Bay to a point on Lake Temiskaming, a distance of about 110 miles. Information may be obtained at the office of the Chief Engr, North Bay.

Guthrie, Okla. Ter.—A charter has been granted to the Guthrie, Shawnee & Coalgate R. R., with a capital of $100,000, to build a line from Guthrie westward to Beaver, a distance of 150 miles. Ex-Gov. Barnes is reported to be one of the incorporators.

Hayfield, Minn.—The Chicago Great Western R. R. Co. is reported to be making surveys for a line to be constructed from Hayfield to Judge, Minn. Saml. C. Stickney, Gen. Mgr., St. Paul.

Bellavista, Cal.—A press report states that the Terry R. R. Co. will be extended from Bellavista, its present terminus, to Fall River Mills, a distance of 53 miles.

Eau Claire, Wis.—Notice is stated to have been filed with the Secy. of State by the Eau Claire, Chippewa Falls & Northern Ry. Co. of the adoption of a route for the extension of the line from Little Falls 40 miles to an intersection with the Wisconsin Central.

Laurel, Miss.—The Mobile, Jackson & Kansas City R. R. Co. is stated to have secured a right of way through Laurel. F. B. Merrill, Gen. Mgr., Mobile, Ala.

PUBLIC BUILDINGS.

Henderson, Ky.—Bids are wanted Sept. 9 for furnishing material and erecting a city hall at First and Elm Sts. Paul M. Barnett, City Clk.

Pueblo, Colo.—Bids will be received at the office of Bishop & Gile, Archts., 217 and 218 Central Blk., until Sept. 15 for constructing and completing the following portions of McClelland Library: All masonry work, including excavating and filling, all concrete work, cut stone, structural and ornamental iron work, sheet metal work, tile roofing, etc. A. McClelland, Chmn. Special Bldg. Com.

Brooklyn, N. Y.—Bids are wanted Sept. 24 (extension of date) for furnishing material and making changes and additions to the Kings Co. Hall of Records, and furnishing fixtures, furnishings and appointments therefor. J. Edw. Swanstrom, Boro. Pres.

National Military Home, Ind.—Bids will be received until Sept. 22 at the office of John Q. Adams, Treas., for erecting the necessary buildings and installing a heating system at the Marion Branch, N. H. D. V. S. Justin H. Chapman, Governor.

New York, N. Y.—Bids will be received by Thos. Sturgis, Fire Comr., until Sept. 12, for erecting an engine house at 105 and 107 W. 102d St.

West Boylston, Mass.—The citizens are stated to have voted to erect a town hall, to cost $15,000, and a school to cost $20,000.

Ada, Minn.—The contract for building the new Norman Co. Court House is stated to have been awarded to Olaf Swenson of St. Paul. The Pond & Hasey Co., of Minneapolis, secured the contract for the heating plant; total cost, $60,000.

Grand Forks, N. D.—It is stated that Warren H. Milner, Stock Exchange Bldg., Chicago, Ill., will prepare plans for a $20,000 library. F. G. Wilder, Secy.

Niagara Falls, N. Y.—Geo. B. Long, Prudential Bldg., Buffalo, is stated to have secured the contract for erecting the Carnegie Library, for $36,697.

Boulder, Colo.—T. H. Browning, of Boulder, has secured the contract for erecting a library for $62,000. Architect, G. W. Roe, Pueblo.

New York, N. Y.—Plans have been filed for a 1-story stone church, to be erected on 180th St. and Vyse Ave. for the First Presbyterian Church, of West Farms, to cost $90,000. Architects, Barney & Chapman, 44 W. 34th St.

San Francisco, Cal.—The Hospital Com. of the Superv. is stated to have decided to prepare plans for the proposed new hospital, using the plans of Martens & Coffey, 819 Market St., as a model.

Marshalltown, Ia.—The contract for erecting the St. Thomas Hospital is stated to have been awarded to P. J. McCavick, of Marshalltown, and A. B. Itoblason, of Dubuque; cost, $30,000.

Iroquois, N. Y.—Bids will be received until Sept. 9 by Henry R. Howland, Pres. Bd. Mgrs., Iroquois, for constructing, heating, plumbing and electric wiring a dormitory and for the construction and plumbing of a laundry building and a power house, including the chimney stack, at the Thomas Asylum for Orphans and Destitute Indian Children, at Iroquois.

Winchester, Ind.—Local press reports state that bids will be received by W. H. Gettinger, Archt., Union City, Ind., until Sept. 17 for erecting a brick and stone building in this city, at a probable cost of $20,000.

Salina, Kan.—C. G. Wilmarth, of Salina, is stated to have secured the contract for erecting the Carnegie Library, for $15,000.

Grand Forks, N. D.—Bids are wanted Sept. 13 for erecting a brick and stone public library. F. W. Wilder, Pres. Library Bd.

Lebanon, Ind.—Shetterly & Hagerman, of Winchester, are stated to have secured the contract for erecting the Christian Church, for $17,337.

Vineland, N. J.—W. E. Allen, of Vineland, is stated to have secured the contract for erecting the new Home for Feeble Minded Women, for about $72,000.

Trenton, N. J.—Lewis H. Lawton & Son, 432 Hamilton Ave., are stated to have secured the contract for erecting the Senate Chamber, for $124,450.

Dallas, Tex.—The citizens are stated to have voted, Aug. 26, to issue $50,000 bonds for the purpose of erecting and maintaining fire and police stations.

Springfield, O.—It is stated that the congregation of the High St. M. E. Church will erect a $35,000 edifice.

Lenox, Mass.—The plans of Architect Weeks, of Pittsfield, are stated to have been accepted for a town hall.

Munhall, Pa.—Rieger & Currier are stated to be preparing plans for a borough hall to cost $35,000.

Marinette, Wis.—The plans of Ferry & Clas, of Milwaukee, are stated to have been accepted for an armory for Co. I, to cost $15,000.

Nashville, Tenn.—It is stated that bids are wanted Sept. 18 for erecting a Carnegie Library. Wm. L. Dudley, Clk. Bldg. Com.

Sheboygan, Wis.—It is stated that bids are wanted Sept. 10 for erecting a public library. Address, Francis Williams, Library Bd.

Oskaloosa, Ia.—It is stated that bids are wanted Sept. 18 for erecting a library, according to plans prepared by Frank E. Wetherell, of this city.

Mason, Mich.—Geo. Rickman's Sons, of Kalamazoo, are stated to have secured the contract for erecting the Ingham Co. Court House, for $39,879.

Newark, N. J.—Separate bids will be received until Sept. 24 by the Comrs. for the Erection of a New City Hall, for installing a ventilating and heating system, electrical equipment and telephone tubing, passenger elevators and ash lift. Andrew Kirkpatrick, Chmn. Jas. M. Seymour, Jr., Consulting Engr., 43 Lawrence St.

BUSINESS BUILDINGS.

Lebanon, Pa.—Isaac Mann & Son, and Isaac Wolf, dealers in ready-made clothing, intend to erect in the near future large and extensive department store buildings.

Frankfort, Ky.—It is stated that the Louisville & Nashville R. R. (R. Montfort, Ch. Engr., Louisville), and the Frankfort & Cincinnati R. R. (Geo. B. Harper, Gen. Supt., Frankfort), will erect jointly a freight depot at Frankfort, to cost about $25,000.

Atlanta, Ga.—Local press reports state that bids will be opened by the Georgia Ry. & Electric Co. Sept. 10 for erecting a $50,000 addition to the car barn on Edgewood Ave.

Elyria, O.—The lowest bid received for erecting the Elyria tube mill for the Columbia Steel Co. is stated to have been submitted by Fred Wolf, of Elyria, for about $50,000.

Flint, Mich.—Clark & Munger, of Bay City, are reported to have prepared plans for a hotel to be erected at S. Saginaw & W. 3d Sts., by a local hotel company.

New Britain, Conn.—A press report states that the Connecticut Ry. & Lighting Co. is soon to erect a 1-story brick building at New Britain, with a steel truss roof; also a building in Waterbury; and at Shelton an entire new plant is to be built. In all the work will cost about $200,000. J. E. Sewell, Gen. Mgr., Bridgeport.

Schenectady, N. Y.—It is reported that J. S. Juno will erect a $40,000 store and business building.

Baltimore, Md.—Bids will be received by the C. M. Kemp Mfg. Co., Guilford Ave. and Oliver St., for erecting a factory.

Norwood, O.—The Bd. of Dirs. of the First Natl. Bank are reported to be considering the erection of a 3-story brick and stone office building.

Kansas City, Mo.—It is stated that J. A. Rose will erect a 7-story fireproof office building on Grand Ave. and 8th St., to cost about $125,000.

Cornwall, Ont.—Bids will be received by the Cornwall Furniture Co., Ltd., until Sept. 9 for erecting a 3-story brick factory in Cornwall.

Milwaukee, Wis.—C. D. Crane, 91 Wisconsin St., is stated to have completed plans for a factory building to be erected by the American Candy Co. on Chicago St. and Bway., to cost about $65,000.

Millers Falls, Mass.—D. O'Connell & Sons, of Holyoke, have secured the contract for erecting a paper mill at Millers Falls, for about $75,000.

New Orleans, La.—Stone Bros., 1104 Hennen Bldg., are stated to have completed plans for a 5-story building on Baronne and St. Joseph Sts. to cost $110,000. It will be occupied by the Ahrens & Ott Mfg. Co.

Chicago, Ill.—Louis H. Sullivan, 1600 Auditorium Tower, is stated to have prepared plans for a 13-story building to be erected on State and Madison Sts. to cost about $800,000.

The Monarch Refrigerating Co. is stated to have decided to erect a 7-story addition at Michigan and Rush Sts., to cost about $75,000.

Iver C. Zarbell, 97 Clark St., is stated to have prepared plans for a 7-story business building to be erected on Jackson Boule. and Jefferson St. for Mrs. A. Farrer, to cost about $80,000.

Cincinnati, O.—Local papers state that the Commercial Tribune Bldg. Co., of which Jos. C. Butler is Gen. Mgr., will erect a bank building 2½ stories, of white marble, to cost about $300,000.

New Orleans, La.—Thos. Sully, 1103 Hennen Bldg., is stated to have completed plans for the Harding Bldg., to be erected on Common and Carondelet Sts., to cost about $125,000. Owners, The Morris Land & Improv. Co.

Duluth, Minn.—Pearson & Fawcett, of Duluth, are stated to have secured the contract for erecting the Metropolitan Opera House on 6th Ave. and Superior St., for about $85,000. Architect, J. J. Wagenstein, Providence Bldg.

Sault Ste. Marie, Mich.—Bids will be received by C. W. Chance, Ch. Engr., 44 McTavish Bldg., until Sept. 10 for erecting 2 car barns, each 65x150-ft. side walls, masonry, steel roof trusses. Roof trusses furnished by company.

Cleveland, O.—M. M. Gleichman is stated to have prepared plans for the Colonial Theater to be erected on Prospect St. It will have a seating capacity of 2,500.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Water St and Rutgers Pl, br workshop; c, $60,000; o, Morris S. Rachmil; a, Max Muller.

129 and 131 5th Ave, br and stone store and lofts; c, $90,000; o, estate Jas A Roosevelt; a, Israels & Harder; b, R H Macdonald & Co.

77th St & Columbus Ave, br hotel; c, $600,000; o, West Side Const Co; a, G F Pelham.

East Bay Ave, from Cabot St to Dupont St and East River, frame factory; c, $31,500; o, Rock Plaster Co; a, Darling & Goldthwait.

DWELLINGS.

Kansas City, Mo.—Albert Turney, 615 Mass. Bldg., is the architect for a $60,000 stone dwelling, to be built for L. E. H. Thompson, at Kenwood Ave. and Armour Boulevard.

Shepard & Farrah, 507 Commerce Bldg., have prepared plans for a $12,000 stone dwelling, to be built at Valentine Road and Madison Ave.

Chicago, Ill.—Andrew Sandegren, 185 Dearborn St., is stated to have prepared plans for an apartment house to be erected on 48th St. and Greenwood Ave. for Brice Worley to cost $75,000.

Salt Lake City, Utah.—J. A. Headlund & Co., Dooley Bldg., are stated to have completed plans for a 3-story apartment house, to be erected by E. M. Miller, on N. Temple and Main Sts., to cost $20,000.

Middletown, N. Y.—Mitchell & Stever, of Binghamton, are stated to have secured the contract for erecting a granite residence for Webb Harton, for $250,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

149 and 151 E 55th St, br and stone tenements; c, $40,000; o, Benj Gabriliowitz; a, Bernstein & Bernstein.

Madison Ave & 37th St, br dwellg; c, $325,000; o, Capt J R De Lemar; a, C P H Gilbert.

3d Ave & 174th St, br tenemt; c, $50,000; o, Rachael Cassel; a, Moore & Landsiedel.

Palisade Ave and 254th St, 3-sty extension; c, $23,000; o, Geo D Eldridge; a, Wilson & Visscher.

SCHOOLS.

Rapid City, S. D.—Bids will be received until Sept. 19 by the School Bd. of Independent Dist. No. 27, for erecting a school in said Dist.

High Springs, Fla.—Bids will be received by Dr. B. C. Hodges, until Sept. 15, for erecting a brick school.

New York, N. Y.—Bids will be received by the Dept. of Educ. until Sept. 15 (readvertisement) for erecting school No. 65, Boro. of Bronx, and for installing electric elevators in the Wadleigh High School, Boro. of Manhattan. Bids will also be received at the same time for erecting School No. 110, Boro. of Manhattan. C. B. J. Snyder, Supt. of School Bldgs.

Long Island City, N. Y.—Bids will be received until Sept. 15 by the Dept. of Educ., N. Y. City, for completing the erection of School No. 5, Boro. of Queens. C. B. J. Snyder, Supt. of School Bldgs., N. Y. City.

Oconto Falls, Wis.—The contract for erecting the new high school is stated to have been awarded to Geo. E. Smith, of Kaukauna, and for heating same to Matson Bros., Marinette; total cost, about $17,000.

Tabor, S. D.—It is reported that the Catholic Society will erect a $30,000 school.

La Junta, Colo.—Bids will be received by Robt. W. Patterson, Secy. School Bd., until Sept. 20 for erecting an addition to School No. 1 in Dist. No. 11.

Columbus, O.—Bids will be received by the Bd. of Trus. of the Ohio State Univ., Columbus, until Sept. 26, for erecting an addition to the Chemical Building and for erecting a Veterinary Building. Alexis Cope, Secy.

Willimantic, Conn.—Bids will be received until Sept. 9 by the State Bd. of Educ., Rm. 42, Capitol, Hartford, for erecting an addition to the State Normal School at Willimantic. Wm. H. Palmer, Jr., Chmn. Com.; Hartwell, Richardson & Driver, Archts., 62 Devonshire St., Boston, Mass.

Newark, N. J.—Chas. P. Baldwin, 736 Broad St., is stated to have been selected to prepare plans for a school in the 8th Ward; cost, $32,000.

Fond du Lac, Wis.—The Council is stated to have passed an ordinance for the issue of $25,000 bonds for the erection of a school.

Tifton, Ga.—It is stated that plans have been adopted for a $18,000 school.

West Boylston, Mass.—See "Public Buildings."

Washington, D. C.—Bids will be received by the Comrs. D. C. until Sept. 15 for erecting an 8-room school at 9th and D Sts. and an 8-room school on Pierce St. Wm. Tindall, Secy.

Columbia, Mo.—The Urbauer Atwood Htg. Co., of St. Louis, is stated to have secured the contract for heating the new University for $18,750.

Marlin, Tex.—Bids are wanted Sept. 11 for erecting a brick high school. Wm. Shelton, Mayor.

Buffalo, N. Y.—F. G. Ward, Comr. Pub. Wks., writes that Barnd & Geiger, 11 E. Mohawk St., have secured the contract for ventilating and heating Lafayette High School, for $41,074.

Orange, N. J.—Contracts for erecting the school at Tremont and Lincoln Aves. are stated to have been awarded as follows: Mason work, Brennan & Finnegan, $13,950; carpenter work, Wm. G. Sharwell, $11,239; plumbing, Finneran & Merrigan, $2,925, and ventilating and heating, N. S. Kellogg, $4,087.

Buffalo, N. Y.—Bids are wanted Sept. 17 for erecting an 8-room addition to Schools Nos. 26 and 53, including masonry, ventilating, heating, plumbing, gas fitting, etc. Francis G. Ward, Comr. of Pub. Wks.

Pontiac, Mich.—At the annual meeting of the Pontiac Union School Dist., Sept 1, it was voted to issue $25,000 bonds for the erection of a school in the western part of the city.

STREET CLEANING AND GARBAGE DISPOSAL.

Trenton, N. J.—Rudolph Hering, of New York, N. Y., in his report to the garbage crematory investigating committee of Common Council, is stated to have recommended improving the burning capacity of the furnace and the increase in the number of furnaces.

Oakland, Cal.—Wm. H. Friend is stated to have petitioned the Council for a franchise for a garbage crematory.

Topeka, Kan.—T. J. Anderson, Secy. of the Commercial Club, is reported to be negotiating with Lewis H. Schneider, a representative of the U. S. Garbage Reduction Co., for the location of a garbage plant in Topeka.

Reading, Pa.—Bids were opened Aug. 25 for the disposal and collection of garbage as follows: James O'Rourke, holder of present contract, burying process, $3 per ton 1 yr., $2.85 per ton 3 yrs., $2.75 5 yrs.; Chas. C. Fisher, Arnold & Edgerton system, $2.24 per ton 5 yrs., burying process $1.67 per ton any term of yrs.; Dixon Garbage Crematory Co., Toledo, O., $29,500 per yr. for 5 yrs., payable monthly, selling plant at end of period for $33,000, or on completion for $31,000; I. J. Lerch, $3 per ton 1 yr., $2.90 3 yrs., $2.75 5 yrs.; John R. Lank, Phila., reduction process, $2.98 per ton 1 yr., $2.80 3 yds., $2.60 5 yrs.; Decarie Mfg. Co., Minneapolis, $2.40 per ton for 5 yrs.

GOVERNMENT WORK.

Tampa, Fla.—Bids will be received at the U. S. Engr.'s Office, Tampa, until Oct. 16 for building and equipping a steel hull, stern wheel, combined dredge and snagboat, as advertised in The Engineering Record.

Boston, Mass.—Bids will be received at the U. S. Engr.'s Office, Boston, until Sept. 30 for dredging at the entrance channel to Lynn Harbor and in the Mystic River, Mass., as advertised in The Engineering Record.

Yellowstone Park, Wyo.—Bids will be received at the U. S. Engr.'s Office, Yellowstone Park, until Oct. 15 for furnishing steel for 30 highway bridges in Yellowstone National Park, as advertised in The Engineering Record.

New Orleans, La.—Bids will be received until Sept. 22 at the U. S. Engr.'s Office, New Orleans, for dredging at Tchefuncta and Amite Rivers, La.

Cleveland, O.—Bids are wanted Sept. 26 for improving Port Clinton Harbor, Ohio, by dredging. Bids are also wanted Sept. 18 for reconstructing and repairing parts of the east and west piers at Fairport Harbor, O. Maj. Dan C. Kingman, Corps Engrs., U. S. A.

Savannah, Ga.—Bids are wanted Sept. 27 for repairing and adding to Mackay's Point training wall, Savannah Harbor, Ga. Capt. Cassius E. Gillette, Corps Engrs., U. S. A.

Louisville, Ky.—Bids are wanted Sept. 29 for steam boilers. Maj. E. H. Ruffner, Corps Engrs., U. S. A.

Memphis, Tenn.—In addition to awards mentioned in this column Aug. 30, for levee work in charge of Capt. E. E. Winslow, Corps of Engrs., U. S. A., Bodkin & Liston, Luxora, Ark., have been awarded the contract for 180,000 cu. yds. levee work in St. Francis district at 14 cts., and Shutt Improvement Co., St. Louis, Mo., 500,000 cu. yds., same district, at 15 cts.

Washington, D. C.—Bids were opened Aug. 28 at Treasury Dept. for safety vaults in Bureau of Engraving & Printing as follows: York Safe & Lock Co., York, Pa., $48,935; L. H. Miller Safe & Iron Co., Baltimore, $38,829.

Erie, Pa.—The government contract for dredging and pier construction at Erie is stated to have been awarded to the Buffalo Dredging Co., Buffalo, N. Y., for $147,000.

Ft. Myer, Va.—Rosser & Castoe, of Bellaire, O., have secured the contract for constructing the steel tank and trestle here for $5,700.

Johnson City, Tenn.—The lowest bidders for various work for the National Home for Disabled Volunteer Soldiers, according to bids opened Sept. 2 by the Bd. of Mgrs., New York Life Bldg., N. Y. City, are as follows: Parrish & Unkefer, Johnson City, general steam distribution, $31,138; sewerage system, $18,131; electric distribution, $19,400; storehouse, $66,000; laundry, $32,400; morgue, $6,725; Gleaves & Co., Lynchburg, Va., general water supply, $18,776; H. Probst, N. Y. City, mess hall and kitchen, $102,850. Contracts have been awarded to Parrish & Unkefer and to Gleaves & Co., for the work for which they were lowest bidders, as stated.

New York, N. Y.—The following bids were opened Sept. 3 by Maj. W. L. Marshall, Corps of Engrs., U. S. A., for dredging *a* in Buttermilk Channel, *b* in Gowanus Creek; prices per cu. yd.: W. H. Beard Dredging Co., 10 Bridge St., *a* 45 cts., *b* 24 cts.; Morris & Cumings Dredging Co., 17 State St., *a* 34.7 cts., *b* 24.7 cts.; R. G. Packard Co., 132 Pearl St., *a* 39 cts., *b* 32 cts.; G. H. Breymann & Bros., Toledo, O., *a* 40 cts., *b* 29 cts.; E. R. Seward, 1027 Macy Place, *b* 21.5 cts.; International Contracting Co., 95 Broad St., *a* 36.5 cts., *b* 30.4 cts.

Philadelphia, Pa.—The following bids are reported Aug. 28 by Maj. Frank Heath, Ord. Dept., for buildings at Frankford arsenal: Geo. W. Pierson, Lippincott Bldg., $61,176; Cramp & Co., $64,800; Penn Erecting Co., $66,739; Lewis Havens' Sons, $65,484; Hiram A. Miller & Son, $71,302; John H. Jordan, $82,222.

Washington, D. C.—Bids are wanted Oct. 1 for erecting a building; erecting a central power and heating plant, electric power plant, power house, chimney and tunnels for the Government Hospital for the Insane at S. Washington, as advertised in The Engineering Record.

New York, N. Y.—Bids are wanted Oct. 6 for building a riprap breakwater at Sag Harbor, N. Y., as advertised in The Engineering Record.

Ft. Keogh, Mont.—Bids are wanted Sept. 22 for constructing a sewer system at this post. Geo. E. Pond, Q. M., St. Paul, Minn.

Joplin, Mo.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Oct. 7 for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Joplin, as advertised in The Engineering Record.

Lockport, N. Y.—The following bids were opened Sept. 4 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Lockport, N. Y.: The Neiderpruem, Gibbs & Schaaf Co., Buffalo, $92,790; J. R. Churchyard, Buffalo, $84,984; Tirrell & Wagner, Newark, N. J., $73,263; E. H. Denniston Co., Syracuse, $68,900; Rummel & Carter, Buffalo, $108,294; Congress Const. Co., Chicago, $83,974; W. H. Egerton, Rochester, $80,545.

Ft. Riley, Kan.—The following are reported the lowest bidders for constructing buildings at this post, for which bids were opened Aug. 25 by Constructing Q. M. Capt. G. O. Cress: J. B. Betts, Topeka, cavalry barracks, $59,874; cavalry stable, $18,600; artillery stable, $21,600; gun shed, $21,200; non-com. officers' quarters, $17,944; bakery, $15,900; Holmgren & Moses, Junction City Kan., artillery barracks, $44,850; Zeigler & Dalton, Junction City, field officers' quarters, $32,955; line officers' quarters, $39,800.

MISCELLANEOUS.

Great Falls, Mont.—City Engr. C. W. Swearingen writes that a subway at 1st or 2d Aves., N., under the G. N. Ry. tracks, is contemplated. Approximate cost, $30,000.

Ogdensburg, N. Y.—The Daly & Hannan Dredging Co., Ogdensburg, is stated to have secured the contract for dredging a channel through the large shoal at the head of the Massena Canal in the St. Lawrence River, so as to afford a greater flow of water into the canal; contract reported to amount to about $60,000.

Boston, Mass.—The City Engineering Dept. is stated to have prepared plans and estimate of cost of tunnelling under Bunker Hill, on a central line of Sullivan and Cook Sts. The engineers estimate that the cost of the proposed tunnel would be about $300,000. According to the plans the tunnel would be 24 ft. between the walls, the roadbed would be 18 ft. and the highest point of the tunnel would be 18.5 ft. The entire length of the tunnel from the entrance to the exit would be 1,740 ft.

Cohoes, N. Y.—A press report states that the Troy Hydraulic Co. has prepared an estimate of the cost of constructing new docks to the tidewater line of the new channel of the river now being dug, including the expense of constructing tail races from the several mills along the canal. The estimated cost will be $90,690.

Pointe-a-la-Hache, La.—Bids will be received until Oct. 1 by the Bd. of Comrs., Pisquemines Parish East Bank Levee Dist., for building about 33 miles of Gulf Coast Levee, containing about 1,350,000 cu. yds. of earth work. Aaron Davis, Pres. For further information apply to the State Bd. of Engrs., New Orleans Cotton Exchange Bldg., New Orleans, La.

Cleveland, O.—Bids will be received by the Co. Comrs. until Sept. 20 for excavating a proposed channel for Euclid Creek. Julius C. Dorn, Co. Clk.; Wm. H. Evers, Co. Engr.

Monroe, La.—The following bids were opened Aug. 28 by the Bd. of Comrs. Tensas Basin Levee Dist., New Orleans, for 200,000 cu. yds. approx. Fulton Lake Levee, Desha Co., Ark.; M. L. Linnan, Semmsport, La., 38¼ cts. per cu. yd.; Lewis & Jennings, Memphis, Tenn., awarded contract, 34½ cts.; Gilchrist Bros., 37½ cts.; M. J. Roach, Memphis, Tenn., 40 cts.

Eaton, Colo.—John A. Banning is reported to have the contract for constructing a supply ditch in connection with a reservoir for the Cache la Poudre Reservoir Co.; solid rock at 99 cts. per cu. yd.; loose rock at 34 cts. per cu. yd., and earth 12¼ cts. Estimated cost, $200,000.

Donaldsonville, La.—The Mississippi & Lafourche Drainage District Comn. is stated to have adopted a resolution which will be submitted to the people, authorizing the issuance of $100,000 bonds.

East Liverpool, O.—A press report states that C. A. Smith, of E. Liverpool, owner of the Rocks Spring pleasure resort, will build a dam costing between $5,000 and $6,000 for the purpose of forming a lake at that resort.

Dowagiac, Mich.—J. W. Pearl, of Benton Harbor, is stated to have secured the contract for straightening the Dowagiac River a distance of 12½ miles, for $11,100.

Pittsburg, Pa.—Bids are wanted Sept. 10 for furnishing a 60-H.-P. tubular boiler. W. E. Thompson, Co. Compt.

Richmond, Va.—Bids are wanted Sept. 10 for dredging and removing sand, mud and mixed gravel (occasionally loose boulders) from the Harbor of Richmond. W. E. Cutshaw, City Engr.

Portland, Ore.—It is stated that the time for receiving bids for machinery for the proposed dry dock has been extended from Sept. 25 to Oct. 9. E. T. C. Stevens, Clk. Port Comrs.

NEW INDUSTRIAL PLANTS.

H. H. Franklin Mfg. Co., Syracuse, N. Y., has let contracts for a 5-story, 110x53-ft. factory and a 30x40-ft. power house. Contracts for generators and electrical equipment are to be let. It is expected to install the fan system of heating and ventilating.

The Baltimore & Ohio R. R. Co. will erect the following buildings at New Castle Junction, Pa.: A 22-stall round house; 35x50-ft. office building; 60x85-ft. machine shop; 25x60-ft. blacksmith shop; 20x60-ft. engine room; 35x60-ft. boiler room; 30x65-ft. storehouse, and 30x35½-ft. oil storage. The capacity of the power plant for electric lighting, heating and shop purposes will be 500 H.-P.

The Horseshoe Mining Co., Deadwood, S. Dak., has let contracts to the Allis-Chalmers Co. for machinery for a 500-ton cyanide mill. Contracts for tanks and other material will soon be let.

The National Pottery Co., Evansville, Ind., will erect a building 400 ft. long with an average width of 107 ft. and having 60,000 sq. ft. floor space. The power plant will consist of a 75-H.-P. engine and two 80-H.-P. water-tube boilers. A. M. Weil, Pres.

The James E. Thomas Co., Newark, O., will erect a 300x110-ft. foundry building and install a 250-H.-P. boiler, two 125-H.-P. engines and generators, five electric traveling cranes, motors for blowers, etc.

McLaren & Co., Chippewa Falls, Wis., have let a contract for building a 4-story, 44x160-ft. shoe factory to be run by water power.

The American Condensed Milk Co., Indianapolis, Ind., will erect a 2-story, 110x200-ft. building at Effingham, Ill. Four 100-H.-P. high-pressure boilers and an electric plant, including a 100-H.-P. engine, will be installed. A tin can plant will also be erected. J. V. Dittemore, Secy. & Mgr.

Frank Geyer, Hightstown, N. J., is interested in the erection of a 3-story, 250x50-ft. woolen mill. Arrangements for the power plant have been made, but the advisability of installing an additional 50-H.-P. boiler is being considered. Contracts for electric light plant, shafting, hangers, belting, pulleys, dyehouse outfit and interior telephone have not been let. Information concerning oil-burning apparatus for boilers is desired.

The Buffalo, N. Y., Weaving Co. is erecting a 2-story, 41x150-ft. addition to its plant. Electric power of 100 to 150 H.-P., furnished by the Niagara Falls Power Co., will probably be used.

H. C. Hubbell & Co., Somerset, Ky., are in the market for a second-hand high-speed engine to develop 125 H.-P. at 90 lbs. steam, two 100-Kw. monocyclic generators in good condition, fifty 1,200-c.-p. inclosed alternating-current arc lamps, 6 miles of No. 6 wire and 2 miles of No. 4 wire.

The Buffalo Foundry Co., Perry & Mississippi Sts., Buffalo, N. Y., has recently decided to increase its capital stock from \$10,000 to \$300,000 and will build a large jobbing plant, which will consist of a 320x145-ft. foundry of steel, equipped with two 30-ton and four 10-ton electric traveling cranes, six 5-ton and six 2-ton jib cranes, 102, 84 and 66-in. shell cupolas, 15-ton air furnace and air plant; a 3-story, 50x200-ft. pattern making and storage building, and a 30x320-ft. supply building. The plant will be so arranged that a 145x400-ft. open-hearth steel department and machine shops can be added when necessary. Electric power from Niagara Falls will be used.

The Lane & Bodley Co., Cincinnati, O., is planning a foundry for its Corliss engine business and jobbing. The foundry will be 120-ft. wide and of indefinite length, the land owned by the company admitting of its extension for about 1,000 ft.

The Lumbermen's Tool Co., Ltd., 422 Widdicomb Bldg., Grand Rapids, Mich., will erect a plant at South Boardman, Mich., and is in the market for boilers and engine of about 100 H.-P., lathe, planer, drill press, shears, etc. Geo. S. Burleson, Cedar Springs, Mich., manager.

The Marietta, O., Paint & Color Co. is building a 30x50-ft. working room and other additions to bring the floor space up to 2,000 sq. ft. A 20-H.-P. engine, with 3-inch line shafting, will be installed.

BUSINESS NOTES.

The Pittsburg Plate Glass Co. has let a contract to the Wm. B. Scaife & Sons Co., Pittsburg, for a 2,500-H.-P. We-Fu-Go water softening and purifying system to be erected at their Elwood, Ind., plant, which will treat well water containing large quantities of scale-forming and corroding substances, for use in the boiler plant. Other recent contracts include the following: Union Steel Co., Donora, Pa., 500,000 gals.; Penna. Salt Mfg. Co., Wyandotte, Mich., 150,000 gals.; The Ogemaw Co., North Bay City, Mich., 1,500 H.-P.; West Branch, Mich., 500 H.-P.; The Lancaster Mfg. Co., Clinton, Mass., 1,000,000 gals.; The Gibson Mfg. Co. Concord, N. C., 100,000 gals. J. Howard Ewald, 83 Laclede Bldg., St. Louis, has been appointed agent of the Scaife and We-Fu-Go systems for Southern Illinois, Missouri and Texas.

The Empire Iron & Steel Co., Niles, O., will begin operations Oct. 1, its product being iron and sheet steel and angles for light structural work. The output of iron and steel angles will be 100 tons daily. The galvanizing plant will be in operation about Jan. 1. The officers of the company are: Pres. & Treas., Wade A. Taylor; Vice-Pres. & Mgr., Chas. S. Thomas; Secy., J. F. O'Dea.

The United Steel Co., Canton, O., has placed an order for four 250-H.-P. water-tube boilers with the Pittsburg Gage & Supply Co., Pittsburg. Other recent contracts include power transmitting machinery for the Maryland Paper Co. and a rope transmission for the State Institution for Feeble Minded, Polk, Pa.

Thos. Potter, Sons & Co., Philadelphia, manufacturers of oil-cloth and linoleum, have adopted electric power distribution for the operation of printing machines, blowers used for drying oil-cloth, elevators and other general work throughout the plant. They have recently purchased from the Westinghouse Electric & Mfg. Co. six induction motors, to be operated from two-phase, 220-volt alternators.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Sept. 9. Houma, La. .... Aug. 9
Adv., Eng. Record, Aug. 23.
Sept. 10. Aiken, S. C. .... Aug. 30
Sept. 10. Reservoir dike, Paterson, N. J. .... Aug. 23
Adv., Eng. Record, Aug. 23 to Sept. 6.
Sept. 11. Baldwins, L. I., N. Y. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 11. Navajo Agency, New Mex. .... Aug. 23
Sept. 12. Blairsville, Pa. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Sept. 12. Grinnell, Ia. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Sept. 12. Philadelphia, Pa. .... Aug. 30
Sept. 15. Golden, Colo. .... Sept. 6
Sept. 15. Fairmont, W. Va. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 15. South Atlantic, N. J. .... Aug. 30
Sept. 16. Biloxi, Miss. .... Sept. 6
Sept. 16. Pierce, Neb. .... Sept. 6
Sept. 16. W. Alexandria, O. .... Sept. 6
Sept. 16. Kirkwood, Mo. .... Sept. 6
Sept. 17. Eden Valley, Minn. .... Sept. 6
Sept. 17. Edmonton, Alberta, N. W. T. .... Sept. 6
Sept. 17. Graham, Va. .... Aug. 30
Sept. 18. New York, N. Y. .... Aug. 30
Sept. 23. Philadelphia, Pa. .... Sept. 6
Oct. 3. Weiser, Idaho .... Sept. 6
Oct. 22. El Paso, Tex. .... Sept. 6
Dec 1. Pumps, Seguin, Tex. .... July 26
——— Bozeman, Mont. .... Sept. 6

SEWERAGE AND SEWAGE DISPOSAL.

Sept. 9. Allegheny, Pa. .... Sept. 6
Sept. 9. Trenton, N. J. .... Sept. 6
Sept. 9. Waterbury, Conn. .... Aug. 30
Sept. 9. New York, N. Y. .... Aug. 30
Sept. 9. Oshkosh, Wis. .... Aug. 23
Sept. 10. Portland, Me. .... Sept. 6
Sept. 10. Salem, O. .... Aug. 23
Sept. 10. Alliance, O. .... Aug. 23
Sept. 11. Iola, Kan. .... Sept. 6
Sept. 11. Marshall, Mich. .... Sept. 6
Sept. 12. Port Huron, Mich. .... Sept. 6
Sept. 12. Monticello, Ind. .... Sept. 6
Sept. 13. Washington, D. C. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 15. Norristown, Pa. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Sept. 16. Irvington, N. J. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 16. St. Louis, Mo. .... Aug. 23
Sept. 17. Brooklyn, N. Y. .... Sept. 6
Sept. 17. Cleveland, O. .... Aug. 30
Sept. 17. Two Rivers, Wis. .... Aug. 30
Sept. 19. Grand Rapids, Mich. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 20. Eaton, Colo. .... Sept. 6
Sept. 20. Youngstown, O. .... Sept. 6
Sept. 22. Vincennes, Ind. .... Sept. 6
Sept. 22. Ft. Keogh, Mont. .... Sept. 6
Oct. 10. Ridley Park, Pa. .... Aug. 16
Adv., Eng. Record, Aug. 16.

BRIDGES.

Sept. 9. Allegheny, Pa. .... Aug. 30
Sept. 9. Bloomington, Neb. .... Aug. 23
Sept. 9. Caldwell, Idaho .... July 12
Sept. 10. Catlettsburg, Ky. .... Aug. 23
Sept. 13. Wilkesbarre, Pa. .... Sept. 6
Sept. 13. Mansfield, O. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 15. Tarentum, Pa. .... Sept. 6
Sept. 15. Clayton, Mo. .... Sept. 6
Sept. 15. Doylestown, Pa. .... Sept. 6
Sept. 15. Montesano, Wash. .... Sept. 6
Sept. 15. Downieville, Pa. .... Aug. 30
Sept. 15. Luray, Va. .... Aug. 30
Sept. 18. Terre Haute, Ind. .... Sept. 6
Sept. 20. Doylestown, Pa. .... Sept. 6
Sept. 20. Philadelphia, Pa. .... Sept. 6
Sept. 20. Terre Haute, Ind. .... Aug. 30
Sept. 23. Harrisburg, Pa. .... Sept. 6
Sept. 23. Reading, Pa. .... Sept. 6
Sept. 23. White Haven, Pa. .... Sept. 6
Oct. 1. Castroville, Tex. .... Aug. 23
Oct. 13. Victoria, B. C. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Oct. 15. Yellowstone Park, Wyo. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Nov. 5. Chicago, Ill. .... Sept. 6

PAVING AND ROADMAKING.

Sept. 9. Allegheny, Pa. .... Sept. 6
Sept. 9. Trenton, N. J. .... Sept. 6
Sept. 9. Banksville, Pa. .... Sept 6
Sept. 9. Camden, N. J. .... Aug. 30
Sept. 9. New York, N. Y. .... Aug. 30
Sept. 9. Schenectady, N. Y. .... Aug. 30
Sept. 10. Boston, Mass. .... Sept. 6
Sept. 10. Ilion, N. Y. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Sept. 10. Boston, Mass. .... Aug. 30
Sept. 10. Massillon, O. .... Aug. 23
Sept. 11. New York, N. Y. .... Sept. 6
Sept. 11. Hamden, Conn. .... Sept. 6
Sept. 12. Moline, Ill. .... Sept. 6
Sept. 12. Hendersonville, N. C. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 13. Kenosha, Wis. .... Sept. 6
Sept. 13. Youngstown, O. .... Sept. 6
Sept. 15. New York, N. Y. .... Sept. 6
Sept. 15. Toledo, O. .... Aug. 23
Sept. 16. Peekskill, N. Y. .... Sept. 6
Sept. 16. Green Bay, Mich. .... Aug. 30
Sept. 18. Cincinnati, O. .... Aug. 30
Sept. 18. Niles, O. .... Aug. 30
Sept. 20. Janesville, Wis. .... Aug. 30
Sept. 20. St. Louis, Mo. .... Aug. 23
Sept. 22. South Bend, Ind. .... Sept. 6
Sept. 29. Fremont, O. .... Sept. 6

POWER, GAS AND ELECTRICITY.

Sept. 11. Memphis, Tenn. .... Aug. 23
Sept. 12. Big Stone Gap, Va. .... Aug. 30
Sept. 13. Akron, O. .... Aug. 23
Sept. 17. Cheviot, O. .... Aug. 23
Sept. 22. National Home, Wis. .... Aug. 30
Oct. 1. Weiser, Idaho .... Aug. 23
Oct. 3. Weiser, Idaho .... Sept. 6
Oct. 15. Chicago, Ill. .... Aug. 23
Nov. 1. Macon, Ga. .... Aug. 30

GOVERNMENT WORK.

Sept. 8. Tompkinsville, N. Y. .... Aug. 23
Adv., Eng. Record, Aug. 23.
Sept. 8. Htg. laboratory, Washington, D. C. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Sept. 8. New York, N. Y. .... Aug. 23
Sept. 8. New Orleans, La. .... Aug. 16
Adv., Eng. Record, Aug. 16 to Sept. 6.
Sept. 9. Htg. P. O., Elmira, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16, 23.
Sept. 10. Annapolis, Md. .... Aug. 30
Sept. 10. St. Louis, Mo. .... Aug. 23
Sept. 10. Brooklyn, N. Y. .... Aug. 16
Sept. 10. Post Office, Anniston, Ala. .... Aug. 2
Adv., Eng. Record, Aug. 2, 9.
Sept. 11. Water supply, Navajo Agency, N. M. Aug. 23
Sept. 11. Wilmington, Del. .... Aug. 16
Sept. 11. Dredging Baltimore Harbor, Md. .... Aug. 16
Adv., Eng. Record, Aug. 16 to Sept. 6.
Sept. 11. Dredging Curtis Bay, Baltimore, Md. Aug. 16
Adv., Eng. Record, Aug. 16 to Sept. 6.
Sept. 11. Dredging, etc., New York, N. Y. .... Aug. 16
Adv., Eng. Record, Aug. 16 to Sept. 6.
Sept. 11. Wiring P. O., New Brunswick, N. J. .. Aug 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 11. Htg. P. O., New Brunswick, N. J. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 13. Elevators, Philadelphia, Pa. .... Aug. 30
Sept. 13. Boston, Mass. .... Aug. 16
Sept. 13. Dock, Norfolk, Va. .... July 26
Adv., Eng. Record, Aug. 2, 9.
Sept. 15. Denver, Colo. .... Aug. 30
Sept. 15. Riprap, etc., Philadelphia, Pa. .... Aug. 23
Adv., Eng. Record, Aug. 23 to Sept. 6.
Sept. 15. Tampa, Fla. .... Aug. 23
Adv., Eng. Record, Aug. 23 to Sept. 6.
Sept. 15. Htg. P. O., Abilene, Tex. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 16. Lighthouse, Philadelphia, Pa. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 16. Htg. P. O., Oakland, Cal. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 17. Newport, R. I. .... Aug. 30
Adv., Eng. Record, Aug. 30.
Sept. 17. New York, N. Y. .... Aug. 23
Adv., Eng. Record, Aug. 23 to Sept. 6.
Sept. 17. Wiring P. O., Abilene, Tex. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 18. Piers, Cleveland, O. .... Sept. 6
Sept. 18. Chicago, Ill. .... Aug. 23
Adv., Eng. Record, Aug. 23 to Sept. 6.
Sept. 18. Wiring P. O., Oakland, Cal. .... Aug. 9
Adv., Eng. Record, Aug. 9, 16.
Sept. 19. Ft. Totten, N. Y. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 10. Brunswick, Ga. .... Aug. 30
Sept. 20. St. Louis, Mo. .... Aug. 23
Sept. 22. New Orleans, La. .... Sept. 6
Sept. 22. Ft. Keogh, Mont. .... Sept. 6
Sept. 22. Portland, Me. .... Aug. 23
Adv., Eng. Record, Aug. 23 to Sept. 6.
Sept. 24. Chicago, Ill. .... Aug. 23
Sept. 25. Dredging, New York, N. Y. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 26. Dredging, Cleveland, O. .... Sept. 6
Sept. 26. Washington, D. C. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 27. Savannah, Ga. .... Sept. 6
Sept. 29. Louisville, Ky. .... Sept. 6
Sept. 29. Dredging, Portland, Me. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 29. Ledge excav., Portland, Me. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Sept. 30. Dredging, Boston, Mass. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Sept. 30. Indianapolis, Ind. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Oct. 1. Washington, D. C. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Oct. 1. San Francisco, Cal. .... Aug. 30
Oct. 6. New York, N. Y. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Oct. 7. Joplin, Mo. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Oct. 9. Newport News, Va. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Oct. 11. Dry dock, Charleston, S. C. .... Aug. 23
Oct. 14. Aberdeen, S. Dak. .... Aug. 30
Oct. 15. Yellowstone Park, Wyo. .... Sept. 6
Adv., Eng. Record, Sept. 6.
Oct. 16. Tampa, Fla. .... Sept. 6
Adv., Eng. Record, Sept. 6.

BUILDINGS.

Sept. 9. Pub. bldg., Iroquois, N. Y. .... Sept. 6
Sept. 9. City Hall, Henderson, Ky. .... Sept. 6
Sept. 9. School, Willimantic, Conn. .... Sept. 6
Sept. 9. Factory, Cornwall, Ont. .... Sept. 6
Sept. 9. Church, Allegheny, Pa. .... Aug. 30
Sept. 9. Jail, Anadarko, Okla. Ter. .... Aug. 30
Sept. 9. Armory, Buffalo, N. Y. .... Aug. 30
Sept. 10. Library, Sheboygan, Wis. .... Sept. 6
Sept. 10. Bus. bldg., Sault Ste. Marie, Mich. .. Sept. 6
Sept. 10. Car barn, Atlanta, Ga. .... Sept. 6
Sept. 10. Bus. bldg., Bedford City, Va. .... Aug. 30
Sept. 10. Library, Sheboygan, Wis. .... Aug. 16
Sept. 11. School, Marlin, Tex. .... Sept. 6
Sept. 11. Pub. bldg., New York, N. Y. .... Aug. 30
Sept. 12. Engine house, New York, N. Y. .... Sept. 6
Sept. 12. Library, Grand Forks, N. D. .... Sept. 6
Sept. 12. Pub. bldg., Hartwell, O. .... Aug. 30
Sept. 12. Court House, Ruston, La. .... Aug. 23
Sept. 12. Church, Beaumont, Tex. .... Aug. 23
Sept. 15. Library, Pueblo, Colo. .... Sept. 6
Sept. 15. School, Washington, D. C. .... Sept. 6
Sept. 15. School, High Springs, Fla. .... Sept. 6
Sept. 15. School, New York, N. Y. .... Sept. 6
Sept. 15. School, Long Island City, N. Y. .... Sept. 6
Sept. 15. Village hall, Lisbon, O. .... Aug. 30
Sept. 15. Court house, Paris, Ky. .... Aug. 30
Sept. 15. Hospital, Texarkana, Ark. .... Aug. 30
Sept. 15. School, Cincinnati, Ia. .... Aug. 23
Sept. 16. Pub. bldg., Columbus, O. .... Aug. 23
Sept. 17. Pub. bldg., Winchester, Ind. .... Sept. 6
Sept. 17. School, Buffalo, N. Y. .... Sept. 6
Sept. 18. Library, Nashville, Tenn. .... Sept. 6
Sept. 18. Library, Oskaloosa, Ia. .... Sept. 6
Sept. 19. School, Rapid City, S. D. .... Sept. 6
Sept. 20. School, La Junta, Colo. .... Sept. 6
Sept. 20. School, Springboro, O. .... Aug. 30
Sept. 22. Pub. bldg., Nat. Military Home, Ind. Sept. 6
Sept. 22. Pub. bldg., New Braunfels, Tex. .... Aug. 30
Sept. 22. Pub. bldg., Nat. Military Home, Kan. Aug. 30
Sept. 24. Pub. bldg., Brooklyn, N. Y. .... Sept. 6
Sept. 24. Htg. city hall, Newark, N. J. .... Sept. 6
Sept 25. Hospital, Columbus, O. .... Aug. 30
Sept. 26. School, Columbus, O. .... Sept. 6
Sept. 29. School, Deadwood, S. D. .... Aug. 30
Oct. 6. City Hall plans, Houston, Tex. .... Aug. 9
Oct. 7. Court House, Miami, Fla. .... Aug. 16
Dec. 2. Capitol work, St. Paul, Minn. .... Aug. 16
Dec. 8. Municipal bldg. plans, Wash'gt'n, D. C. Aug. 30
——— Factory, Baltimore, Md. .... Sept. 6
——— Pub. bldg., Sewickley, Pa. .... Aug. 30

MISCELLANEOUS.

Sept. 9. El. ry. franchise, Pasadena, Cal. .... Aug. 23
Sept. 10. Dredging, Richmond, Va. .... Sept. 6
Sept. 10. Boilers, Pittsburg, Pa. .... Sept. 6
Sept. 10. Garb. disposal, N. Adams, Mass. .... Aug. 23
Sept. 10. Wharf, Orillia, Ont. .... Aug. 23
Sept. 10. Garb. disposal, Atlanta, Ga. .... Aug. 16
Sept. 20. Cleveland, O. .... Sept. 6
Sept. 20. Garb. disposal, Adams, Mass. .... Aug. 30
Sept. 27. R. R. work, Toronto, Ont. .... Sept. 6
Sept. 30. Harbor, Port Adelaide, S. A. .... July 5
Oct. 1. Levee work, Pointe-a-la-Hache, La. .. Sept. 6
Oct. 8. R. R., Portuguese East Africa .... Aug. 30
Oct. 9. Dry dock machinery, Portland, Ore. .. Sept. 6
——— R. R. work, Chicago, Ill. .... Aug. 30

THE ENGINEERING RECORD.

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A New Departure in Consulting Engineering.

An incident of much significance is marked by the appearance of a report, printed elsewhere in this issue, made by a consulting engineer on the operation of a garbage crematory. This report is probably the first that was ever made in the United States by a sanitary engineer who has made a prolonged study of the subject in the United States and abroad, and bases his recommendations on a painstaking investigation of the condition and operation of such a plant. It has long been held by many observers of municipal conditions in this country that the problem of garbage disposal is one of the most unsatisfactory, in its present stage, of all which confront the city official. In many respects the condition resembles that which obtained 15 years ago in the mechanical filtration of water. At that time the competition between holders of various patents was so severe that comparatively little attention was paid by them to the scientific investigation of the processes they were advocating. Some of the results of this strife were to be seen in the expenditure of considerable sums for plants wholly unsuited to the situations for which they were built, and in the suspicion and occasional contempt with which conservative engineers regarded the rapid filtration of water and the use of a coagulant. It was the investigation of the Louisville Water Company into the merits of mechanical and other systems of filtration, conducted in an impartial manner and with scientific skill by Mr. George W. Fuller, which first demonstrated to the American engineering public the great value of the rapid system of filtration.

For the same reason it has long been the opinion of The Engineering Record that until a consulting engineer of high standing and thorough knowledge of the subject made an independent investigation and report on some garbage crematory in actual use, it would be almost hopeless to expect much advance in refuse destruction in this country. For this reason the report made by Mr. Hering to the authorities of Trenton is of exceptional value. He explains why it is that the actual destruction of the garbage by fire is only one part of a complicated system of working which must be reasonably perfect in all parts to be satisfactory to the public. The collection and disposal of garbage in large cities is a matter almost as important as the collection and disposal of sewage. It is more difficult in some respects, because these wastes from the houses and shops must be carried conspicuously through the streets and not removed out of sight through channels below the surface. From the receptacle where the garbage is collected to the ash pit where the clinkers are raked out of the crematory, there is a chain of operations which requires conscientious work on the part of laborers, skill on the part of managers and a high order of engineering ability on the part of designers of the plant. It is because Mr. Hering points out these features of the problem so well, and emphasizes his remarks by illustrations drawn from an existing crematory against which numerous complaints have been made, that his report must be considered a document of much importance.

It is to be hoped that this report is but the first of many which consulting engineers will be retained to make on this subject. The time has certainly gone by when the investigation of such a problem as is presented by the collection and disposal of the garbage of a city should be undertaken except with the assistance of an impartial, well-informed engineer. Hardly a month passes that The Engineering Record does not receive accounts of tours of investigation made by city officials to garbage plants in other places, for the purpose of ascertaining what sort of a furnace they should use in their own city. The information collected in this way may or may not be useful, but there is no question that if these tours are made in company with an independent expert the committee will return with numerous ideas of what not to do. There is hardly a garbage disposal system in the country today which cannot be improved, either in construction or in operation. Garbage disposal is the source of many unnecessary complaints and the cause of great waste of money. If other cities follow the example of Trenton these troubles will be greatly reduced.

Concrete-Steel Theory and Computations.

There will be found in The Engineering Record for August 23, an abstract in detail of an important and valuable paper on concrete-steel by Professor Brik. This paper is a comprehensive but concise statement of the concrete-steel problem as a branch of engineering construction as it now stands. Among other things Professor Brik gives results of some of the latest experimental investigations having for their purpose the determination of both the ultimate resistance and the moduli of elasticity of concrete in flexure, which depend not only on the age and quality of the material but also on the dimensions of the beam carrying the transverse load. Those who are to any extent familiar with the condition of our knowledge respecting the empirical quantities necessary for concrete-steel computations will easily realize the serious lack of data in these premises and the importance of securing them from suitably conducted experimental investigations.

There is little or no lack of experiments having for their purpose the determination of the modulus of elasticity for concrete in compression, nor unfortunately is there lack of wide diversity in results. It is evident enough that that modulus will increase with the age of the concrete for a considerable period of time, but the diversity remarked is found among results belonging to different specimens of concrete of the same age and of the same proportions of constituent elements. The tests of a Monier arch of seventy-five feet span by the Austrian Society of Engineers and Architects, as published in the Report for 1895, gives values of the compression modulus running from about 4,660,000 to nearly 5,180,000 pounds per square inch and with about one-fifth greater values for the tension modulus. By employing the horizontal and vertical deformations a kind of average modulus for the whole arch was found to be about 4,750,000 pounds per square inch, yet probably no civil engineer would consider it prudent to use in actual design as high a value as one approaching the lowest of those just given.

It is not uncommon to find a sharp distinction drawn between the values of the moduli of elasticity for concrete in tension and compression. Indeed, some, as Professor Hatt, take the compression modulus at even twice that for tension, while the Committee of the Austrian Society of Engineers and Architects found the tension modulus materially larger than the other in their tests of the seventy-five-foot Monier span, although it should be stated that the tension specimens had more age than those subjected to compression.

As a matter of fact experimental data are unfortunately far too meager at the present time to give any reliable relation between the two moduli, and there is at least some basis for the assumption that in concrete of considerable age they may be taken equal without much if any error. There is urgent need for careful experimental investigation with as large pieces of concrete as possible, both with and without steel reinforcement. In the meantime it seems scarcely necessary to complicate formulas for practical use with a difference between the two values certainly not yet established and about which there is serious doubt.

Another feature of this matter of which much is made is the variability of the modulus of elasticity of concrete with varying intensities of stress. A large amount of valuable data bearing on this point, and of most admirable character can be found in the "Report of Tests of Metals and Other Materials" at the Watertown Arsenal for 1899. Twelve-inch cubes of concrete of various proportions of cement, sand and broken stone or gravel and of age as much as six months were employed. A careful examination of those results will show that frequently permanent sets were observed at intensities of stress as low as two hundred pounds per square inch, while in other cases no such sets were observed under much higher stresses even up to one thousand pounds per square inch, or more. Indeed, the behavior of the concrete in at least one or two cases shows practically perfect elasticity up to nearly 4,000 pounds per square inch. A careful study of all those results must convince one that Portland cement concrete and mortars may properly be treated in computation as possessing an elastic limit in compression, with proportions of one, three and six or richer, of not much under 1,000 pounds per square inch, especially when proper balancing of the materials is practiced. This latter feature of concrete making, rapidly gaining in favor as it should, gives to the resulting material, among other advantages, enhanced elastic qualities. Undoubtedly when the stresses in concrete exceed 600 to 1,000 pounds per square inch the point is reached where the compression modulus may be expected to begin to decrease, but if the concrete is made as it should be at the present time, little or no error will be committed in assuming what may, with some privilege perhaps, be called the elastic limit at about 1,000 pounds per square inch. In many cases of rich mixtures such as one, two and four, it is not excessive to take that limit as high as 2,000 pounds per square inch. Inasmuch as these numerical results are based on figures actually derived from twelve-inch cubes of practically unbalanced constituents, it appears seriously doubtful, if not actually unjustifiable, to treat concrete as a material without much elastic behavior. This last observation has special force when applied to concrete-steel structures in which the comparatively great stiffness of the steel acts to a considerable extent as a kind of elastic aid to the concrete. Unquestionably in concrete-steel pieces the modulus of elasticity decreases rapidly as the intensity of stress approaches the ultimate resistance of concrete alone, and becomes probably but little more than zero in the composite piece when the intensity reaches its ultimate value, although no actual fracture of the concrete may take place. Just as marked an observation may, however, be applied to structural steel or any other ductile material. Yet no one would think of using anything but the formulas of the common theory of flexure for steel or wrought iron beams.

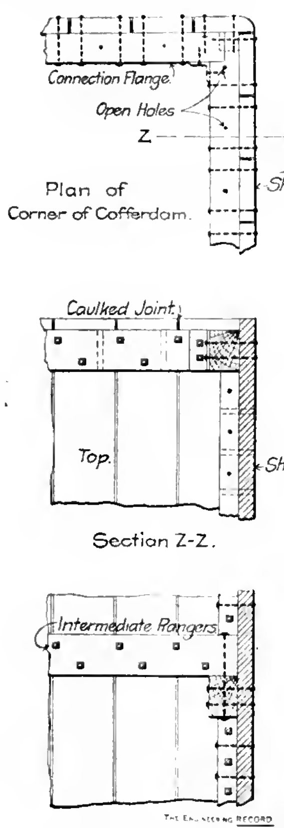
This is a very important feature of the concrete-steel matter. Too much effort has been made to represent what are supposed to be physical features of concrete so far removed from corresponding features of ductile materials as to make the formulas applicable to the latter inappropriate for the former. While it is probably unsafe to predict much as to what further investigations may disclose, it may with propriety be positively stated that little or nothing has yet been revealed which makes it necessary or advisable to assume a different law of variation of the bending stresses in concrete-steel beams or employ a different form of formula from those given by the familiar common theory of flexure.

The values of working stresses for the concrete in concrete-steel beams given by Professor Brik are certainly reasonable and safe and practically the same may be said of his moduli of elasticity. It is probable that in no case should the modulus be taken higher than 3,000,000 pounds per square inch, nor need it often be taken lower than 2,000,000 pounds per square inch, although there are special cases where 1,500,000 pounds would seem to be justifiable.

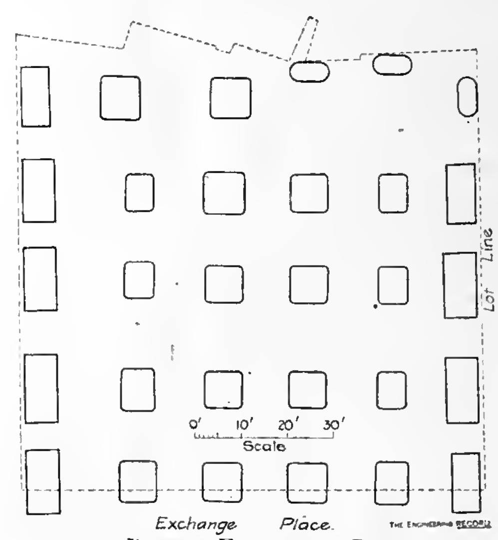
The Monroe Suit for Defective Fire Protection was fully explained in The Engineering Record of June 2, 1900, but the final judgment which the Louisiana Supreme Court has just rendered is an entire surprise to those familiar with its former decision. The case was a suit by a manufacturing company against a private water company for damages to its plant caused by defective fire protection. The first trial resulted in establishing the water company's responsibility if a defective supply could be proved. The second decision, 32 S. Rep. 376, is that the main reason for the fire department's poor work was the presence of the sprinkler system in the plant, which drew so much water from the mains that the two hydrants ran short. This releases the water company from liability. As this view is a novelty, the court's words are quoted: "The witnesses testifying who seem most familiar with the scientific rules governing the subject-matter with which they are dealing attribute any failure of the fire department of Monroe to have done more effective work than it might have done on the occasion of the fire on the plaintiff's property, not to any fault on the part of the defendant company, but to the existence of the sprinkler system upon the plaintiff's property, and to the fact of there being a continuous simultaneous discharge of water during the fire from all of its openings, through the connection of the system with the public mains, in close proximity to the public hydrants from which the defendant was operating."

The Bank of the State of New York.

The Bank of the State of New York occupies a site approximately 100 feet square on Exchange Place near Broad Street, New York City. It is a steel-cage building corresponding in general type to others of the same class which have been described from time to time in The Engineering Record, but varies somewhat from them in the character of the steel sub-structure, the wind bracing and column details. It will have a height of twenty-five stories or about 340 feet above the curb, and will have a basement and cellar below that level, the floor of the latter being about 21 feet below the curb and about 5 feet below the ground-water level. The superstructure will be supported on 27 main lines of rectangular steel columns in two-story sections, seated on 27 concrete piers carried down to solid rock by the pneumatic caisson process. Except under the side wall columns the caissons and piers are concentric with the columns. Under the side walls the columns are located as close as possible to the lot lines which brings them eccentric with their respective piers. They are arranged in five rows parallel with the street front and in six rows perpendicular to the first and parallel with the lot lines. This produces spaces of from about 18¼ to 23½ feet on centers between the piers.



DETAILS OF COFFERDAM.



PLAN OF FOUNDATION PIERS.

The main piers are all rectangular in cross-section and vary in size according to their total loads, which are calculated to produce maximum pressures of 30,000 pounds per square foot on the concrete. The wall piers are about 7 feet wide and 14 feet long and most of the interior piers are 8 feet square, but there are variations of a foot or two both ways from these dimensions which are over all and include the thickness of the cofferdams in which the piers were built. The exterior wall caissons have square corners, the interior ones have their corners rounded to a radius of 3 inches except three small ones supporting two-story columns under the light court, which are 4½ feet wide and 6½ feet long with semi-circular ends.

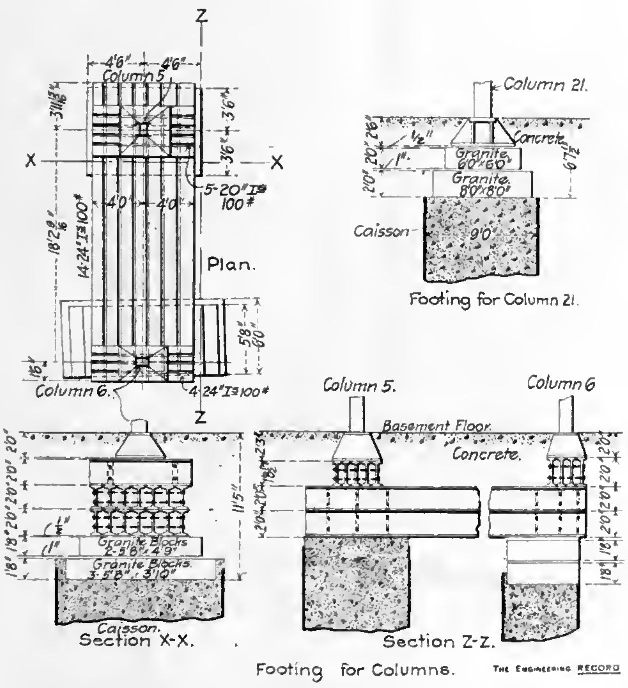
The site was previously occupied by a building under which there was no cellar and when it was removed the excavation was only carried down at first to a depth of about 6 feet below the curb. Sheet piling was driven across the street front and ten lines of horizontal 12x12-inch struts at curb level were set perpendicular to the tops of the piles and carried across the lot to bearing with 5-ton horizontal jack screws against vertical distributing pieces on the face of the wall of the adjacent building. About as many similar braces at right angles to these and in the same plane were carried across the lot and set against the side walls of the adjacent buildings on Exchange Place, thus forming a system of rectangular panels arranged so that the caissons were located inside the panels and cleared the braces. Caisson 26 is not in line with the others in the same transverse row, and the braces there could not be carried through straight, so the intersecting section of the brace was omitted and the end of the corresponding brace in the next panel took bearing against inclined braces diverging both sides of the caisson to the wall.

The sides of the panels were from 8 to 20 feet long and where the braces intersected at their corners one of them was continuous and the other one was cut to clear with butt joints on the sides of the continuous brace. The ends of the cut brace rested on a short-4-inch plank, which extended across the under side of the continuous brace and was supported on top of a vertical 12x12-inch post on the center lines of the struts. The foot of the post had a double wedge bearing on a short timber sill. Most of the braces were continuous from post to post, but sometimes splices occurred between posts and were made with butt joints and plank fish plates bolted on the vertical sides of the timber. A heavy deck of thick planks was laid on top of the braces at about street level and served as platform for unloading and storage and supported offices, dressing rooms for the caisson men, and a traveling derrick with which the caissons and materials were handled. Under the platform the air compressors, receiver, boilers, pumps and small shops were located and pipes were run to the caissons.

The derrick had a framed timber platform about 40 feet square with its sills braced by diagonal horizontal struts having beveled ends abutting against and bolted to them and having the joints made with plank scabs. At each corner of the platform the sills were of double thickness and formed seats for derrick masts 35 feet high. Each mast had a stiff leg reaching from its top to the opposite end of the platform sill in each adjacent face. The four sets of stiff legs thus made X-bracing in each vertical face of the traveler. There were no horizontal struts connecting the tops of the mast.

The feet of the stiff legs were beveled to horizontal and vertical surfaces, the former bearing on the sill and the latter against the end of a thick plank spiked to it. A 5x½-inch steel tie-plate was also bolted to each side of the foot of the stiff leg and to the sides of the sill. Each mast had a 50-foot boom with a capacity of about 10 tons. The traveler was operated by three double drum Lidgerwood hoisting engines and was moved on solid wooden rollers, set in either direction under the sills.

The caissons were made entirely of wood with vertical sheathing of 3-inch pine plank, 10 to 12 inches wide, planed outside and bolted to 6x8-inch horizontal inside rangers about 5 ft. apart with two ⅝-inch carriage bolts having outside heads which were not countersunk in the sheathing. The sets of rangers were separated by 3x3-inch vertical corner pieces, and the longitudinal rangers were lapped across the upper sides of the transverse ones. The caissons were 10 and 12 feet high over all with 8x8-inch inside horizontal timbers mitered together to form the cutting edge flush with the bottoms of the staves. The caisson roof was a deck of two solid courses of 8x8-inch timbers crossed. The caisson walls were carried up in the same vertical planes by the sides of the cofferdams which were made in one or two vertical sections from 10 to 18 feet high, according to the depth of the piers.



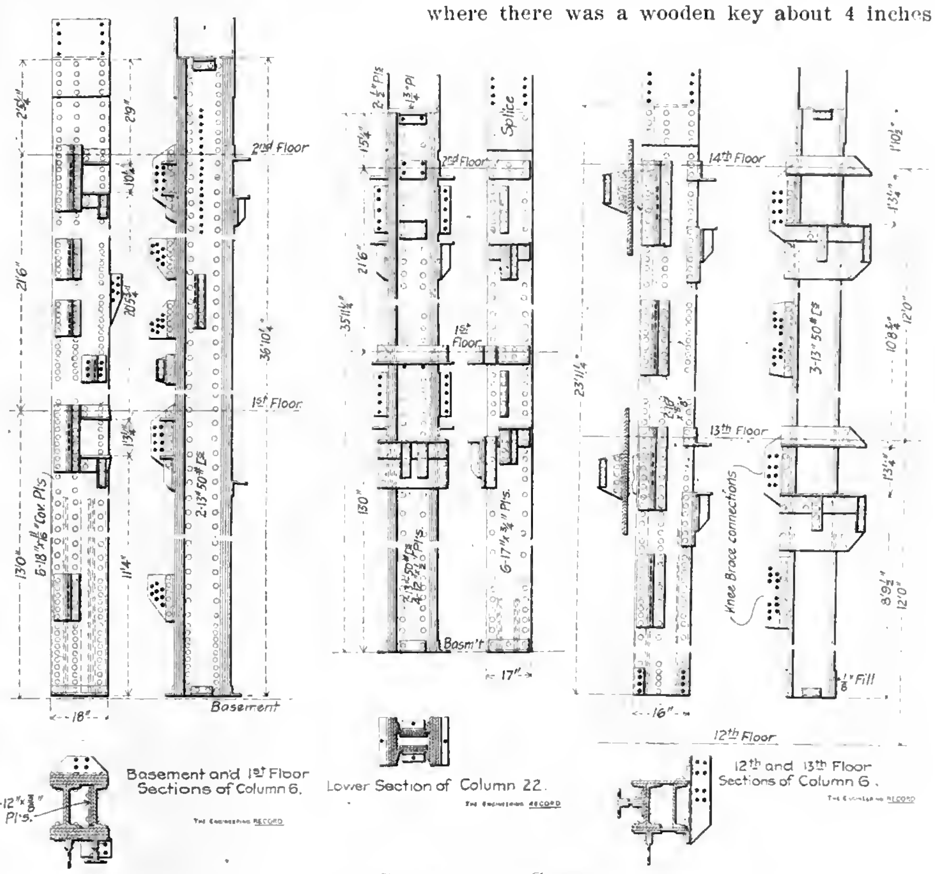
DETAILS OF COLUMN FOOTINGS.

blockaded by the buckets. The shafts were detached from the caissons before the latter were concreted. A maximum pressure of about 15 pounds was furnished by the two McKiernan air compressors, and pressure was on as many as three caissons at once. The caissons were sunk through earth, quicksand and clay with a little gravel to a stratum of hard pan about 4 feet thick, which was about 39 feet below the bench mark on the curb on the east side of the lot, and sloped to a depth of 46 feet on the west side.

The caissons were sunk with from 50 tons of pig iron for the smallest to 300 tons for the largest and descended at a maximum speed of 2 feet an hour, or 40 feet in 24 hours; one being sunk, concreted and the lock removed in 36 hours after air pressure was applied. They were sunk about 18 inches into the hard pan and stopped there while the excavation was carried down to the surface of the rock, which was carefully cleaned before concreting. The excavation was made a foot or two wider below the cutting edge than above it. The thirty caissons were sunk in about 40 working days

Battery Place Building foundations described in The Engineering Record of June 21. The locks were considered very satisfactory on account of their simplicity and the ease and rapidity with which they were operated. They were made high enough to allow the lower doors to drop in them above the top of the shaft and had separate doors for men and buckets. The bucket doors were fully counterbalanced and had single leaves pivoted on horizontal axes.

The caissons and cofferdam sections were built by the contractors at their yards in Long Island City and shipped whole to the site where they were delivered, generally at night, on large trucks drawn by two or three teams each. The largest caisson weighed about 10 tons, and was set in place by two booms of the traveling derrick. The wall caissons were sunk within about 6 inches of the lot line and were provided with greased vertical guide planks spiked to the walls of the adjacent buildings. The interior caissons were located exactly by intersecting transit lines and were sunk inside braced horizontal timber guide frames with a clearance of 6 inches, except in the centers of the sides where there was a wooden key about 4 inches



DETAILS OF COLUMNS AND CONNECTIONS.

The cofferdams were built like the caissons except that the bottoms were made like the tops and they had no roofs. The transverse and longitudinal rangers in the top and bottom sets were halved over each other at the ends so that both were in the same plane and formed inside flanges, about 2 inches clear of the ends of the sheathing boards. The joints were strengthened by vertical connection angles, as shown in the detail sketch, and the sections were connected by vertical bolts through the flange rangers. The sheathing planks were spaced with ¼-inch cracks between them which were calked with oakum and the ends were cut exactly square and even so as to match as perfectly as possible and were bolted together with hemp gaskets.

The caissons were sunk with 30x54-inch steel air shafts with inside guides between the bucket space and the ladder space and special air locks, patented by Mr. D. E. Moran, were arranged to serve for both men and materials without the possibility of the men ever being

and would have been sunk more quickly if operations had not been delayed waiting for the shoring and underpinning of the adjacent buildings. The caisson work was done by three 8-hour shifts of about 12 men each and the total number of men employed on the caisson and pier work was about 250.

The quantities involved were about 3,000 yards of excavation in the caissons, 4,000 yards of excavation outside the caissons, and 2,000 yards of concrete in the piers. Concrete was hand mixed on the platform at street level and was deposited in the caissons under pressure with cylindrical ½-yard buckets discharging through bottom flaps which were released when the descent of the bucket was arrested. The spoil was hoisted out of the caisson in ½-yard cylindrical steel buckets and dumped on the main working platform whence it was shoveled into wagons and removed at frequent intervals of the day and night. The buckets, shafts and air-locks used on this work were the same as those used by the same contractors for the

wide and 12 inches long with beveled ends, which took bearing on a well greased sheathing board.

The caissons were sunk to about 2 feet below water line, by open excavation before the air pressure was required, the excavation being made from within so that the sides of the caisson should prevent the necessity of sheeting which would have been required for an open pit excavation. The caissons were sunk with an accuracy of about 1 inch laterally. The three small caissons under the light court which supported short columns, differed from the other caissons in having rounded ends and horizontal 3x3-inch steel angle frames 4 feet apart to which the vertical sheathing planks were secured. The angles were in single pieces spliced with 3x½-inch cover plates. The caisson roof was a ½-inch steel plate stiffened with 3x3-inch angles and the cutting edge was reinforced by a 3x3-inch angle, horizontal flange down.

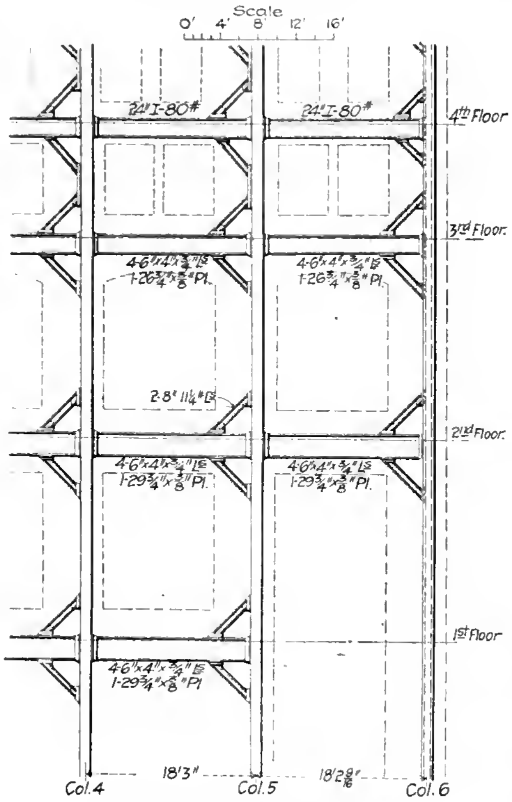
All of the piers are capped with two or three

2-foot courses of cut granite, the lower courses on the interior piers being about 2 feet wider and longer than the top courses. For the square piers each course is a single stone, the lower one about 1 foot narrower and shorter than the top of the pier after the latter is stripped of its cofferdam sheathing. In the long wall piers there are several stones in each course, each as long as the width of the course. These courses are all of the same width and are eccentric with the pier, the outer ends being flush with the outside face of the piers. The stones are set with ½-inch joints of cement mortar under the beds and under the cast-iron pedestals for the interior columns. The long wall piers and the interior piers adjacent to them support nine cantilever girders which carry the wall-columns at their extremities, about 3 feet outside the centers of the piers.

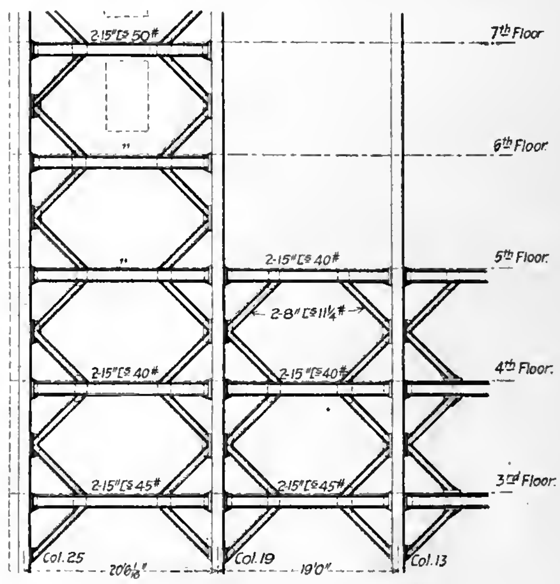
These girders are made up of double tiers of 24-inch 100-pound I-beams, with their flanges riveted together as indicated in the elevation, and the pairs of beams connected by tie-rods and separators. There are from five to eight pairs of beams in each girder and they are from about 20 to 29 feet long. Single-tier grillages of four or five transverse beams are set on both ends of the cantilever girders to receive the column bases and distribute their loads uniformly over all the separate elements of the girder. They are from 12 to 20 inches deep and are connected with separators and bolts. All girder and grillage beams are thoroughly painted two coats, covered with hot asphalt and are enclosed in a solid mass of concrete rammed between their webs and extending 2 inches beyond the sides and ends of the beams and up to the cellar floor to wholly enclose the cast-iron column pedestals.

The columns are made in two-story lengths, all in the same tier being spliced at the same level, 15¼ inches above the floor line, with two side plates and a horizontal diaphragm plate, which are field-riveted to the lower and shop-riveted to the upper ends of the columns. They have closed rectangular sections made up of plates and channels with a maximum cross sectional area of 176 square inches for a total load of 2,295,000 pounds. Column number 6 is one of the heaviest and has a special section made up of six cover plates and three channels, two of the latter riveted together back to back, and the other one with its web reinforced by two thick plates. In the upper tiers of this column the size and weight of the channels are maintained, but the sectional area of the column is reduced by diminishing the number, thickness and width of the cover plates and by omitting the channel web reinforcement plates.

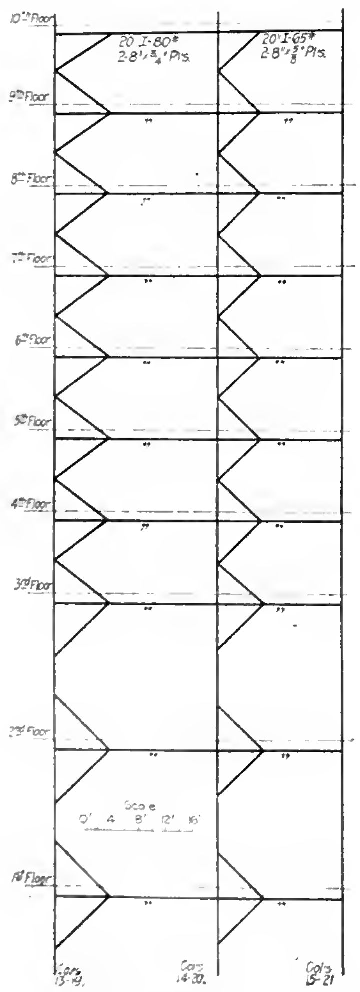
This is a corner column and has vertical web plates projecting from two adjacent outer sides to receive the field-riveted connections of the wind bracing struts. It also has offset connections to support the wall girders clear of the two outer faces of the column. These are designed so that the same support receives the two girders meeting at one point in a horizontal plane. A vertical plate parallel with the channel web is shop-riveted to a pair of vertical angles, which have their other flanges shop-riveted to the edges of the cover plates, as shown in the cross-section. This plate has a 6x6-inch angle riveted to its upper edge with the horizontal flange bearing on the milled upper ends of reinforcement and distribution angles. The support being made eccentric to the column affords bearing for one wall girder parallel to the bracket angle and projects far enough past the edge of the column to receive the other girder, at right angles to the first one on the cantilever end. Corresponding



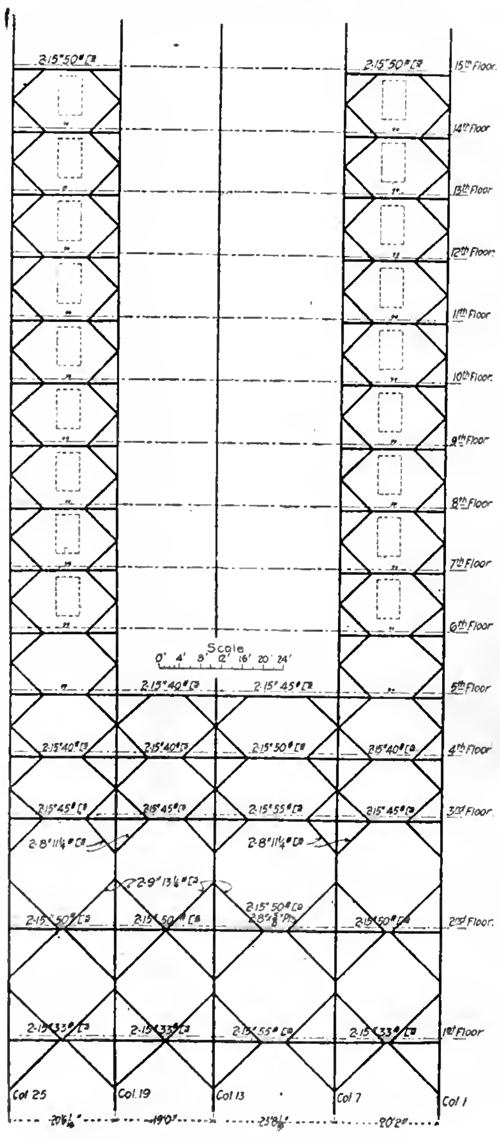
WIND BRACING, STREET FRONT.



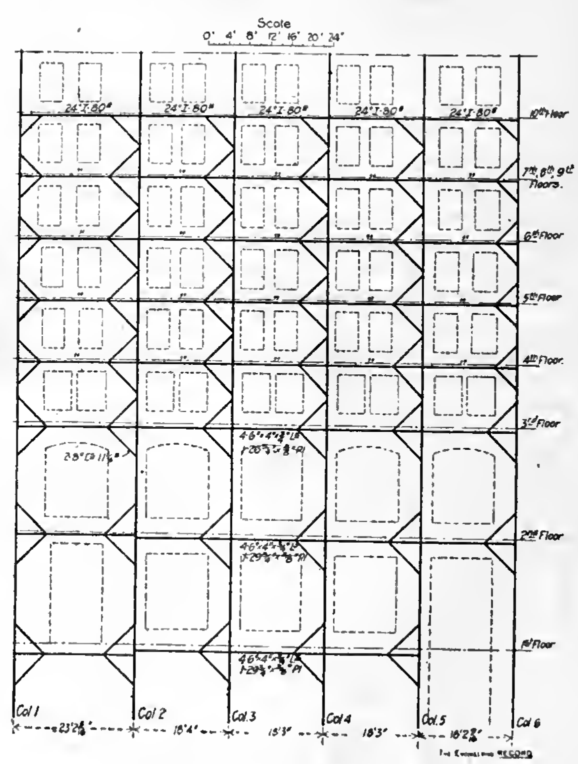
UPPER PART OF SIDE WALL BRACING.



INTERIOR WIND BRACING.



WIND BRACING, SIDE WALL.



WIND BRACING, STREET FRONT.

transverse angles without web plates receive the top flanges of the wall girders. On the opposite side of the column the girder connection is made to the vertical face of a bracket which has an I-shaped horizontal cross-section and is composed of four short 4x3-inch vertical angles and a web plate riveted through the webs of the double channels. In the basement story of the column the wind-brace connection on one side is a long bracket which is shop-riveted to the strut and has 18 field-bolts through both of the channel webs.

Wall column 22 has a load of 1,637,000 pounds in the basement story where its cross section is 130 square inches, made up of six cover plates, and two channels with their webs reinforced with two plates each. The wall girders are clear of the outer edges of the channel flanges and cover plates and those of adjacent panels abut on the center line of the column and are riveted on the same supporting angle bracket which is connected to the column by a vertical plate riveted to the edges of the cover plates as described for the corner column, but in this case, symmetrically. The other three faces of the columns have on their center lines connections for the floorbeams in three directions. These are simple angle brackets with reinforced horizontal flanges to support the lower flanges of the beams and corresponding angles without reinforcement to receive the upper flanges. The floor girders have in addition vertical connection angles shop-riveted to the column and field-riveted to one side of the girder web.

The intermediate wall columns in the street-front are similar to column 6, but have their channel webs at right angles to those in Column 6 and have the eccentric bracket plate riveted directly across the cover plates instead of at right angles to them. The floorbeam connections are in the center lines of the column faces and have simple bracket angles to receive the top and bottom flanges. The interior columns are all made with two channels and four cover plates in the lower stories, and have all beams and girders connected on the center lines of all four faces. The girders have reinforced horizontal bracket angles under the lower flanges and vertical angles for web connections; the floorbeams have no reinforcement for the lower flange bracket angles and have no web connections. Both beams and girders have top flange connection bracket angles field-riveted to both beams and columns.

In the typical floors there are parallel with the street two lines of main girders, composed of single 20-inch I-beams connecting the columns of the interior rows. They carry web connected 12-inch I-beam floorbeams 5½ feet apart perpendicular to the street line and proportioned for a total floor load of 160 pounds per square foot including the weight of the terra cotta flat arch panels. The wall girders are 12 and 15-inch I-beams bracketed out about 1 foot clear of the floor girders with riveted diaphragm plates about 5 feet apart and supported at the ends on the columns as shown in the details of columns 6 and 22. The floor girders between wall columns are I-beams 12 or 15 inches deep, according to span except where they serve as wind struts also and are either 24-inch I-beams, pairs of 15-inch channels or plate girders.

On the street front the wall girders are made extra deep up to and including the 10th floor, to act as wind struts, as indicated in the diagram of the lower part of the columns 1, 2, 3, 4, 5 and 6. Similar bracing is introduced in the lower 10 stories of one end of the second and third rows of interior columns parallel to columns 1-6, as indicated in the diagram of interior sway bracing, but the system is carried only through two of the five panels in the cross section of the building in each case. In both of the exterior walls which are perpendicular to the street front the bracing is carried up to and including the 15th floor as indicated for one of them in the diagram of the lower parts of columns 1, 7, 13, 19 and 25. In the opposite side wall all panels in the 15 lower stories are fully braced similarly to those in the first five stories between columns 1 and 25. In the last mentioned wall the horizontal struts are all pairs of 15-inch channels back to back. These are heavier in the middle than in the side panels and heavier below the 10th floor than above it. The diagonal braces are pairs of 8-inch channels down to and including the third floor, the remainder are pairs of 9-inch channels. The materials of the wind bracing in the other four planes are noted on the diagrams, and the details correspond to those shown in portions of the side and front walls. The wall girders which act as horizontal wind struts have at each end a pair of vertical flange angles field-riveted to opposite sides of their webs. One of these angles is shop-riveted to the side of the column a little beyond the center line, the other is shipped loose and is located so that the holes in one flange match the open holes through the channel flange and cover plate of the column and so can be field-riveted. When this connection is made to the channel web instead of the cover plate of the column neither row of rivets can be field driven and one angle is shop-riveted and the other is connected by bolts which pass through the column and have nuts bearing on the outside of the opposite channel. The wind bracing is proportioned for an assumed wind pressure of 30 pounds on the faces of the building above 100 feet from the ground.

Messrs. Clinton & Russell were the architects of the building, and Col. J. H. Wells of their staff was the structural engineer. Messrs. Purdy & Henderson were the consulting engineers for the structural steel work. The George A. Fuller Company was the general contractor, and the Foundation & Contracting Company were the sub-contractors for the caisson work. The structural steel has an estimated weight of about 3,000 tons exclusive of about 300 tons in the foundation girders and grillages, and is made by the Carnegie Steel Company.

Measures for the Prevention of Water Waste are being seriously considered by the Metropolitan Water and Sewerage Board of Boston. The daily consumption during 1901 was 117 gallons per inhabitant, and the last report of the board states that an increase in the next few years corresponding to that which has occurred since the beginning of the operations of the Board, will compel resort to be had in a very few years to additional sources of supply, some ten or twelve years earlier than had been estimated by the State Board of Health in 1895. Although it was found that the cost of determining the amount of water furnished to each city and town in the Metropolitan District would be considerable, the Board concluded that such cost would be justified if the different cities and towns could thus be given a pecuniary motive for enforcing proper regulations against waste. The Metropolitan Water Act provided that the annual assessment upon the cities and towns other than the city of Boston should be levied one-third in proportion to their respective valuations and the remaining two-thirds in proportion to their respective populations. The Board proposes to change this, so that the assessment shall be based one-third in proportion to the valuations and two-thirds in proportion to the quantities of water respectively used.

Standard Specifications for Cast-Iron Pipe.

At the meeting of the New England Water-Works Association held this week in Boston, the most important action was the adoption by a unanimous vote of the final report of the Committee on Standard Specifications for Cast-Iron Pipe. This Committee presented a preliminary report some months ago. Its discussion by engineers, water-works superintendents and foundrymen enabled the Committee to prepare its final draft with the advantage to be derived from a full understanding of the opinions of all interested. The original specifications presented in 1901 have been modified in many minor particulars as well as in the most striking feature. This was the proposition to give all pipe of the same nominal size a uniform outside diameter. The representatives of the pipe foundries convinced the Committee that the saving in the patterns for the outside of the pipe, were such a requirement adopted, would be a small matter compared with the vastly increased expense of fittings for casting the inside of the bell where the inside diameter varies with each class. There was beside a danger that the pipes would be of poor quality if too great differences in the thickness of the pipe were made by increasing the thickness of the clay on the core.

In the revised specifications, printed below, there are two patterns of outside diameter for all sizes from 4 to 16 inches, with one class of special castings; three patterns for all sizes of pipe from 18 to 60 inches, with two classes of specials from 18 to 24 inches, and three classes of specials for the largest sizes. Different classes for each pattern are obtained by making the outside diameter equal to the nominal diameter plus twice the thickness of the heaviest class of that pattern, the pipe of the heaviest class having the inside diameter equal to the nominal diameter and a uniform thickness from end to end. The lighter classes are obtained by reducing the thickness of the shell on the inside, except on the extreme ends, where it is to be the same as in the heaviest class and tapered to meet the thinner portion of the body of the pipe through a length not exceeding 6 inches.

To use one pattern of specials with two patterns of pipe, the joint room for the larger is made a little thinner than the standard joint of the pipes and a little thicker for the smaller pattern. No joint room, however, is less than 0.35 inch or more than 0.6 inch. Owing to the time occupied in the consideration of specifications of pipe, the Committee was unable to submit at the meeting complete tables for the specials. In general design, however, they are similar to those used by the Metropolitan Water Works.

It is rare that a water-works association reaches results of such wide value as those attending the adoption of these specifications. Cast-iron pipe is used so extensively that the great variation in the minor details of its form are a reproach to the business sagacity of the engineering profession. It is only by standardizing such supplies, admirably adapted for standardization, that the best quality of pipe and specials can be obtained at a minimum of cost and time. It is to be hoped that these specifications will receive the wide adoption that followed the recommendations of the American Society of Civil Engineers in the matter of rail sections. Finally it should be emphasized that Messrs. Coffin, Brackett and Forbes, who have given so much of their time to the Committee's work, deserve the warm thanks of all who have the good interest of water-works affairs at heart. The labor attending the preparation of such a report can only be appreciated by those who have carried on similar work.

Sec. 1. The pipes shall be made with hub and spigot joints, and shall accurately conform to the dimensions given in Tables 1 and 2. They shall be straight and shall be true circles in section, with their inner and outer surfaces concentric, and shall be of the specified dimensions in outside diameter. They shall be at least 12 feet in length, exclusive of socket. For pipes of each size from 4 to 16 inches in diameter there shall be two standards, and for each larger size three standards of outside diameter. The inside diameter of each class shall be increased from the nominal size in the manner hereinafter specified, so as to obtain the standard thickness and weight. For pipes from 4 to 16 inches in diameter one class of special castings shall be furnished with all classes of pipes. For pipes from 18 to 24 inches in diameter, Class D special castings shall be furnished with pipes of Classes A, B, C and D, and Class F special castings with pipes of Classes E and F. For pipes 30 inches in diameter and larger, Class B special castings shall be used with pipes of Classes A and B, Class D special castings with pipes of Classes C and D, and Class F special castings with pipes of Classes E and F.

All pipes having the same outside diameter shall have the same inside diameter at both ends. The inside diameter of the lighter pipes of each standard outside diameter shall be gradually increased for a distance of 6 inches from each end of the pipe, so as to obtain the required standard thickness and weight for each size and class of pipe.

Sec. 2. Especial care shall be taken to have the sockets of the required size. The sockets and spigots will be tested by circular gages, and no pipe will be received which is defective in joint-room from any cause. The diameters of the sockets and the outside diameters of the spigot ends of the pipes shall not vary from the standard dimensions by more than 0.06 inch for pipes 16 inches or less in diameter; 0.08 inch for 18, 20 and 24-inch pipes; 0.10 inch for 30, 36 and 42-inch pipes, and 0.12 inch for 48, 54 and 60-inch pipes.

Sec. 3. For pipes whose standard thickness is less than 1 inch, the thickness of metal in the body of the pipe shall not be more than 0.08 inch less than the standard thickness, and for pipes whose standard thickness is 1 inch or more, the variation shall not exceed 0.10 inch, except that for spaces not exceeding 8 inches in length in any direction, variations from the standard thickness of 0.02 of an inch in excess of the allowances above given shall be permitted.

Sec. 4. Defective spigot ends on pipes 12 inches or more in diameter may be cut off in a lathe, and a half-round wrought-iron band shrunk into a groove cut in the end of the pipe. Not more than 12 per cent. of the total number of accepted pipes of each size shall be cut and banded, and no pipe shall be banded which is less than 11 feet in length, exclusive of the socket. In case the length of a pipe differs from 12 feet the standard weight of the pipe given in Table No. 2 shall be modified in accordance therewith.

Sec. 5. All special castings shall be made in accordance with the cuts and dimensions given in the tables forming a part of these specifications. The diameters of the sockets and the external diameters of the spigot ends of the special castings shall not vary from the standard dimensions by more than 0.08 inch for castings 16 inches or less in diameter; 0.10 inch for 18, 20 and 24-inch pipes; 0.13 inch for 30, 36 and 42-inch pipes, and 0.16 inch for 48, 54 and 60-inch pipes.

The flanges on all manhole castings and manhole covers shall be faced true and smooth, and drilled to receive bolts of the sizes given in the tables. The contractor shall furnish and deliver all bolts for bolting on the manhole covers, the bolts to be of sizes shown on plans, and made of the best quality of mild steel, with hexagonal heads and nuts and sound, well-fitting threads.

Sec. 6. Every pipe and special casting shall have distinctly cast upon it the initials of the maker's name. When cast especially to order, each pipe and special casting shall also have cast upon it figures showing the year in which it was cast and a number signifying the order in point of time in which it was cast, the figures denoting the year being above and the number below; thus,

1901 1901 1901
.1 .2 .3

etc., also any initials, not exceeding four, which may be required by the purchaser. The letters and figures shall be cast on the outside and shall be not less than 2 inches in length and ⅛ inch in relief for pipes 8 inches in diameter and larger. For smaller sizes of pipes the letters may be 1 inch in length. The weight and the class letter shall be conspicuously painted in white on the inside of each pipe and special casting after the coating has become hard.

Sec. 7. No pipe shall be accepted the weight of which shall be less than the standard weight by more than 5 per cent. for pipes 16 inches or less in diameter, and 4 per cent. for pipes more than 16 inches in diameter; and no excess above the standard weight of more than the given percentages for the several sizes shall be paid for. The total weight to be paid for shall not exceed for each size and class of pipe received the sum of the standard weights of the same number of pieces of the given size and class by more than 2 per cent.

No special casting shall be accepted the weight of which shall be less than the standard weight by more than 10 per cent. for pipes 12 inches or less in diameter and 8 per cent. for larger sizes; and no excess above the standard weight of more than the above percentages for the several sizes will be paid for.

Sec. 8. All pipes and special castings shall be made of cast iron of good quality, and of such character as shall make the metal of the castings strong, tough, and of even grain, and soft enough to satisfactorily admit of drilling and cutting. The metal shall be made without any admixture of cinder iron or other inferior metal, and shall be remelted in a cupola or air furnace.

Sec. 9. Specimen bars of the metal used, each being 26 inches long by 2 inches wide and 1 inch thick, shall be made without charge as often as the engineer may direct, and in default of definite instructions the contractor shall make and test at least one bar from each heat or run of metal. The bars, when placed flatwise upon supports 24 inches apart and loaded in the center, shall for pipes 12 inches or less in diameter support a load of 1,900 pounds and show a deflection of not less than 0.30 inch before breaking, and for pipes of sizes larger than 12 inches shall support a load of 2,000 pounds and show a deflection of not less than 0.32 inch. The contractor shall have the right to make and break three bars from each heat or run of metal, and the test shall be based upon the average results of the three bars. Should the dimensions of the bars differ from those above given, a proper allowance therefor shall be made in the results of the tests.

Sec. 10. The straight pipes shall be cast in dry sand molds in a vertical position. Pipes 16 inches or less in diameter shall be cast with the hub end up or down, as specified in the proposal. Pipes 18 inches or more in diameter shall be cast with the hub end down.

The pipe shall not be stripped or taken from the pit while showing color of heat, but shall be left in the flasks for a sufficient length of time to prevent unequal contraction by subsequent exposure.

Sec. 11. The pipes and special castings shall be smooth, free from scales, lumps, blisters, sand holes, and defects of every nature which, in the opinion of the engineer, unfit them for the use for which they are intended. No plugging or filling will be allowed.

Sec. 12. All pipes and special castings shall be thoroughly cleaned and subjected to a careful hammer inspection. No casting shall be coated unless entirely clean and free from rust, and approved in these respects by the engineer immediately before being dipped.

Sec. 13. Every pipe and special casting shall be coated inside and out with coal-tar pitch varnish. The varnish shall be made from coal tar. To this material sufficient oil shall be added to make a smooth coating, tough and tenacious when cold, and not brittle, nor with any tendency to scale off.

Each casting shall be heated to a temperature of 300° Fahrenheit immediately before it is dipped, and shall possess not less than this temperature at the time it is put in the vat. The ovens in which the pipes are heated shall be so arranged that all portions of the pipe shall be heated to an even temperature. Each casting shall remain in the bath at least five minutes.

The varnish shall be heated to a temperature of 300° Fahrenheit (or less, if the engineer shall so order), and shall be maintained at this temperature during the time the casting is immersed.

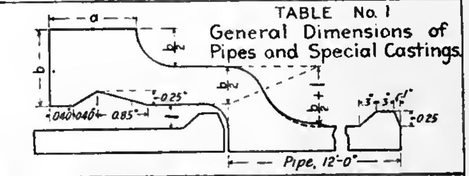
Fresh pitch and oil shall be added when necessary to keep the mixture at the proper consistency, and the vat shall be emptied of its contents and refilled with fresh pitch when deemed necessary by the engineer. After being coated, the pipes shall be carefully drained of the surplus varnish. Any pipe or special casting that is to be recoated shall first be thoroughly scraped and cleaned.

Sec. 14. When the coating has become hard, the straight pipes shall be subjected to a proof by hydrostatic pressure, and, if required by the engineer, they shall also be subjected to a hammer test under this pressure.

The pressure to which the different sizes and classes of pipes shall be subjected are as follows:

	20-inch diameter and larger. Pounds per sq. in.	Less than 20-inch diameter. Pounds per sq. in.
Class A pipe.........	150	300
Class B pipe.........	200	300
Class C pipe.........	250	300
Class D pipe.........	300	300
Class E pipe.........	350	350
Class F pipe.........	350	350

TABLE No. 1
General Dimensions of Pipes and Special Castings.



Nominal Diam. INCHES	Classes	Actual Outside Diam. INCHES	Diam. of Sockets: Pipe INCHES	Diam. of Sockets: Special Castings INCHES	Depth of Sockets: Pipe INCHES	Depth of Sockets: Special Castings INCHES	"a"	"b"
4	A,C,E	4.80	5.60	5.70	3.00	4.00	1.50	1.30
-	G,I,K	5.00	5.80	-	-	-	-	-
6	A,C,E	6.90	7.77	7.80	-	-	-	1.40
-	G,I	7.10	7.90	-	-	-	-	-
8	A,C,E	9.05	9.85	10.00	3.50	-	-	1.50
-	G,I	9.30	10.10	-	-	-	-	-
10	A,B,C,D	11.10	11.90	12.10	-	4.50	-	-
-	E,F,G,H	11.40	12.20	-	-	-	-	-
12	A,B,C,D	13.20	14.00	14.20	-	-	-	1.60
-	E,F,G,H	13.50	14.30	-	-	-	-	-
14	A,B,C,D	15.30	16.10	16.35	-	-	-	1.70
-	E,F,G,H	15.65	16.45	-	-	-	-	-
16	A,B,C,D	17.40	18.40	18.60	4.00	5.00	1.75	1.80
-	E,F,G,H	17.80	18.80	-	-	-	-	-
18	A,B.	19.25	20.25	20.40	-	-	-	1.90
-	C,D	19.50	20.50	-	-	-	-	-
-	E,F	19.70	20.70	20.70	-	-	-	-
20	A,B	21.30	22.30	22.50	-	-	-	2.00
-	C,D	21.60	22.60	-	-	-	-	-
-	E,F	21.90	22.90	23.00	-	-	-	-
24	A,B	25.40	26.40	26.60	-	-	2.00	2.10
-	C,D	25.80	26.80	-	-	-	-	-
-	E,F	26.10	27.10	27.10	-	-	-	-
30	A,B	31.60	32.60	32.60	4.50	-	-	2.30
-	C,D	32.00	33.00	33.00	-	-	-	-
-	E,F	32.40	33.40	33.40	-	-	-	-
36	A,B	37.80	38.80	38.80	-	-	-	2.50
-	C,D	38.30	39.30	39.30	-	-	-	-
-	E,F	38.70	39.70	39.70	-	-	-	-
42	A,B	44.00	45.00	45.00	5.00	-	-	2.80
-	C,D	44.50	45.50	45.50	-	-	-	-
-	E,F	45.10	46.10	46.10	-	-	-	-
48	A,B	50.20	51.20	51.20	-	-	-	3.00
-	C,D	50.80	51.80	51.80	-	-	-	-
-	E,F	51.40	52.40	52.40	-	-	-	-
54	A,B	56.40	57.40	57.40	5.50	5.50	2.25	3.20
-	C,D	57.10	58.10	58.10	-	-	-	-
-	E,F	57.80	58.80	58.80	-	-	-	3.80
60	A,B	62.60	63.60	63.60	-	-	-	3.40
-	C,D	63.40	64.40	64.40	-	-	-	-
-	E,F	64.20	65.20	65.20	-	-	-	4.00

TABLE No. 2
Standard Thicknesses and Weights of Cast Iron Pipes
12 feet in length exclusive of socket

Nominal Diameter of Pipe	Class A Thickness of Shell INCHES	Class A Weight per Length POUNDS	Class B Thickness of Shell INCHES	Class B Weight per Length POUNDS	Class C Thickness of Shell INCHES	Class C Weight per Length POUNDS	Class D Thickness of Shell INCHES	Class D Weight per Length POUNDS	Class E Thickness of Shell INCHES	Class E Weight per Length POUNDS	Class F Thickness of Shell INCHES	Class F Weight per Length POUNDS	Class G Thickness of Shell INCHES	Class G Weight per Length POUNDS	Class H Thickness of Shell INCHES	Class H Weight per Length POUNDS	Class I Thickness of Shell INCHES	Class I Weight per Length POUNDS	Class K Thickness of Shell INCHES	Class K Weight per Length POUNDS
4	.34	200			.36	215			39	230			.42	245			.45	260	.48	275
6	.38	330			.42	355			.46	385			50	415			.54	440		
8	.42	475			.48	525			.53	575			.58	630			.63	685		
10	.47	650	.50	685	.53	725	.56	765	.60	805	.63	845	.67	885	70	925				
12	.49	810	.53	865	.57	920	.61	980	.65	1035	.69	1090	73	1150	77	1210				
14	.53	1010	.57	1085	.61	1155	.66	1230	.70	1300	.75	1380	.79	1450	83	1530				
16	.55	1215	.60	1310	.65	1410	.70	1500	.75	1600	.80	1700	.85	1800	.90	1900				
18	.57	1410	.63	1540	.69	1660	.75	1790	.80	1910	.86	2040								
20	.60	1610	.66	1760	72	1920	.79	2080	.85	2250	.92	2410								
24	.64	2050	72	2290	80	2530	88	2770	.95	3000	1.03	3240								
30	.71	2860	.81	3230	91	3600	1.01	3950	1.10	4320	1.20	4680								
36	.79	3800	.90	4270	1.02	4830	1.13	5300	1 25	5900	1.37	6360								
42	.87	4900	1.00	5560	1.13	6270	1.27	6970	1.40	7700	1.53	8350								
48	.95	6130	1.10	6970	1.25	7900	1.40	8780	1.55	9740	1.70	10600								
54	1.03	7510	1.20	8600	1.37	9800	1.54	10900	1.72	12350	1.90	13500								
60	1.10	8900	1.30	10300	1.50	11900	1.70	13300	1.90	15100	2.10	16500								

SEC. 15. The pipes and special castings shall be weighed for payment under the supervision of the engineer, after the application of the coal-tar pitch varnish. If desired by the engineer, the pipes and special castings shall be weighed after their delivery, and the weights so ascertained shall be used in the final settlement, provided such weighing is done by a legalized weighmaster. Bids shall be submitted and a final settlement made upon the basis of a ton of 2,000 pounds.

SEC. 16. The contractor shall provide all tools, testing machines, materials, and men necessary for the required testing, inspection, and weighing at the foundry of the pipes and special castings; and, should the purchaser have no inspector at the works, the contractor shall, if required by the engineer, furnish a sworn statement that all of the tests have been made as specified, this statement to contain the results of the transverse tests upon the test bars.

SEC. 17. The engineer shall be at liberty at all times to inspect the material at the foundry, and the molding, casting, and coating of the pipes and special castings. The forms, sizes, uniformity, and conditions of all pipes and other castings herein referred to shall be subject to his inspection and approval, and he may reject, without proving, any pipe or other casting which is not in conformity with the specifications or drawings furnished.

SEC. 18. The inspector at the foundry shall report daily to the foundry office all pipes and special castings rejected, with the causes for rejection.

SEC. 19. All the pipes and other castings must be delivered in all respects sound and conformable to these specifications. The inspection shall not relieve the contractor of any of his obligations in this respect, and any defective pipe or other casting which may have passed the engineer at the works or elsewhere shall be at all times liable to rejection when discovered, until the final completion and adjustment of the contract, provided, however, that the contractor shall not be held liable for pipes or special castings found to be cracked after they have been accepted at the agreed point of delivery. Care shall be taken in handling the pipes not to injure the coating, and no pipes or other material of any kind shall be placed in the pipes during transportion or at any time after they receive the coating.

SEC. 20. Wherever the word "engineer" is used herein, it shall be understood to refer to the engineer or inspector acting for the purchaser, and to his properly authorized agents, limited by the particular duties intrusted to him.

A Septic Disposal System for the sewage of the county court building at Clayton, Mo., has recently been built in an adjoining public park by the Cameron Septic Tank Company, of Chicago. It has a capacity of 10,000 to 15,000 gallons per day and cost $2,750.

Disk Anchors for temporarily holding brush jetties have been designed by Mr. John O. Holman. They are mushroom shaped and 10, 16 and 20 inches in diameter. They are dished about one-fourth of their diameter and weigh 15, 26 and 50 pounds respectively. There is a large hole at the center and two smaller holes near by, the latter for securing the mooring cable. A hollow pipe with a conical nozzle is thrust into the large hole and the anchor and pipe sunk like a jet pile by forcing a stream of water down the pipe. When it is desired to take up the anchor, the end of the pipe is loosely attached to the cable so as to make the latter act as a guide and run down to the bottom; the jet of water is then turned on and in a short time the anchor is jetted free.

The Unusual Rainfall Conditions in eastern Massachusetts in the early part of 1901 are discussed in the report for that year of the Metropolitan Water and Sewerage Board. There was an unusually low rainfall and flow of the streams from the first of January to March 10. The average yield for the month of February on the Sudbury watershed was 300,000 gallons per day per square mile, while the next lowest record for that month in a period of 27 years was 541,000 gallons, and an average is 1,889,000 gallons. Immediately following this drought there was a remarkably large rainfall in March, April and May, nearly one-half the rainfall of an average year.

The Cost of Dredging with Different Classes of Plant.

Somewhat condensed from a paper read before the International Navigation Congress at Düsseldorf by Mr. John Bogart, M. Am. Soc. C. E.

The excavations for a large canal have been in progress under the direction of the writer during the years 1897, 1898, 1899, 1900, and 1901. In this period there have been moved 5,868,000 cubic yards. Of this material 1,436,000 cubic yards were excavated under water by dredgers of several different types, and 4,432,000 cubic yards were excavated above ground by steam shovels and certain special forms of graders and excavators and conveyors, this latter amount including 88,700 cubic yards of rock requiring blasting.

The canal is in St. Lawrence County, New York, and connects the St. Lawrence River with the Grasse River. Its length is 16,200 feet. It carries water from the St. Lawrence River above the Long Sault Rapids to the Grasse River, the water of which is at this point about 44 feet below that of the St. Lawrence. Here there has been built a power-house for the development of water-power and electricity. [The works have been fully illustrated in The Engineering Record of January 6, February 10 and November 3, 1900.] The design for the complete works includes a lock to transfer vessels from the canal to the Grasse River, and through that river to the St. Lawrence below the Rapids. The lift of this lock will vary with the elevation of the water in the two rivers—never exceeding 45 feet.

The alignment of the canal is very direct. It has but three curves, each of 5,730 feet radius. There are two deep excavations, each about 3,000 feet long, in which the natural surface has a maximum elevation of about 72 feet above water-surface in the canal. Throughout the remainder of its length the natural surface averages from 12 to 14 feet above water-surface. The whole canal is in excavation.

The St. Lawrence River, at the entrance to the canal, fluctuates in height about 2½ feet as a maximum. The fluctuations in the Grasse River are generally 4½ feet, the river being near its low stage during the greater part of the year. Occasionally the river has attained a height of 14 feet above low water for a few hours. This occurs only under certain conditions of ice, in winter, which set the water back.

The area of the water section of the canal when finally completed will be 5,870 square feet. The dimensions below water surface will be 187½ feet wide at bottom, 265.3 feet wide at water surface, 25.93 feet depth of water. The total excavation requisite to secure this water section will amount to 7,760,000 cubic yards.

After some progress had been made, it was decided to excavate at first a canal with a water section of 2,574 square feet, the reduction being made so as to permit the development of a large amount of power sooner than could be done if the whole excavation were completed before transmission of water through the canal. The canal with this reduced section has been completed. The present dimensions below water surface are: 155.8 feet wide at bottom; 199.3 feet wide at water surface; 14.5 feet depth of water.

The material excavated was largely alluvial deposit. A soft gray clay, with some sand, some gravel, some boulders, and with loam at the surface, was found everywhere, except at the two high ridges. At these the material was an indurated clay with gravel and large boulders. This indurated material was very difficult to excavate. Power and dynamite were used freely in all excavations made above water. Very powerful steam shovels could not work advantageously until the indurated material was blasted; the conditions of the locality, difficulty in obtaining suitable dredgers, and the unexpected failure of the two very large vacuum dredgers hereafter described, led to the excavation by steam shovels and other methods of dry removal for about three-quarters of the total amount moved, and only about one-quarter by dredging under water.

The dredgers used have been of the following types:

Centrifugal Pump Dredgers.—The excavation made by a rotary cutter; the excavated material forced to its place of deposit through long steel pipes. In one of these dredgers the pipe was 12 inches in diameter, in another it was 18 inches in diameter.

Dipper Dredgers.—The excavation made in the usual way by the scoop dipper with movable back; deposited in scows, and these towed by tugs to the place of deposit in water.

Vacuum Pump Dredgers—The excavation made by an orange-peel bucket, deposited in a hopper and transmitted by use of vacuum chamber through long steel pipes to place of deposit. This pipe was for these dredgers 18 inches in diameter.

The centrifugal pump dredger with suction and discharge pipes of 1 foot diameter was built on the ground where some excavation had been made, water was pumped to this excavation after the dredger was built so as to float it, and a sufficient supply of water was continued by pumping to allow the dredger to work without interruption.

The hull is southern pine, 65 feet long; 30 feet wide; 6 feet deep. The longitudinal timbers on bottom are 8x12 inches and 3 feet center to center. The timbers on each side of the center are double 16x12 inches. The side uprights are 6x8 inches and 3 feet center to center. The whole is covered by plank 3 inches thick. At the front of the hull is an A frame of timber 12x12 inches, reinforced by two steel 1¾ inch rods to each timber. The top of this frame is 45 feet high above the deck. It is anchored by two other timbers 12x12 inches, running from its top back to each side of the hull 24 feet from the front, and also by two 2 inch rods from its top to each side of the deck at the middle of the hull. Six feet above the deck is a cross-piece on the A frame, the center of which supports the foot of a timber boom or frame, the other end of which is supported by a wire cable from the top of the A frame. At the end of the boom are three sheaves, each carrying wire cable; two of these swing the dredger from side to side, the other raises and lowers the timber frame which supports the suction pipe, the cutting instrument, and the shaft operating this cutter. At the stern of the hull are two anchoring spuds of timber, 9x16 inches and 40 feet long. These are raised or lowered by cables running through sheaves on a square timber frame, and by means of these spuds the dredger is held in position and is moved forward or backward by raising one spud, swinging the hull, dropping that spud, raising the other, and swinging in the other direction.

The movable frame is 45 feet long, made of two timbers, each 12x12 inches, with space between them for the suction pipe, 12 inches in diameter. A shaft of steel 4 inches in diameter is above the suction pipe. The frame and its appurtenances is raised, lowered, and held in position by the cable from the A-frame passing through the sheave at end of boom and running to the engine. The suction-pipe and the cutter-shaft are jointed so as to allow free vertical movement of their supporting frame. The cutter is composed of blades which radiate from the end of the shaft and are curved backward and connected at their outer ends by a ring of metal, thus forming a skeleton basket-shaped frame, 3½ feet in diameter at base and 2 feet 10 inches deep. The shaft passes through the center of this cage and the blades are forged together and attached to the end of the revolving shaft.

The number of blades varies with the character of the material excavated, adhesive material and clay requiring greater space between the blades than free friable earth or sand. In the soft clay excavated by this machine a space of about 2½ inches between the blades was found advisable.

The end of the suction pipe is fixed at the rear or base of this cutter. When the shaft and cutter revolve, the blades loosen and cut into the material against which the cutter is held. This disintegrated material passes between the blades into the interior of the basket and thence directly into the suction pipe with a volume of water ranging with the character of material excavated. This pipe goes directly to the centrifugal pump. This pump is connected to a separate compound condensing engine of 125 horse-power. It is capable of operating against a head of 60 feet. It delivers the water and excavated material directly into the pipe which passes out from the stern of the dredger. This pipe is of wrought iron, spiral-riveted. Its lengths are connected by flanges bolted together, and at convenient intervals there are placed sections of heavy rubber pipe 6 feet in length, thus permitting all requisite changes of alignment. The length of the discharge pipe actually used for this work was generally 1,200 feet. The pump forced the water and material through this and greater lengths of pipe without difficulty. The lift above the surface of the water in which the dredger floated averaged 30 feet.

The Lidgerwood engine, which does all the work except actuating the pump, is in the forward part of the boat and has a cylinder 6¼x10 inches, link motion, with six drums. One drum raises and lowers the cutter and suction pipe; two drums swing the boat from side to side, and two raise and lower the anchoring spuds. The same engine turns the shaft of the cutter. The boiler is of 125 horse-power and supplies steam at a pressure of 125 lbs. Every movement of the machinery is controlled by one man, operating levers placed in a house on the upper forward deck of the dredger.

As the cutter revolves, the frame carrying it and the outer end of the suction pipe is slowly moved sideways, the whole boat swinging upon one of the anchored spuds as a pivot, until the edge of the required excavation is reached. The frame is then lowered enough to cut another slice of material, and then moved in the other direction. This operation is repeated until the proper depth is attained. Then the dredger is moved backward for another cutting.

The water with the excavated material is delivered at the outer end of the discharge pipe. The amount of material carried with the water varied from 7 to 30 per cent. The usual running average of excavated material was about 25 per cent. The semi-fluid mass was so directed that it spread over a considerable area of land, depositing the solids gradually, the water running to one of the rivers or at certain points back into the canal. When sufficient area was provided so that there was time for precipitation, the water became quite clear. When it ran to the river within a short time it carried with it about 2¼ per cent. of suspended material. This dredger was not able to excavate the indurated material above described. It did excavate successfully the soft clay and loam and sand, separately or as they occurred in combination. It worked continuously throughout each season, except when ice prevented. Rain and bad weather did not interfere with it. It was run 22 hours during each 24 hours, except on Sundays. It was served by two sets of men, each working 11 hours. It excavated and delivered during three seasons 459,800 cubic yards. The cutting was made to a maximum depth of 22 feet below the surface of water in which the dredger floated, and the material was raised an average of 30 feet above that water and deposited an average of 1,200 feet from the dredger. This dredger requires for its operation one captain, one engineman, one oiler, one fireman, one foreman of deck hands, and three men. The compensation of the force at the average rates paid during the progress of this work amounted for each shift of 11 hours to $17.95.

For each day of 22 hours	$35.90
Oil, waste, etc., for 22 hours	5.00
Coal, 9 tons at $3, for 22 hours	27.00
Total each 22 hours	$67.90

This amount includes the labor required in placing and taking care of the discharge pipe as well as in operating the dredger. The pay of the deck hands, the lowest-priced labor employed on this dredger, was $1.65 for the 11 hours, or 15 cents per hour. The above cost of $67.90 thus equals 41.18 days' pay of this class of labor. These laborers were selected as partially skilled men, the pay of common unskilled labor being 12½ cents per hour, or $1.375 per day of 11 hours. The price of coal is more than it would be in many parts of the United States.

The cost of this dredger was $40,000. Interest at 4 per cent. is $1,600 per annum. The life of the dredger would not exceed about ten years—that is to say, it would not require an expenditure equal to the original cost of the dredger to keep it in constantly good condition, and to have it in that condition at the end of ten years. There must therefore be charged against the work done $4,000 per annum for repairs and renewals, and $1,600 per annum for interest.

In the locality of this canal, and generally in the northern parts of the United States, dredging can only be done during about eight months of the year. The annual cost for repairs, renewals, and interest must in this particular case be distributed over the actual working days, say $26.80 per working day. The dredger must be cared for during the winter season, at a cost which, distributed over the actual working days, may be charged at $1 per working day.

The total cost per actual working day of 22 hours is thus:

Labor and supervision	$35.90
Coal at $3 per ton	27.00
Supplies	5.00
Interest, repairs and renewals	26.80
Care during winter	1.00
Total	$95.70

As stated above, this dredger excavated during three seasons 459,800 cubic yards. Very careful observations were made of actual working days occupied in the excavation of 218,250 cubic yards. This amount was excavated and discharged in 194 working days, thus giving for this large volume an average of 1,125 cubic yards per day of 22 hours.

The average cost was thus, with allowance for repairs, renewals, care in winter, coal, supplies, and labor, 8,507 cents per cubic yard.

It will be observed that if the cost of labor, coal, and supplies alone was taken into consideration, the resulting average cost would be 6.035 cents per cubic yard. This compares with statements of cost of dredging which have been made with reference to other works. The cost of capital invested and of repairs and renewals is certainly an actual element of cost of work done.

The centrifugal pump dredger with suction and discharge pipe of 18 inches diameter was substantially of the same construction as the one with 12-inch suction and discharge pipe already described quite fully. All parts were correspondingly larger. The hull of this dredger was that of one of the vacuum dredgers, hereinafter referred to, which was incapable of economically working in this material. The hull is 103 feet long, 34 feet wide, and 10 feet deep. The vacuum machinery and the excavating bucket and all attachments were removed. A centrifugal pump, 18-inch suction and discharge, and an engine, drums, cutter, cutter shaft, suction pipe and other machinery were put in.

The mode of operating this dredger is exactly the same as the 12-inch one already described. It excavated similar material. It worked through two seasons except when ice prevented. It was run 22 hours each day, except Sundays, and was managed by two sets of men, each working 11 hours. It excavated and delivered during two seasons 290,780 cubic yards. The cutting was made to a depth of 22 feet below the surface of the water in which the dredger floated, and the material was raised an average of 30 feet above that water, and deposited an average of 1,200 feet from the dredger.

This dredger requires for its operation one captain, one engineman, one oiler, one fireman, one spud-tender, one foreman of deck hands, and three men. The compensation of this force at the average rates paid during the progress of the work amounted for each shift of 11 hours to $20.95.

Or for each day of 22 hours	$41.90
Oil, waste, etc., for 22 hours	8.00
Coal, 18 tons at $3, for 22 hours	54.00
Total each 22 hours	$103.90

This included placing and taking care of the discharge pipe.

The cost of a new dredger similar to this one would be $60,000. Interest at 4 per cent. is $2,400 per annum. Repairs and renewals, as explained for the similar dredger, would be for this dredger $6,000 per annum. These distributed over actual working days would be $40.19 per working day. The care during winter distributed over the actual working days cost $1 per day.

The total cost per actual working day of 22 hours is thus:

Labor and supervision	$41.90
Coal at $3 per ton	54.00
Supplies	8.00
Interest, repairs and renewals	40.19
Care during winter	1.00
Total	$145.09

Careful observations show that this dredger excavated and discharged 246,983 cubic yards in 160 working days, thus giving an average of 1,543.6 cubic yards per day of 22 hours. The average cost was thus, with allowance for repairs, renewals, care in winter, coal, supplies, and labor, 9,399 cents per cubic yard.

The excavation made by dipper dredgers and delivered into scows at side of dredgers amounts to 525,306 cubic yards. One of these dredgers has a dipper with a capacity of 2½ cubic yards. The dipper has three steel teeth, about 6x5 inches. The hull is 85 feet long, 28 feet wide and 10 feet deep. There are three anchoring and supporting spuds, each 20 inches square. The dipper arm is 28 feet long, of wood sheathed with steel. The material was delivered into scows, each having a dropping pocket with a capacity of 140 cubic yards. A tugboat took these scows in turn into the St. Lawrence

River, dropping the excavated material in a bay near the mouth of the canal. The distance to which the scows were towed averaged about 5,500 feet.

The dipper dredger worked ten hours per day. The tug and scows could not be operated at night. This dredger excavated to a depth of 20 feet below water surface.

The cost of operating this dredger, including the crew of dredger, tug and scows, coal, supplies, etc., was for each day of ten hours $30.56.

The cost of dredger, tug, and two scows is $43,000. Interest at 4 per cent. is $1,720 per annum. One-tenth cost for repairs and renewals is $4,300 per annum. These distributed over actual working days would be $28.80 per working day. Care during winter months, distributed over working days, $1 per day. The total cost per actual working day of ten hours is thus:

Labor, supervision, coal and supplies........	$30.56
Interest, repairs and renewals..............	28.80
Care during winter.........................	1.00
Total	$60.36

This dredger excavated, delivered into scows, and deposited in the river 138,001 cubic yards in 183 days of 10 hours, thus giving an average of 754.1 cubic yards per day of 10 hours. The average cost was thus, with allowance for repairs, renewals, care in winter, coal, supplies, and labor, both for dredger, scows, and towing tugs, 8.004 cents per cubic yard.

This excavation was in indurated material, as described above. Neither the centrifugal pump dredgers nor the orange-peel bucket dredgers referred to below could excavate this material.

Another larger and heavier dipper dredger worked during one season. This has a dipper with a capacity of 6 cubic yards, with which it excavated the indurated material, depositing it into scows in the same manner as the dredger last above described. The location of its working was such as to make it impracticable to keep an account of the amount of material moved by it during sufficiently prolonged periods to warrant an exact statement and comparison with the figures of cost of the other dredgers above given. While the amount per day excavated by this large dredger was greater, the cost per cubic yard was about the same as that shown by the smaller dipper dredger as given directly above.

Another dipper dredger, with a scoop of 1½ cubic yards capacity, worked during one season. It was quite similar to the one with the dipper of 2 cubic yards capacity, and the cost of excavating and depositing material by it was the same as stated above.

Soon after the beginning of the work on this canal, two large dredging machines were built at Buffalo, and brought by water to the canal. The designers of these machines expected that they would give effective and economical results, both in the indurated and in the softer material. The two machines were of exactly the same design and construction.

The hull is 103 feet long, 34 feet wide, and 10 feet deep. There are two decks, the upper one having sleeping and living rooms for the captain and all hands. All parts of the hull and upper works are strongly braced with heavy timbers and steel rods. The dredger is provided with large water tanks and coal hoppers. There are three anchoring spuds—two forward and one near astern. These are operated by an independent double-drum engine. There are two marine boilers, each of 150 horse-power, supplied with water by two Blake pumps. Two steel vacuum chambers are near the center of the boat, each cylindrical, 5 feet in diameter, 19 feet high. There is a hopper attached to the bow of the dredger, 40 feet long, 12 feet wide, built of I-beams covered with ⅜-inch steel.

The bottom of the hopper slopes to the center of the boat. A suction pipe, 18 inches in diameter, runs from the center of the hopper into and close to the bottom of the hull, backward 35 feet, where it connects by a Y to two pipes, also 18 inches in diameter, going to the two vacuum chambers. From each of these an 18-inch pipe leads aft to a Y, whence an 18-inch discharge pipe passes out from the stern of the boat. There are four 18-inch valves, one in each branch of each Y. These valves are separately operated by steam pistons controlled at the pilot-house. In the hopper at the entrance to the suction pipe is a cutter with four 2½-inch blades. This cutter is run by a separate double-cylinder engine. A high-pressure Blake pump, 10-inch suction and 8-inch discharge, supplies water to the hopper.

A heavy A frame, 26 feet from the bow, carries a cable passing from the engine drum to the outer end of a boom 40 feet long. This frame also carries the cables for operating the dredger bucket. This bucket is suspended from two sheaves, 30 inches in diameter, near the end of the boom. The bucket has a capacity of four cubic yards. It is of the form known as the Hayward orange-peel type, so-called from its resemblance to the peel of an orange when cut into quarter pieces. It has four triangular curved blades, which, when closed, form a tight semi-spherical bowl. When open the blades resemble sharp spades, and are so adjusted to steel arms, connecting rods and cables, that the maximum downward digging effect is produced with but slight tendency to lift the bucket until closed. The dredging is done by the main engine placed at the back of the pilot house. This has cylinders 14x18 inches and two drums 30 inches in diameter carrying the hoisting cables.

A 4-inch high-pressure Blake pump supplies water to the vacuum chambers and is regulated by pressure valves, so that it will stop acting when the chambers have the requisite pressure. A direct current generator supplies electric light.

All machinery is controlled by levers placed in the pilot house at the bow of the boat.

The dredging is done by the orange-peel bucket in the ordinary manner. This lifts the material from the bottom or sides of the excavation and drops it into the hopper, which is supplied with water by the large pump. The cutter is revolving in order to disintegrate the mass of excavated material. Steam is turned into one of the vacuum chambers, and then cold water is pumped in through a spray, condensing the steam and forming a vacuum. The forward valve is then opened and the water and excavated material drawn from the hopper into the chamber. The valve is then closed, the rear valve opened, steam turned into the chamber, forcing the water and excavated material into and through the discharge pipe. While one vacuum chamber is discharging the other should be filling, their work alternating and the discharge made practically continuous.

An orange-peel bucket with a capacity of one cubic yard had been successfully operated in excavating the soft clay from the canal near the Grasse River. This was supported on a movable platform on land. The clay was wet but not under water. It was expected that this large floating dredger would be more advantageous. It was found, however, that this large bucket was quite incapable of excavating the indurated material. It could not move sufficient to pay for its maintenance. It could excavate the softer material; but the hopper, the cutter and the vacuum method of transmission failed to transport the material with economy. It formed into balls and lumps in the hopper and did not flow with the water as suspended material but rather as small separate masses carried through the pipes. The steam capacity, though large, was not sufficient to operate the vacuums alternately with continuity, and thus, instead of a steady flow through the discharge pipe, there was an intermittent series of impulses. The attempt to use these vacuum orange-peel dredgers for this excavation was abandoned, and one of them was rebuilt as the centrifugal pump dredger with 18-inch discharge pipe, described above. The other vacuum dredger was sent to the vicinity of New York, and is working in material quite different from any encountered in the canal.

No ladder of continuous scoop dredgers were used on this work. Experience on the St. Lawrence River not very far from this locality had shown good results from such dredgers, and it is regretted by the writer that the contractors did not place at least one such in operation.

Summarizing the statements above made: The total amount excavated by dredgers in this canal was 1,436,000 cubic yards. There were in addition excavated by other means 4,433,000 cubic yards.

The vacuum pump dredgers with orange-peel buckets and pipe transmission lines were not serviceable in excavating and transmitting either the indurated or the softer material.

The centrifugal pump dredger excavating by revolving cutter to depths under water not exceeding 22 feet, lifting the material to a height of 30 feet above water and depositing it through a pipe of 12 inches diameter, 1,200 feet distant from the canal, could not excavate the indurated material but worked with success in the softer material. It excavated and deposited in three seasons 459,800 cubic yards of this material at an average cost of 8.507 cents per cubic yard, this cost including labor, supplies, coal, repairs, renewals and care during the winter seasons.

The centrifugal pump dredger, generally similar to the one last mentioned but with a discharge pipe 18 inches in diameter, working in the softer material, excavated and deposited in two seasons 290,780 cubic yards at an average cost of 9.399 cents per cubic yard. The centrifugal pump dredgers worked 22 hours of each 24 hours.

The dipper dredgers excavated during three seasons 525,306 cubic yards. This was indurated material. It was deposited in scows and towed by tugs and deposited in water about 5,500 feet from the dredgers. One of these dredgers with a dipper of 2½ cubic yards capacity, working 10 hours each day and excavating to a depth of 20 feet below the water surface, lifted and delivered 138,001 cubic yards in 183 working days of 10 hours, at an average cost of 8.004 cents per cubic yard, this cost including labor, supplies, coal, repairs, renewals and care in winter, for the dredger, scows and tug for towing.

Coal is included in these statements at a cost of $3 per ton; the modification for a different price of coal can be readily found.

In latitudes where dredging can be done during all seasons of the year the modification required can be easily made from the data above given; the cost per unit will be reduced provided also there is continuous work for the dredger throughout the year.

The Noted Burr Bridge at Harrisburg, one of the oldest in the country, is to be torn down. The piers were begun in 1812 and the first vehicle passed over it in 1816. In 1846 it was partly wrecked by a flood and in 1866 by fire. It was originally built from Theodore Burr's designs at a cost of $192,000.

Reconstruction of the Lake Winnibigoshish Dam.

Two very interesting types of movable weirs were constructed during 1900 by the Corps of Engineers, U. S. A., in carrying out the plans for the reconstruction of the dams at the headwaters of the Mississippi River. They are described in the report of Captain H. M. Chittenden, which forms a part of the report of the Chief of Engineers for the year 1900, and the following account of the work has been prepared from the description there given:

The Lake Winnibigoshish reservoir was completed in 1884 at a cost of $238,000. The dams consisted of 2,546 linear feet of low dikes, 1,009 linear feet of embankment 20 feet high above low water, and 172 linear feet of Norway and white pine timber cribwork filled with granite bowlders. The controlling works were in the latter structure. The dikes were built of fine sand and sodded and were 10 feet wide on top, having a slope on the lake side 2 horizontal to 1 vertical, on the lower side 1½ to 1, height 4.8 feet above flowage line. The embankments at each end of cribwork were also of sand, but contained a center core of puddled clay in which was embedded a 6-inch timber diaphragm. Top width of embankment, 10 feet; slopes 2 to 1. The upstream slope was covered with a 4-inch layer of clay and 12 inches of bowlders, riprap size. The embankments were carried 6½ feet above flowage.

The timbered portions of dam containing the controlling works rested on a pile foundation driven in clay. The foundation measured 172 feet long by 191 feet 6 inches wide, thus giving a wide apron. In cross section the timber dam had a vertical upstream face 19 feet high, top 16 feet wide, then a vertical drop of 9 feet, a horizontal step of 12 feet, and another vertical face 11 feet 9 inches high. The elevation of the upstream apron was 1 foot 9 inches higher than the downstream one; width of upstream apron 49 feet, base of dam 28 feet, width of downstream apron 114 feet and 6 inches, making 191 feet and 6 inches width of foundation. The upstream apron was placed 4.8 feet below low water in Lake Winnibigoshish. There were twenty-five sluices in the dam—twenty-four covered and one open for logs. Twenty-three of the covered sluices were 4 feet wide by 5 feet high, and one was 4 feet 6 inches wide by 5 feet high. The tops of the covered sluices were 0.2 foot above low water in lake and closed by ordinary sliding gates. The log sluice was 5 feet 6 inches wide and closed by stop planks.

By 1898, after fourteen years' service, the Norway pine in the cribwork had become so rotten that the timber dam became unsafe. The general deficiency act approved July 7, 1898, authorized the renewal of the reservoir dams, and the river and harbor act approved March 3, 1899, made an appropriation for the renewal of the Lake Winnibigoshish and Leech Lake dams. The reconstruction of the former was commenced in the spring of 1899 and completed in the fall of 1900. The new structure has been built on the old foundation, which was in excellent condition, but was strengthened by additional piles and lengthened about 3½ feet. The superstructure consists of two concrete abutments, five concrete piers, five steel Tainter gates and one wooden reversed Parker bear trap gate. Four piers are 11 feet by 37 feet 6 inches in plan, and the other is 12 feet 5 inches by 101 feet 6 inches. The abutments are 187 feet 6 inches long.

The concrete was made of Saylor's Portland cement, very fine sand, and crushed granite bowlders, mixed by power in a 4-foot cubical box mixer, in proportion of 1:3:6. Ninety-seven per cent. of the sand passed a No. 50 sieve and 33 per cent. a No. 80 sieve. All the stone was taken at a nominal expense from the old dam and from the dike. The stone was crushed with a jaw crusher and the entire product run to the mixer without being screened. The crushed material varied in size from dust and sand to flat spawls 4 to 5 inches square. In adding sand to the mix allowance was made for the dust and sand in the crushed stone. From three to eight small boulders were placed in each batch before going to mixer. The total amount of concrete laid was 4,444 cubic yards, at a cost of $10.72 per yard. Had the same price been paid for the rock as was paid for that used to replace the rock removed from the dike, the cost of the concrete would have been about $13.

The concrete forms were lined with No. 8 iron. All concrete was laid wet and quaky and rammed or worked with 40-pound rammers. The faces of the blocks are smooth, uniform in color, and present a fine appearance. The concrete is hard and tough. The sides of the sluices where the gates rub are lined with cast-iron plates that were adjusted to true planes after the walls were laid. The blocks of concrete were limited to 12 feet in length; adjoining blocks were doweled together. No effort was made to complete a block in one working day, and the horizontal planes between successive days' work were washed with cement grout and bonded together by bowlders half embedded in each.

The dam is situated near the outlet of a large inland lake, and when the water is high the lake extends to the dam. To avoid the injury that would be occasioned by the thrust of ice during those winters when the water in the reservoir was at a high stage, an expedient has been adopted to prevent thick ice forming above the dam. Slots for stop plank were provided in the abutments and piers close to the upstream faces. During the winter months the gates are kept open, but the sluices are closed with stop planks, except for a thin sheet of water that is allowed to escape over the top plank. This prevents the formation of thick ice.

The Tainter gates are of steel sheathed with 3 inches of oak. Each gate has five sets of radial arms, with six arms in each set, all securely riveted to a built-up steel axle having cast-steel trunnions that revolve in cast-iron journal boxes anchored to the concrete. The gates are counterweighted with concrete weights hung by chains fastened to each end of the gates, which pass over four sheaves supported by steel framework. The hoisting gears are double-purchase winches winding a five-eighths inch chain, this arrangement being separate from the counterweight mechanism. One man can hoist or lower a gate, but as the dam tender has an assistant, it is usual for two men to work together.

The principal dimensions of the gate are: width, 14 feet; height above upper floor, 19½ feet; radius, 24 feet; diameter of trunnion, 10 inches; length of journal bearing, 12 inches; vertical distance of axle above upper floor, 12½ feet.

The gate in the log sluice is a wooden reversed Parker bear-trap with forged steel hinges. The X-leaf is made of 12x12-inch Oregon fir; the Z-leaf of 6x12-inch oak; the Y-leaf of 20x12-inch Oregon fir, and the idler leaf of 9x12-inch Oregon fir. The rise of the Y-leaf is limited by twenty-four 1⅛-inch stud chains. The dimensions of this gate are as follows: length of crest, 12 feet; horizontal distance between base hinges, 55 feet; vertical height between base hinges, 1 foot 9 inches; horizontal distance between hinges on X-leaf with the gate lowered, 22 feet; horizontal distance between hinges on Y-leaf, 36 feet 10 inches; rise, 15 feet 2 inches.

Although the gate is loaded with protecting plates of strap iron and railroad rails, it is sensitive and responds quickly to any movement of the valve. The lowest head at the dam since completion of the gate has been 23 inches; it was sufficient to raise the gate, but the least head required is not known. The gate works well, coming to its final upward position easily and without a jar or jerk.

The concrete conduit for leading the water to the valve and for discharging the water when the gate is to be lowered is 3 feet 6 inches square, and built in the long pier beside the gate. The valve, which is of cast iron, is semi-cylindrical in shape, with its axis vertical, so that when turned so as to just allow the water to enter the bear trap the exit for the water from the trap has begun to close, and when the exit is entirely closed the entrance is entirely open, thus allowing the total head to act in raising the gate. The valve is very much like one of the Tainter gates placed on end. The diameter of the valve is 8 feet, and its height, or length of axis, is 3 feet 8 inches. It has been found to work very well, being turned by a worm and wheel gear placed on top of the pier. A slight pressure on the hand wheel suffices to turn it, and by adjusting the position of the valve the bear trap can be held in any desired position within its range of motion, thus giving an easy and complete control of the discharge.

After having been in service for nearly a month, and having been operated many times, a few minor defects became apparent in the details of the bear-trap gate, which it was deemed advisable to correct. Accordingly, the area occupied by the gate was surrounded by a bulkhead and pumped dry. The observed defects were then removed, and since that time the gate has worked admirably.

The various operations connected with the reconstruction of this dam were carried on in the following order: After clearing away the old dam and preparing the foundation the concrete work was begun. When the concrete portions of the structure were finished, work was begun dismantling the derrick and plant for storage or removal to the Leech Lake dam, which was also being reconstructed at that time. The Tainter gates and also the log sluice gate were then put in place, and in the last of August, 1900, pumping was stopped and the cofferdam allowed to fill. At the same time the pulling up of the sheet piling of the cofferdam was begun, the object being to run the water through the new dam as soon as possible in order to permit the closing of the cut through the dike, through which the Mississippi River flowed during the reconstruction. Timber trestles were placed in the Tainter gate openings to support the gates during erection, and at the same time permit the passage of water. The erection of the gates began toward the last of September, and the steel work went together without trouble, very little drifting being necessary.

The dike through which the temporary cut was made for the river to flow through is 20 feet high above low water in the lake with slopes of 1 on 2. There is a wooden diaphragm of 6-inch sheeting reaching just above the flowage line and surrounded by a well-compacted clay puddle wall about 14 feet wide at the base and 5 feet wide at the top. This timber diaphragm is very well preserved by the clay. The cut through the dike was 100 feet wide at the water surface, and over 6,500 cubic yards of sand and clay were used in filling.

The construction of the concrete counterweights for the Tainter gates was the last work performed during 1900, and the weather had grown so cold by that time that the recesses between the piers were roofed over and the inclosure kept warm by stoves. All work on the reconstruction of the dam ceased about December 1, and there still remained to be done in the spring of 1901 the installation of the cranes for raising the stop planks, some minor work upon the gate hoisting machinery, and the building of booms to protect the dike from waves. This work was started with a small crew on May 14.

The cost of the reconstruction of the Lake Winnibigoshish dam, exclusive of superintendence, office expenses and repairs to the wagon road between the dam and the nearest railway station (11 miles distant) is itemized as follows: Buildings, including cement house, \$5,304.91; plant, \$9,162.95; cofferdams, \$16,301.40; embankments, \$10,380.42; repairs to old foundation, \$23,213.29; concrete at \$10.72 per cubic yard, \$47,664.21; five Tainter gates and one bear-trap gate, \$27,053.60; piers and booms above dam and embankment, \$5,029.41; making a total expenditure up to the end of 1900 of \$144,110.19.

In addition to above, but not included in the cost of reconstruction, the upstream slope of the embankment has been re-covered. The 12 inches of riprap stone did not protect it against wash and scour by rain and wave action. The interstices between the stones appeared to be too large, and it was thought best to place next to the 4-inch layer of clay 6 inches of broken stone and then a layer of bowlders 16 inches thick at the bottom of the slope, tapering to 4 inches at the top of the embankment. A further protection against wave action was provided by a floating timber boom 14 inches deep by 54 inches wide, supported by piles driven into the overflowed bottom lands a short distance above the toe of the embankment. With the exception of the slope covering, the embankments were in first-class condition. The timber diaphragm in the puddled clay core was remarkably well preserved.

As supplementary to the preceding description it may be of interest to give a brief history of what is known as the bear-trap gate or dam. The first to bear this name was built in 1819 by Josiah White on the Lehigh River in Pennsylvania, as a means for the improvement of navigation in the interests of the Lehigh Navigation Company. The following quotation from the "History of Lehigh and Carbon Counties, Pennsylvania," by Alfred Mathews and Austin N. Hungerford explains the situation:

"They [Josiah White and Erskine Hazard] found that they had been misinformed in regard to the lowest point reached by the river, and that the natural flow of the Lehigh was insufficient to give 18 inches and a width of 25 feet as was required by law, and hence they were obliged to resort to the plan of producing artificial freshets. For this purpose a peculiar sluice was needed, and Josiah White devoted himself for several weeks to the work of constructing one, finally producing what came to be known as the 'bear-trap.' He built a miniature experimental sluice in Mauch Chunk Creek, and the name 'bear-trap' was given to it by the workmen who were annoyed by the curious as to what they were making.

"During the year 1819, twelve of these dams and locks were built and the managers fully proved their ability to send to the market, by the artificial navigation, such a regular supply of coal as would supply the demand."

In the "Journal" of the Association of Engineering Societies for June 1896, there was given a complete history of the bear-trap dam, including the analyses of the later forms, from which the following extracts have been taken:

The design of the bear-trap did not receive from American engineers the support that it was entitled to, perhaps because the development of our internal waterways on a large scale was not undertaken until after the French had made an unfortunate construction of one on the River Marne, and forthwith condemned it. The experience in France was widely published and served to prejudice our own engineers.

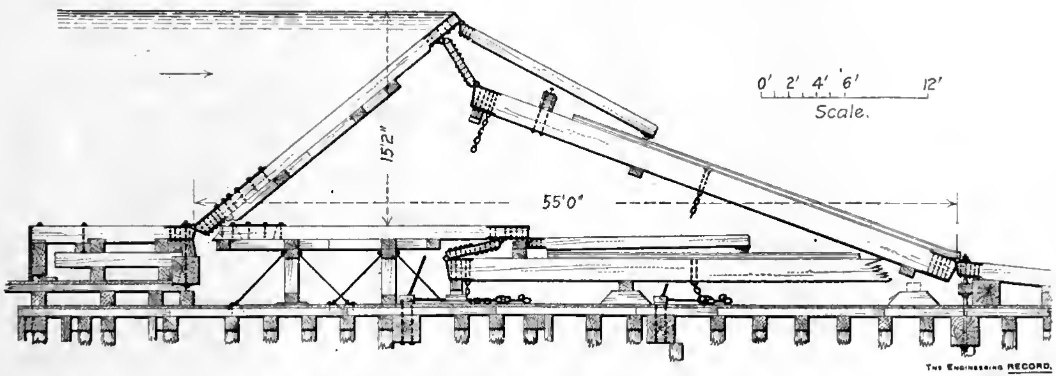
In 1862, Mr. John Du Bois, of Williamsport, Pa., patented a modification of White's design. Mr. Du Bois' gate was followed in France in 1870 by a device of M. Carro. Neither of these alterations were improvements on the prototype. In an attempt to improve on the old bear-trap, Hon. Felix R. Brunot, of Allegheny, Pa., patented in 1867 a "sluice gate for dams and locks."

Mr. Ashbel Welch, the twelfth president of the American Society of Civil Engineers, was one of the first engineers to place confidence in the structure, and the next well-known engineers to look with favor upon the bear-trap were a board of United States officers, who in 1883-4 recommended its adoption at the Beattyville dam on the Kentucky River. Here two gates, each 60 feet long, were built in 1886. In 1888-9 a drift pass 52 feet wide in the Davis Island dam on the Ohio River was closed by a bear-trap, and was in constant use after that time.

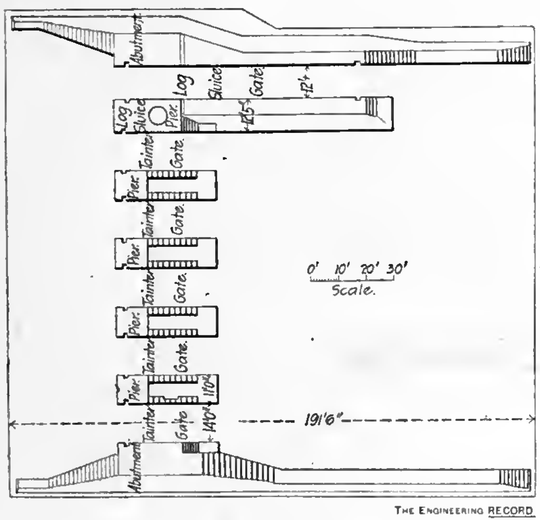
No positive advancement was made over Mr. White's pattern until 1887, when Thomas Parker, of Menomonie, Wis., received a patent for the improvement that marks an era in the development of bear-trap gates. Mr. Parker sought to minimize the two chief defects of the old form, which were friction between the two leaves and the inability to construct a high dam upon a short base.

In 1890 appeared the device of Robert A. Lang, of Eau Claire, Wis., in which he substituted chains and rods for the upper one of Parker's folding leaves, and converted the idler into a functional part of the weir. This, however, is thought by some to be a retrograde step, as introducing more friction. Major Marshall had studied the same idea previously.

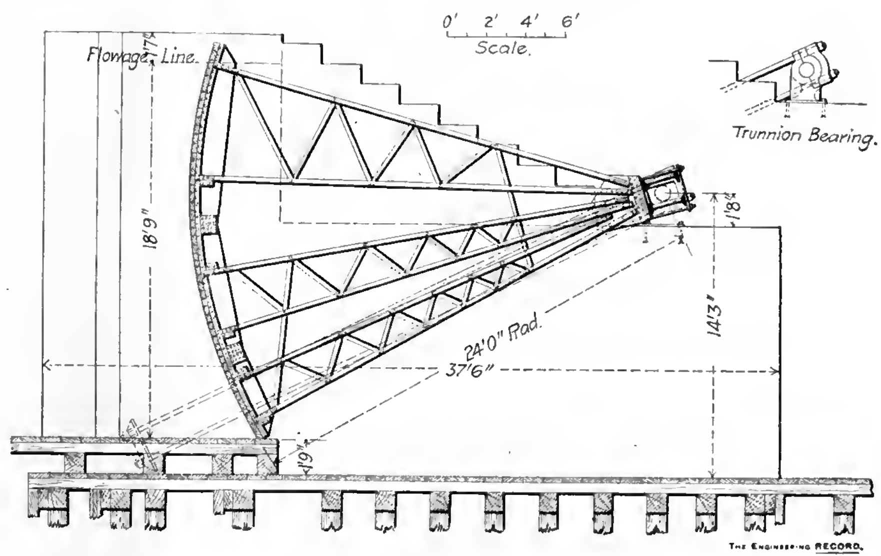
Horace Harding, U. S. Assistant Engineer in the Mobile district, planned a reversed Parker, minus the idler, for a lock gate in 1892. Since then several have independently proposed the same change. In 1892, H. M. Chittenden and A. O. Powell, of the U. S. engineer corps, were detailed to investigate the subject of the forces brought to bear on the gate, and their two analyses are given in the issue of the "Journal" of the Asociation of Engineering Societies from which this history has been prepared. Later developments of the bear-type are more or less well known to engineers, and will therefore not be given here.



THE REVERSED PARKER BEAR-TRAP GATE.



PLAN OF GATES, WINNIBIGOSHISH DAM.



TRANSVERSE SECTION OF ONE OF THE TAINTER GATES.

Relation Between Macadam Roads and Electric Street Railways.

A paper read at the Third Annual Good Roads Convention at Albany by Edward P. North, M. Am. Soc. C. E.

No one can look at the returns of the last census without concern for the future of our rural districts, and consequently on the future of this State. The rewards offered to ambition in 22 counties in this State have in the past ten years grown relatively, if not absolutely, less, and they are being depopulated. The list of those counties, with their population in 1900 and the loss since 1890, is given as follows:

Counties.	Population in 1900.	Loss since 1890.
Allegheny	41,510	1,739
Chenango	36,568	1,208
Columbia	43,211	2,961
Cortland	27,576	1,081
Essex	30,707	2,345
Greene	31,478	120
Lewis	27,427	2,379
Livingston	37,059	742
Madison	40,545	2,347
Orleans	30,164	639
Oswego	70,881	1,002
Otsego	48,939	1,922
Putnam	13,787	1,062
Rensselaer	121,697	2,814
Schoharie	26,854	2,310
Schuyler	15,811	900
Seneca	28,114	113
Tioga	27,951	1,984
Washington	45,624	66
Wayne	48,660	1,069
Wyoming	30,413	780
Yates	20,318	683
Total	845,294	30,266

That is to say: In the 22 counties mentioned there has been a decrease in population of over 3½ per cent. during the past ten years. In this period the State as a whole has gained 1,270,159, a gain of 21.2 per cent., but the gain in cities of 25,000 inhabitants or more has been 1,268,769, so that the gain in our population has been almost entirely made in cities.

In the city of New York, comparing equal areas, the increase between 1890 and 1900 has been from 3,437,202 to 4,507,414, or 1,070,212, which nearly accounts for the net urban gain, some cities of 25,000 and over having lost population.

It will be noticed that of the five counties on the east side of the Hudson from Putnam to Washington, inclusive, all but Dutchess have lost population. The increase in that county, 3,791, is offset by a gain in the population of Poughkeepsie of 3,859. The net loss to the five counties is 3,065 inhabitants.

Comparing our condition with the whole country and neighboring States, we find:

States.	Population in 1900.	Ten years increase.	Pro rating of increase.
United States	76,303,387	12,937,008	20.7
Connecticut	908,420	162,162	21.7
Massachusetts	2,805,346	566,403	25.3
New Jersey	1,883,669	438,736	30.4
New York	7,268,894	1,270,159	21.2

The comparison shows that among the States only Nevada has lost population. In Connecticut there has been a loss in Tolland County, which lies east of Hartford, of 558. In Massachusetts there has been a loss in two counties—Barnstable 1,346, and Nantucket 262; the first of these is east of Buzzards Bay, including Cape Cod, the other is an island. There has also been a loss in two counties of New Jersey—Burlington 287, which lies south of Trenton and east of Camden, and Hunterdon 848, which lies southeasterly from Phillipsburg.

A more intimate knowledge than I possess is requisite for an ex-cathedra statement as to the causes that have reduced the rewards of enterprise and made a decrease in the attractiveness of the above mentioned 22 counties as a place of residence, and there is a promptly acknowledged inability to prescribe a certain specific for the difficulty. But it is competent, and seems highly desirable, to call the attention of this body to the facts enumerated, and ask a serious study by individual members to be followed at a later meeting by a classification of the facts found which relate to and govern this extremely unsatisfactory movement in our population.

As there is difficulty in arranging any series of facts, or even in looking for them without the aid of some theory, even if it is to be promptly discarded, it is suggested that the inquiry should be commenced on the supposition that lack of convenient and cheap transportation may be the governing factor in these changes of population.

There can be little doubt in any mind that cheap and rapid transportation, affording convenient access to large markets, controls the position of large industries; or, in other words, these will be located where the cost of assembling the raw materials for manufacture and distributing the finished products is the smallest. The high cost of wagon transportation over unimproved roads now precludes profitable manufacturing at the site of the numerous small powers once used, and it is doubtful if they will ever again be employed as they were fifty years ago, diversifying the industries of the country districts, and making first-class mechanics of nearly all farmers' boys.

The occupation of the country by farmers and by those who are not obliged to be in some town every day, with those suburbanites who are known as commuters, stands on a different and more hopeful basis. Farming is an occupation that is generally pursued for gain rather than for the sake of unremunerated labor. But the farmer is confronted with the fact that while all cost of transportation must in some ratio be divided between the producer and consumer, he generally sells in a nearly satisfied, if not glutted, market, where the cost of transportation falls on him, so that he in general is the heaviest loser by roads over which the cost of haulage is excessive.

When his day's work is done he joins his wife and children in the leisure class, and becomes, like the commuter, dependent on the ease with which he can reach the various centers of interest near him; and good macadam roads have already proved their value in keeping the farmer's family contented in their home, as well as increasing the net rewards of their labor.

The choice of residence by commuters is governed by mixed considerations of time, cost and attractiveness of locality, and good roads are a weighty factor in the attractiveness of a locality. It is probably because New Jersey commenced building macadamized roads about thirty years ago that the State is able to show a 30 per cent. increase in her population, while the five counties east of the Hudson and north of Westchester, without improved roads, show a net loss of slightly more than 1 per cent. This, however, is not entirely due to the absence of improved roads; it is claimed that the railroads extending north and south through these counties take less pains to develop their commuting traffic than do the roads through either New Jersey or Connecticut.

Some theories of this kind seem necessary in accounting for decreased population in a beautiful and healthy country near to and closely connected with the largest and richest city on this continent, whose business men are filling up the near-by counties of New Jersey and Connecticut.

If we assume that the average wealth of inhabitants of this State is equal to that of the average inhabitant of the whole country, as stated by the Treasury Bureau of Statistics, namely, $1,235.86 per capita, the withdrawal of 30,266 persons from country homes in this State implies a loss of over $4,000,000 to the localities from which they moved.

Judging from a limited experience, it may be safe to say that a good road will attract both residents and business. These make the road attractive to trolley companies, and a trolley road, obviating the necessity of getting out either a horse or wheel, makes the locality still more attractive to residents and business.

It is well known that in many parts of Europe the inhabitants congregate in small villages, walking miles to their farms, and it is probable that under the improved ease of circulation presented by trolley cars the population of the country will concentrate on roads occupied by them. When any such development occurs the trolleys will be double tracked, and the value of a road of ordinary width for traffic by wagons, etc., will be greatly impaired, if not destroyed, as the wagon traffic is becoming more dense and more important to the locality.

On Fifth avenue, in the city of New York, the traffic has outgrown the capacity of the wheel way, and it must be widened at a great cost. In London the widening of Cheapside and Newgate streets was completed about ten years ago, and it is claimed that the operation must be repeated on Cheapside, as that thoroughfare is again overcrowded. These widenings have been accomplished at what was held to be prohibitory cost, on account of the destruction of the buildings fronting on them. Like widenings will undoubtedly be necessary on most of the roads that are to be macadamized in this State, and they should be completed before improvements add materially to their cost.

The feeling of antagonism to trolley roads, which destroy a newly made macadam and permanently impair the usefulness of the road for wagons, automobiles and wheels, should not make us forget their great value in distributing population. At the same time the companies exploiting them should be required to join the local authorities in widening all roads used by them. In some parts of Massachusetts the entire cost of widening roads has been thrown on the trolley company. This may not be entirely just. The question, however, should receive the study of this convention, both now and hereafter; for such a distribution of the cost as shall not impede trolley building to the loss of the country inhabitants and real estate values, and at the same time be just to the property owners, cannot be made without consideration.

The Septic Sewage Disposal Works at Red Bank, N. J., have been in operation since May. The sewage flows first into a covered grit basin, installed in duplicate to catch all sand and large substances. It then passes into a covered resolving tank 43 feet in diameter and kept filled to a depth of 9 feet. The sewage enters and leaves the tank about half way between the top and bottom. From the tank the septic sewage passes to the bottom of two covered upward filters 12 feet in diameter and 6 feet deep, which discharge into an effluent pipe running to the sewer. The plant was designed by Dr. Adolph G. Brown.

The Sanitary Inspection of the Watershed of the south branch of the Nashua River above Clinton, Mass., has been carried on in a systematic manner, according to the report of the Metropolitan Water and Sewerage Board, preparatory to the storage of water in the Wachusett Reservoir. The watershed has been divided into districts, according to the natural drainage lines of the brooks, and a careful inspection of each district has led to the removal of many cases of pollution arising from defective house drainage and other causes. A constant inspection of the camps of the laborers and of other buildings within the reservoir basin has been made by the medical inspector, and very few cases of contagious diseases have occurred.

An Investigation of a Garbage Crematory.

Extracts from a report by Rudolph Hering to the Special Committee on Crematory of the City Councils of Trenton, N. J. A comment on this report is printed on page 241.

The base of the furnace is placed one story below the street level, so that the garbage can be readily delivered from the street to the floor level above the furnaces, and easily be fed to them through openings in the floor. The furnaces and feeding floor are enclosed in a brick building, apparently well and strongly built. The crematory is of the Davis type, and consists of two complete garbage furnaces connected by separate flues to a single chimney stack. The chimney is built of brick, has an internal section 5 feet square, and is about 120 feet high above the base and about 100 feet above the entrance of the flues. In the stack are a set of screens of ½-inch mesh, for the purpose of intercepting dust and larger particles escaping from the fires, and also a regulating damper which can be operated from a point near the feed holes.

Each furnace consists of:

1. An arched drying chamber, 8 feet square and 8 feet 6 inches high to the key of the arch, into which the garbage is dumped through a feed hole. It is provided with grates, chiefly for drainage purposes. The garbage remains in this chamber during the process of draining and drying, and at intervals it is raked down with long iron rakes into the combustion chamber.

2. An arched combustion chamber, 4 feet long, 6 feet wide and 4 feet high to the key, placed in front and approximately at the same level of the drying chamber. It is provided with grates on which coal is burned to assist the burning of the garbage which the attendant rakes down from the drying chamber.

3. A main flue about 3 feet wide by 3 feet 6 inches high, leading from the furnace to the chimney stack.

4. An arched secondary flue, 4 feet 6 inches long by 5 feet 4 inches wide and 3 feet high, in which is situated a set of fire grates about 2 feet long and 4 feet wide, and on which auxiliary fires are kept burning ostensibly for the purpose of completely eliminating odorous fumes on their way to the stack.

5. A so-called evaporating pan, under and of the same area as the drying grate, into which the liquid from the garbage freely drains. Some of this liquid may be evaporated, but most of it is led off by a 4-inch drain pipe to the sewer in the street.

6. A feed hole or opening above the drying chamber, through which the garbage is dumped. It is closed with a movable iron cover.

7. Grate bars, about 4 feet long and 4 inches wide, the openings between which are ½ inch wide for the fire grates and ¼ inch wide for the drying grate.

8. Ash pits under all grates, and firing and observation gates or doors complete the chief parts of the installation.

The chimney stack, the furnaces themselves and their parts appear to be built of good material and indicate good workmanship. The station appeared to be kept clean and in good order.

The City's Refuse.—The city's refuse may be classified as follows:

1. Ashes, bottles, cans and other non-combustible material, which is collected and disposed of by tipping and filling at various places in the city.

2. The garbage proper or house refuse, being largely of combustible nature and also known as "swill" or "slop," containing at the present season much fruit and being almost saturated with water, is collected and delivered at the crematory by the city in special garbage carts.

3. Garbage and refuse from stores, markets, etc., is collected and brought to the crematory by private parties. Much of it is of a very combustible nature, such as paper, rags, straw, wooden boxes, etc.

The collection and disposal of the first of these classes, apparently not causing any trouble, has not been considered in this investigation. The disposal of the garbage and refuse mentioned as the second and third classes has been a cause, however, for serious complaint, and to this the investigation is limited. Speaking generally, the sources of the troubles complained of may be stated as follows, and are subsequently discussed under separate headings: 1. Collection of garbage and odors arising from it when delivered at the works. 2. Odors from the ashes after their removal from the furnace when retaining some incompletely burned material. 3. Dust of completely burned garbage escaping from the stack and depositing in the neighborhood. 4. Unburned or still burning particles of garbage escaping from the stack and depositing in the neighborhood, with the possibility of falling upon shingle roofs or inflammable material and thereby causing fires. 5. Odors due to the unburned gases escaping from the stack.

Collection of Garbage and Odors Arising When Delivered at the Works.—The city garbage is collected in iron carts of approved make, holding about one ton and drawn by two horses. The carts collect from all parts of the city, daily except Sunday, and between the hours of 6 A. M. and 6 P. M. Each one serves a certain district, the number of trips being of such frequency that each house is visited as many as two or three times each week, according to the season. The carts are watertight, sanitary in every way, and so far as we know have not given any offense. The private garbage and dry refuse is brought to the crematory in the ordinary store wagons. We were not made aware that such collections had given any offense. The dry refuse, such as paper, wood, rags, etc., is generally collected from the houses in large bulk, while the garbage proper is first put into pails, boxes or barrels, usually left open, and subsequently collected by the teams.

On arriving at the crematory the contents of the carts and wagons are immediately dumped into the furnaces, unless these are already charged to their full capacity, in which case the wagon is detained or left standing until one of the furnaces is in a condition to receive the charge.

The only odors which may arise from the present method of city collection, can be caused by the often improper and usually open receptacle, but chiefly by the occasional filling of the carts beyond their normal capacity, so that the lids do not close, and odors may be given off while the carts pass along the street. The same objection may apply also to the private wagons for collecting garbage, but so far as we know, complaints have not been made.

These sources of trouble are easily prevented by proper municipal regulations and due care. Among the other essentials to prevent offensive odors from arising before the material is subjected to the burning process, are frequent collections of the garbage in proper vehicles, both of which you have already provided for very satisfactorily.

Odors from Ashes After Removal from Furnace When Retaining Some Incompletely Burned Material.—Offensive odors arise when the ashes are removed from the grates and deposited in exposed places before the garbage is thoroughly burned. This trouble is especially likely to occur with a crematory like yours, located in the midst of a thickly settled district where such odors are more readily noticed than in remote districts.

On the day of our first visit to your crematory there was a strong odor emanating from the pile of clinkers or ashes which had been dumped in front of the building. An examination showed that it was due to quite a number of unburned pieces of animal and vegetable refuse. This annoyance clearly cannot occur if the garbage is so thoroughly consumed upon the grates that nothing but clinkers and ashes remain when their removal from the furnace is necessary.

The remedy for the defect is therefore clear. 1. The furnace must be in a condition to be capable of completely burning the organic matter, of which more will be said below. 2. The attendant must be very observant and attentive in not pulling out anything but thoroughly burned material.

This inattention has at other places been a frequent cause of objectionable results and therefore of complaints. Too generally it is supposed that any stoker or fireman quite familiar with handling coal fires is also able to handle garbage fires. The latter, due to the presence and mixture of the greatest variety of combustible and noncombustible matter, are very much more difficult to operate than simple coal fires. When starting the furnaces in Hamburg, the most extensive garbage plant in the world, and also the experimental furnaces in Berlin, it was found necessary to import firemen from England, where crematories have been in use for fifty years, in order to train the German firemen in the special art of garbage cremation. It is an art that requires experience, skill and a faculty for constant attentive observation, which can be acquired only under skillful guidance by continued practice of intelligent and faithful men.

Dust and Burned Garbage Escaping from Stack and Depositing in Neighborhood.—When garbage is carefully burned and the combustion is complete, there may yet be trouble from the fine ashes of paper, wood, rags and other organic matter escaping from the stack and being carried with the wind to greater or less distances, even entering windows and causing dirt and consequent annoyance.

This nuisance is chiefly due either to faulty design of the flues or chimney, or to improper manipulation of the draft, or to both. In fact, ashes should not be carried up into the stack at all, but be deposited in enlarged flues or dust chambers on the way to the stack. These chambers should be given a relatively large sectional area, in order that the velocity of the fumes may be retarded and the heavier dust particles settle out, thus leaving practically the gases alone to pass freely out through the stack.

Even if the flues and dust chambers are properly designed, improperly designed dampers or their careless manipulation may also be the cause of this trouble. Dampers should have the full size of the flues, and be provided with simple mechanism so as to be easily operated from the fire-room or from a point near the feed hole. They should be always closed when the feed hole is open for charging the furnace, and also whenever the furnace doors are open for the purpose of firing, stoking or cleaning. That is, they should be almost tightly closed, leaving only enough draft so that fumes do not rise into the building from the feed hole or furnace doors. In general, they should always be under such careful control and so manipulated that the velocity of the gases in the settling chamber and the flues can be maintained below a certain required maximum rate. What this maximum rate should be, permitting the dust particles to settle, we are not able to state with desirable definiteness, because the data are meager concerning such deposit, which depends upon the size of the particles and their specific gravity; the finer and lighter the particles of course the more readily they are kept afloat in the moving gases.

It may, however, be safe for practical purposes at present to estimate that the velocity of the current through the dust chamber should be kept as low as from 1 to 1.5 feet per second. In order to secure this reduced velocity, we must first know the volume of gas which passes through the dust chamber in a given time. It is a variable quantity and depends on the chimney draft and the manipulation of the dampers. With the proper grate area for the burning of thirty tons of garbage per day, we may, however, roughly estimate the volume of air required for the combustion as being about 150 cubic feet per second. This would therefore require a sectional area of at least 100 square feet, or more than four times the combined area of the present flues. To facilitate further the deposition of dust it is an advantage to have the level of the inlet as far as possible below the level of the outlet, so that the force of gravity, slight as it would be, can favor rather than hinder the tendency for the dust to deposit.

The construction of a dust chamber of ample dimensions, placed between the furnaces and the stack, and properly designed dampers, would very materially, and with careful manipulation in accordance with the momentary conditions of the openings at the feed hole and gates, probably wholly, remedy the defect discussed under this heading. The chamber should, however, be constructed with a sufficient number of baffles to secure a uniform reduction in the velocity, not allowing the gases to pass through more quickly in the center than along the sides.

Unburned Particles of Garbage Escaping from Stack.—The effects of completely burned particles of garbage escaping from the stack have just been described. The annoyance from the partly or wholly unburned particles now to be considered is more aggravated, owing to their charry or greasy nature, and, as they are heavier, also to their tendency to settle more quickly and therefore more densely in the immediate neighborhood of the crematory. There is forthcoming the possibility of still burning or glowing particles setting fire to roofs or to inflammable material in the streets or yards.

To determine the extent of this nuisance, careful observations were made, and it was observed, almost without exception, that particles of black charred paper and similarly light material escaping from the stack could be seen at intervals during a whole day. They were apparently more numerous shortly after the furnace doors or the feed holes were opened, which naturally caused an increased draft through the flues and chimney. The damper, which is supposed to be closed during the feeding of garbage to the furnace, was not always operated with the necessary ease during the days of our inspection.

To determine how far-reaching this nuisance was in the neighboring districts, observations were made at distances of one-quarter, one-third and one-half a mile from the crematory, during one afternoon when the conditions appeared to be normal. The day was clear, and the wind was blowing at an estimated rate of about ten miles per hour. At a distance of one-quarter of a mile from the stack, about fifteen charred particles were observed in ten minutes to pass a plane at right angles to the direction of a moving smoke. At a distance of about one-third of a mile about ten particles passed in ten minutes, and at a distance of two-thirds of a mile two particles passed in ten minutes. The size of these particles varied from one-quarter of an inch to three-quarters of an inch square, averaging probably less than one-half an inch square.

Further observations were made by selecting places in fields, where the ground was sufficiently open to aid one in finding particles which might have previously settled on the ground. These places were selected always in the line of the moving smoke. The sizes of the particles were about the same as those first mentioned. At a distance of about two-thirds of a mile from the crematory, and after searching for about fifteen minutes, two charred particles were found on an area of fifty feet square. At a distance of one-third of a mile, after the same interval, eight particles were found on an area of about fifteen feet square. For how long a period these particles had accumulated cannot be stated. As a heavy rain had fallen during the previous night, sufficient in all probability to destroy traces of particles previously deposited, and as the wind had been in the same quarter only during the afternoon, it seems probable that these particles were the accumulations of only a few hours.

Observations were also made regarding the escape of burning embers from the stack. They were best undertaken at night, while the crematory was yet in full operation and when the burning particles were readily visible. On each of two nights, and extending over periods of from two to three hours, the burning particles from the stack were closely watched with the following results: 1. No embers were seen in a flaming condition; 2. Glowing embers were generally emitted after opening of the furnace doors for firing, cleaning or raking down the garbage. 3. During these times it was estimated that an average of fifty to one hundred sparks were emitted per minute. Of these it was further estimated that fifty per cent. did not travel in a glowing state more than 25 feet from the top of the stack, ninety per cent. not over 50 feet, ninety-five per cent. not over 75 feet, ninety-nine per cent. not over 100 feet, and rarely one could be seen 150 to 200 feet. From these observations it is evident that the trouble from escaping particles of unconsumed garbage is a serious one, and worse than if merely burned dust escaped from the stack.

In seeking for means to remedy this defect, we must carefully inquire into its two prime causes, namely, the incomplete combustion in the furnace and too great a velocity of the fumes in the flues.

Odors Due to Unburned Gases Escaping from Stack.—The stench resulting from incomplete combustion is usually the most serious trouble that arises from garbage cremation, and it is the one which in our country does not seem to have as yet been completely solved at any one of the principal garbage furnaces. It is my opinion, in addition to what has already been said, largely due to the design of the furnace.

A fruitful discussion of this subject must necessarily be divided into a careful examination of: 1. The character of the material delivered, its composition, moisture and combustible matter. 2. The essential parts of the furnace to obtain a complete combustion of such material. 3. The manipulation of charging, discharging, regulating drafts, etc.

1. The Material Delivered.—The burning quality of garbage depends principally upon three things: the amount of combustible material which it contains, the amount of fine material or dust, chiefly of an incombustible nature, which fills the pores and obstructs the free access of air, and the amount of moisture. Garbage which is poor in combustible material will not readily burn under any conditions, and garbage though rich in combustible material may yet be so filled with moisture as not to burn without previous drying, or the interstices may be so completely filled with fine ashes or dirt that combustion is retarded and even prevented by the lack of air.

In European cities, where garbage and city rubbish is mixed also with ashes, the combined refuse is comparatively dry, and the percentage of unburned coal in the ashes, together with the combustible matter of the garbage itself, is sufficient in properly constructed furnaces to burn without the addition of fuel. In our country, however, there are many cities, as Trenton, where it has become the practice to separate the ashes and the garbage. The burning then may become a more difficult matter and ofttimes can only be accomplished by the addition of fuel.

Regarding the propriety of separating the refuse substantially into ashes, dry rubbish and kitchen garbage, much can be said on both sides. The wisdom of separating the ashes in Trenton from the rest of the refuse, under the present circumstances, should be considered only from the economical point of view. That is, would the amount of unburned coal remaining in the ashes after sifting make it unnecessary to purchase clean coal for assisting the fires in the furnace, and would the total expense of delivering the ashes at the crematory, of sifting them and subsequently disposing of the siftings, be less than that of the present method? I am not prepared now to answer this question, as it would require an investigation much larger than was necessary for present purposes, and was not undertaken also for the reason that the installation of the furnaces is not sufficiently large to treat the great bulk of clinkers, slag and ashes that would thus be added to the fires and also require temporary storage.

To compare the garbage of Trenton with the same class of refuse in London, Berlin, New York and Boston, of which I have the information, Table I is presented, showing the various percentages of material of which garbage is generally composed. The table gives only a partial list of the material which in some of these cities were quantitatively determined, and includes only the garbage proper for the purpose of comparing it with that of Trenton.

The table shows that the garbage of Trenton is not very different from that of other cities, being as rich as any in combustible matter. The percentage of moisture, however, is very high,

Table I.—Percentage Composition of Garbage in Certain Cities in Europe and the United States, Excluding Ashes, Coal and Non-Combustible Rubbish.

	London.	Berlin.	New York.*	Boston.	Trenton.
Authority	Codrington.	Bohm & Grohn.	Craven.	O'Shea.	Special Committee on Garbage.
Kitchen garbage, animal and vegetable matter	77	82	64	84	84
Paper		11	28		12
Rags, clothing, carpets, etc.	23	3		16	3
Boxes, barrels and other rubbish		4	8		1

*Excluding Brooklyn.

and though reliable data concerning this point are not available for all of the cities, I have reason to believe that it is higher than in any of the other cities given in the list. This of course is an important matter in any process of disposal by combustion.

Let us take, for instance, the thirty-one tons of garbage delivered in Trenton per day, with 81 per cent. moisture. (See Table II.). This quantity will therefore contain approximately 24 tons of water which must be eliminated in the furnaces either by draining or evaporating before the garbage can be completely burned. Assuming that all must be evaporated in the furnaces, and taking as a basis the usual value of ten pounds of water evaporated per pound of coal, it will require 2.4 tons of coal to evaporate this water. The twenty per cent. solid material in the garbage, about ninety per cent. of which is combustible, will daily yield roughly 6 tons of dry combustible material. With a conservative calorific value of one-third that of coal, this gives an equivalent of 2 tons of coal, thus leaving a net average amount of about 0.4 ton of coal which must be added daily to consume the garbage with its present quantity of moisture. The amount of coal now actually consumed per day was found to be 2.3 tons. It is therefore clear that the arrangement of the furnace or the manner in which is is operated, or both, are not economical. At certain seasons when the garbage is not so moist as now, it seems that less or even no coal, except to start the fires, may be needed other than on rare occasions.

Table II.—Results of Operation of Garbage Crematory at Trenton for Week of Aug. 4-9, Inclusive, 1902.

Total garbage burned, tons	188.0
Garbage burned per day, tons	31.3
Coal used on main fires, tons	10.7
Coal used on auxiliary fires (estimated), tons	3.0
Total coal used, tons	13.7
Coal used per day, tons	2.3
Garbage burned per ton of coal, tons	13.8
Approximate number of hours burning each day, average	14.0
Equivalent number of days of 24 hours for the week	3.5
Equivalent garbage burned per sq. ft. of grate area per day of 24 hours, lbs	1,080
Equivalent amount of garbage burned per cell of 25 sq. ft., per day of 24 hours, tons	13.3
Estimated total amount of clinkers from garbage and coal grates, tons	14.0
Estimated total amount of ashes from below grates	3.0
Estimated total amount of ashes and clinkers, tons	17.0
Per cent. of ashes and clinkers to garbage burned, tons	9.1
Range of temperature of flue gases in stack (estimated), deg. F	600-1,000
Percentage of moisture in garbage	81.0
Corresponding water evaporated daily in furnaces, tons	25.5
Amount of coal required per day to evaporate this water on basis of 10 lbs. water per lb. coal, tons	2.5

Our observations show that much of the water which is brought with the garbage and settles to the bottom of the carts, percolates through the drying grate into the evaporating pan, which was quite filled with perhaps half a ton of water. To evaporate all these drippings would require a considerable amount of heat.

It is clearly more economical from a calorific point of view, to prevent this large amount of water from getting into the furnace, than to let it first pass through what is supposed to be the drying chamber and then into the sewer. It is quite proper, and it is the custom in many places, particularly in Europe, to dump the garbage on the floor around the feed hole, not only to mix the material properly for burning, as will be mentioned later, but to let what water will drain off go directly into the sewer. The economical as well as beneficial effect of this prior draining during at least a large part of the year will be quite noticeable.

I am satisfied that the calorific value of this garbage is such that its complete combustion could be secured with a much smaller amount of coal than is now used. To obtain this result, it will be necessary to operate the crematory along the lines already mentioned with a view of preventing a nuisance, and to have a furnace in which the combustion of the garbage can be more economically obtained, i. e., to insure complete combustion without excessive loss of heat. It remains, therefore, to examine into the essential parts of

2. The Garbage Furnace.—Although the nature and composition of garbage affects greatly the relative burning qualities in any furnace, the successful burning in any case will depend primarily upon the construction of the furnace itself. Garbage furnaces in England, where they have been used for half a century, are usually divided into small units called cells, in a manner similarly to a battery of boilers, and are arranged in pairs straddling a common main flue. Each cell has a separate connection with this flue and is operated independently of the other cells. The grate area of one cell is usually 25 square feet, this being the size which has been found to be most conveniently and economically operated. The grate bars are usually detachable and have an effective air space of about 25 to 30 per cent. of the grate area. They are usually inclined to the front so that the garbage from the feeding hopper can slide down or be raked down upon them. The chamber over the grates is of ample size, longer than the grates, and slopes with the grate surface. Over the upper end of this incline is the hopper and opening for receiving the garbage. As it burns away on the grate below, the raw material above slowly slides down to take the place of the consumed material. While descending, it is subjected to the influence of the heat from the fire in front and gradually dried and then automatically ignited. The stoker observes the process and aids it by properly pulling and spreading fresh material at the rear and drawing out the hard clinkers and ashes in front.

The gases and hot air pass into flues usually above the grates, and then into a settling chamber where the dust particles deposit. Then they again enter the main flue and pass through the chimney. Generally the gases also pass through a so-called fume-cremator, where they are reduced to an inodorous condition. In some European refuse destructors, as they are called, the heat of these gases from the main flue is utilized in making steam for power or electric lighting. To aid combustion forced draft is frequently resorted to, either by steam jet or air jet, the jet entering under the grates of the furnace. It is found greatly to increase the burning. Dampers are placed on the main flues and on the flues connected with each cell. The latter are always closed during the process of firing, raking or cleaning of a cell. Ash pits and cleaning doors are provided under the gates of each cell, also cleaning doors at the settling chamber, flues and chimney.

American garbage furnaces differ essentially from the European in that the grate surfaces are much larger and practically horizontal. The result of this practice is that when wet garbage is dumped here and there upon the burning garbage, the fire is suddenly and partially extinguished below. A very irregular burning is caused thereby which it is necessary to improve by the addition of coal. It also requires more skillful stoking and spreading of the heterogeneous material over the large horizontal grate and a more difficult operation in removing the clinkers, than in a furnace with a sloping chute and a grate of much smaller area, on which the material is gradually brought from a moist state to one of great heat, resembling a self-feeding coal furnace.

The amount of garbage burned in each English cell will depend upon its composition and moisture. With proper drying it is usual in Europe to burn 5 to 7 tons per day per cell of 25 square feet of grate area. In the Berlin Experiment Station something less than 6 tons were burned, and owing to the small amount of combustible material in the Berlin garbage it was necessary to add some coal during certain seasons.

Considering the furnaces operated in your city, in the light of the above remarks, the nature of their defects seems to me apparent. The grates of both combustion and drying chambers are horizontal, so that the garbage stays where it drops, and can only be moved forward and spread with some difficulty by the aid of large heavy rakes. The garbage when dumped into the drying chamber is formed into a dense heavy pile, only the upper portion of which is usually raked down upon the combustion grates, leaving the lower portion undisturbed and unburned often until the last of the garbage is consumed at night. This raking down of the upper portion does not insure us that the garbage will be completely burned. Even pulling it down upon the coal fire in front does not do this, unless much more time and skill are used than was observed during our examination.

The amount of garbage burned in Trenton per equivalent of English cell area (see Table II) is as much as about 14 tons, considering only the coal grate surface in the combustion chamber, while in Europe the quantity ranges from six to seven tons. It must be realized, however, that in Trenton much burning takes place in the first or dry chamber. All of the highly combustible materials, as paper, wood, straw and the like, are there consumed and should not be credited to the second or combustion chamber. Although in Trenton, to aid combustion, about 120 pounds of coal are used per ton of garbage, in Europe the unused coal in the ashes of the mixed garbage amounts, roughly speaking, to the same quantity.

The analysis in Table I indicates that, leaving out the ashes with its unburned coal, the net burning quality of European and American garbage is not very different. This evidence, although it is meager, indicates that you cannot maintain a higher rate of combustion per square foot of grate area than is maintained in the furnaces abroad. Independently of the material burned over the grate of the drying chamber, which I think we might estimate as being at least one-fourth of the total amount, we still have a greater amount of garbage proportionally per square foot of grate surface passing through the combustion chamber than is found to be practicable in the best furnaces abroad. From this reasoning we may infer that the combustion in Trenton is not as thorough as in England, and such inference seems to agree with the facts as found. Remedies for this defect of insufficient combustion in the furnace can be obtained: 1. By increasing the number of furnaces. 2. By running the crematory for twenty-four hours. 3. By improving the burning capacity of the furnace.

To increase the number of furnaces is a matter that will need attention in any event at no distant day. By building another furnace at once, the present overcharge could be relieved. Whether an additional furnace had best be built at the present site or in another part of the city, where it might decrease the length of haul for collection for some districts, while increasing the unit cost of labor for attendance, I did not ascertain. Should it be found impracticable to build another furnace at present, it is entirely practicable to run the present crematory for twenty-four hours, by using two or probably three shifts.

Continuous operation has merits, in a more uniform service and in a saving of the losses of heat due to cooling and to the starting of fires every day. At present you are frequently obliged to run during a portion of the night, and the additional cost of running continuously would not be proportionately greater. Continuous operation requires storage of the garbage for use during the hours when no collections are made. Should all garbage be collected in 12 hours and burned at a rate to consume it in 24 hours, storage must be provided for one-half a day's supply. This at present would be about 15 tons, requiring about 25 cubic yards of storage. If piled 2 feet high this requires a space less than 20 feet square, for which there is ample room.

Referring to what has been said regarding the preliminary draining of the garbage and what will yet be said regarding the feeding to the fires, this storage on the feeding floor is an advantage to be recommended to you also for day service, whenever the state of the fires and an unfavorable previous charge makes temporary storage of some of the garbage necessary in order to obtain better combustion. The temporary storage of this material for a few hours cannot cause any nuisance if it is freshly collected. Such storage is customary in Europe under similar conditions.

While the continuous operation of the furnaces can relieve some of the present difficulties, the third mentioned remedy, namely, the improvement of certain parts of the furnaces, should be likewise recommended. An improvement which I believe to be of much practical value in securing complete combustion without excessive loss of heat, is the introduction of the sloping grate, and of a drying chamber having a floor sloping towards this grate at a different angle to feed, if not automatically, yet with only slight aid from the stoker. By this means the garbage passes gradually from its natural state to that of complete combustion, and the difficulties of stoking are reduced to a minimum. The hottest fire will be near the front of the furnace, and here the fumes get their most effective burning.

The gases should therefore leave the furnace near the front. They should pass to the rear outside, but closely to the walls of the drying chamber, and in such a manner that these are heated as much as practicable, and thus help the drying process from the bottom, sides and rear of the chamber, as direct radiation from the hottest fire helps it in front.

Should the garbage be well drained on the feeding floor, the drying chamber would need no grate nor evaporating pan.

Regarding the introduction of forced draft by blowers forcing air under the grates, it may be said that the advantage of this assistance is recognized in Europe and utilized in the best furnaces. I have no hesitation in expressing the belief that an improvement in the design and operation of your furnaces, with a greater air pressure below the grate, could enable steam to be made in sufficient quantity to operate such blowers, but also, as may be inferred from what has been said above, accomplish the burning with better effect as regards the escape of unburned particles than the aspiration from a more rapid chimney draft, drawing up the fumes from the upper surface of a mass of burning garbage.

Under the present heading it yet remains to speak of the auxiliary fires burning between the furnace and the chimney. Without question such fires are needed at times when for one reason or another it is advisable separately to cremate the fumes coming from the furnace before they ascend the chimney. In your case this may always be required, because the location of the crematory is near the built-up parts of the city, and because the difficulty in training men to operate such a plant properly always points to the wisdom of having a safeguard against slight imperfections of manipulation. Such auxiliary fires must, however, also be carefully run to secure the object for which they are kept burning, and at any time proof of this should be readily obtainable by inspection.

3. The Operation of the Furnace.—Almost, if not equally as important as the proper design of a furnace, is its skillful operation, and too little attention has usually been given in our country to this feature of garbage destruction. A little indifference or carelessness even with the best furnace can result in incomplete combustion, with the resulting annoyance above described. It is a simple matter to burn a homogeneous material, such as coal or wood, but to operate a furnace with probably the most complex mass of matter apt to be found in a modern community, is difficult and also serious from the deleterious effects resulting from failures. The employment of specially trained firemen having good judgment, attentive and faithful, seems to determine the success or failure of the undertaking.

Good judgment with regard to the conditions and time of firing and feeding of garbage and with regard to the selection of material for succeeding charges so as to maintain the necessary heat, close attention to all of the dampers for regulating the drafts either when feeding, stoking or cleaning, scrupulous care in seeing that no unburned particles are removed with the ashes, are all simple matters, though when they fail even singly they may give imperfect results, and failing together they may be disastrous.

When the garbage is delivered at the crematory too rapidly, or not in the best order for firing, as already mentioned, it should be stored. The storage may be in the carts themselves, or on the floor near the feeding holes, as done without annoyance in nearly all crematories abroad. When a load of paper, wood and rubbish arrives, it should not, as was observed on one of our visits, be charged on top of a load of fresh garbage, but be dumped to one side and fed at a time when its fuel value for the moist material will be more effective. This heat value of the dry rubbish is quite appreciable, and in one instance was estimated roughly at one-third the value of a ton of coal, without being utilized for the burning of any fresh kitchen garbage.

The temporary storage of the garbage on the floor over the furnaces, for a better mixing and drying of the same, requires suitable gutters to be formed on it which will collect the water and carry it to the sewer.

Careful attention must also be given to the auxiliary fires, so that they burn briskly at times when the conditions for the escape of odorous fumes from the furnace are most favorable.

All ash pits, flues, dust chambers and other parts of the furnace must be frequently inspected and cleaned, since any deposits may contract the sectional area of the flue and thereby modify the normal draft through them.

Resume and Recommendations.—It now remains briefly to summarize the foregoing into a statement of the annoyances you are experiencing, with recommendations of the most efficient practical means of removing them. Notwithstanding the existing defects and the criticisms which it has been necessary to make, the Trenton furnaces belong to the better class of such plants in our country. The troubles and nuisances with which you are now contending are also more or less common elsewhere.

The chief reason for this fact appears to be the insufficient attention that has been given the subject by those best able to do so. Sufficient inquiries have not been made into all the various causes of the specific troubles, so as to correct each and all of them in an intelligent manner. In many quarters there appears to be even a lack of appreciation of the real difficulties involved in the problem, both as regards construction and operation. Especially as to the latter there is a disposition to undervalue the necessity of having operators with a good practical knowledge of firing such a complex material as garbage, so as to obtain complete combustion, of the effects and interaction of drafts in furnaces operated separately, but leading into the same main flue, and of the means for settling the dust which rises with the fumes. As soon as these difficulties are more generally appreciated, their proper solutions will no doubt soon follow.

The character of the Trenton garbage collection is at present fairly satisfactory. The best practice in this climate regarding the receptacles at the house suggests galvanized iron buckets with cover. These become less foul than if made of wood, and the covers prevent the scattering of the material by animals or wind and the dissemination of filth by flies. The collection in well-constructed metal carts such as you have and also the frequency of your collections are quite satisfactory. It may be suggested, however, that provision for thorough cleaning of the carts after dumping would be a still further improvement. To obviate the escape of odors from ashes that have not been completely burned, it is necessary to have furnaces that will economically burn the garbage, and also very attentive as well as skillful firemen, trained and experienced in this special kind of work.

To obviate the nuisances of dust escaping at the stack, either from well burned or unburned garbage, it is necessary after securing perfect combustion, to introduce a dust-settling chamber of proper size between the furnaces and the stack, containing baffles and properly placed inlets and outlets. The screens now in the chimney, although useful as a safeguard against accidental emissions of light but large matter, are insufficient to retain all of the matter now escaping from the furnaces.

To reduce further the possibility of unburned particles escaping through the stack, it is important to place dampers in the flues leading from each furnace, as well as in the chimney, so as to afford control of the drafts at all points where and when it is needed. Skillful observation at every moment of the condition and character of the garbage, and faithful attendance in operating the dampers to maintain an effective velocity of the gases, which at the same time does not carry the dust, are necessary to obtain success.

The prevention of odors due to unburned gases escaping from the stack depends upon the character of the garbage, the sufficient capacity of the furnace, its design and the operation of the plant.

The garbage now delivered, when properly drained and carefully burned in a well designed furnace, is readily combustible, and should not require the addition of as much coal as now used; and at some seasons, except to start fires and otherwise on rare occasions, perhaps no coal may be required.

We find that the furnaces are not sufficient in size to effect a complete destruction of the material during the hours of the day when the crematory is operated. Continuous firing for twenty-four hours can relieve this deficiency. To this end it would be necessary to store the material for a part of the day, and this could not be objectionable in any way.

To secure a complete combustion of the garbage more economically than at present, the design of the furnaces should be somewhat altered. The horizontal grates are not the most suitable for the material, which must first be dried and then with difficulty pulled from one position to another for burning. A sloping grate for burning and a sloping floor for the drying chamber, from which the material can be gradually and almost automatically moved from the feed hole to the hottest fire, permit of a better utilization of the heat and reduce the difficulties of stoking.

The gases should leave the furnace from a point above the hottest fire, and be utilized to heat the walls of the drying chamber so as to assist in the proper preparation of the garbage for burning. Forced draft under the grate will also be of great advantage in aiding combustion.''

Auxiliary fires for burning the fumes before they rise into the chimney are a wise addition to your crematory, and should be retained as a safeguard on account of nearness to the inhabited parts of the town.

The Convention of the New England Water-Works Association.

The twenty-first annual convention of the New England Water Works Association was held this week at the Hotel Brunswick, Boston. The opening session was called to order Wednesday morning by President Frank E. Merrill, and the address of welcome was made by ex-Mayor J. O. Hall, of Quincy, Mass. The following applicants were then elected members of the Association. Active members: H. V. Macksey, in charge of meters, fire pipes, etc., Boston water works; Edward T. Waters, biologist, Metropolitan Water and Sewerage Board, Boston; Fred J. Taylor, chief engineer and superintendent of water works at Westboro Insane Hospital, Westboro, Mass.; William E. Johnson, engineer for Board of Water Commissioners, Hartford, Conn.; John F. Miller, with Pennsylvania Water Company, Edgewood, Pa.; John W. Hill, chief engineer, Bureau of Water Filtration, Philadelphia, and J. A. Canals, City Engineer of San Juan, Porto Rico. Associate members: John M. Holmes, Philadelphia, Pa.; Stilwell-Bierce & Smith-Vaile Company, 73 Oliver street, Boston, Jenkins Brothers, 17 Pearl street, Boston and Mr. Alphonse Fteley, formerly chief engineer of the Croton Aqueduct Commission, was elected to honorary membership in the Association.

At the afternoon session, Wednesday, a paper entitled "Duties of Municipalities Regarding Water Supply," was read by Hon. J. O. Hall, of Quincy, Mass. This was followed by the presentation of the report of the committee on "Standard Specifications of Cast Iron Pipe," by the chairman, Mr. Freeman C. Coffin. This report is reviewed elsewhere in this issue. Printed copies of the report, together with the proposed specifications, were distributed among those present and an earnest request was made by the president for a full discussion of the subject. After reading the report Mr. Coffin briefly explained wherein it differed from the preliminary one presented at the meeting in December, 1901. Such changes as had been made were adopted only after a thorough investigation, both by the Association's committee and one representing the pipe manufacturers, and after receiving and considering many written and oral suggestions from members and others interested. While these specifications did not embody every point which might seem desirable by engineers, yet Mr. Coffin believed that, for general practice, they would fill all present requirements, and the committee felt no hesitancy in recommending their adoption.

In the discussion which followed the presentation of this report, Mr. Leonard Metcalf stated that he saw little to criticize in it. He thought the committee deserved great credit for its patient and painstaking work and he hoped the result would be far-reaching. As to the question of adopting these specifications he was in doubt as to the wisdom of taking final action at this meeting, and asked if it would not be well to wait until it was known whether other associations would follow suit.

In reply to this question Mr. Coffin stated that the committee felt that it had done its work and that little could be gained by delay. It was not likely, he thought, that other associations would take the initiative in this matter. On the other hand information had reached the committee to the effect that the American Water Works Association had intimated, through its committee appointed to consider the subject, that, should action be taken by this society at this time, similar specifications would be adopted by it.

Mr. Morris Knowles, of Pittsburg, Pa., asked if it was desirable to have so many classifications. There seemed to be a difference of opinion, he said, between the committee and the manufacturers, the latter believing it would be an advantage to have fewer sizes. It was very frequently the case that lighter pipe cost more to manufacture than heavier pipe of the same diameter where in many instances there would otherwise be no particular choice between the two. In reply to this question Mr. Coffin stated that he knew of members of the New England Water Works Association who were using light weight pipe such as had been provided for in these specifications. It was known that the cost of this pipe was greater than that of heavier weight. It was not for him to discuss the relative merits of either, but, since the lighter weights were being used by members of the association, the committee had thought it wise to make provision for them in the specifications.

Mr. G. H. Benzenberg, of Milwaukee, Wis., continued the discussion by stating that he felt that the requirements had not been made rigid enough and particularly so regarding the matter of coating. He thought the time would come when a galvanized coating would be generally used for water pipe. It was true that the cost of such coating would be greater than that used at the present time, but the efficiency and durability of the pipe would also be greatly enhanced. Experience has shown that, if requirements were set high, the contractors would meet them.

Mr. W. C. Hawley, of Wilkinsburg, Pa., stated that he desired to emphasize the importance of the subject of coating. He thought that this matter should receive greater attention than it had hitherto. The question of enforcement was one also which needed attention. It would make no difference how good a set of specifications could be devised, the contractor would pay little attention to them unless an inspector was constantly on hand to enforce them.

Mr. Dexter Brackett, a member of the Committee, stated that it would be impossible to carry out all that engineers might desire. He was of the opinion that the requirements in the committee's specifications can be enforced. Personally he would like to see a better coating for water pipe. There was no reason why any city could not improve upon these specifications, if they so desired. For general practice, Mr. Brackett thought that the Committee had gone as far as it could for the present time.

On motion of Mr. E. H. Gowing, the report was then adopted and the specifications in it made the standard of the association.

At the Wednesday evening session an illustrated talk on "Recent Construction on the Metropolitan Water Works" was given by Mr. Frederick P. Stearns, chief engineer of the Metropolitan Water and Sewerage Board of Boston. A paper on "The Water Supply of Nashua, N. H.," was then presented by Mr. Horace G. Holden, superintendent of water works of that city.

A paper entitled "A New Turbidimeter," by Charles Anthony, Jr., Hereford, England, was read by Mr. Charles W. Sherman at the opening of the Thursday morning session, and discussed by Mr. Sherman and Mr. Allen Hazen. It was followed by a paper entitled "The Removal of Color and Odor from Water," by Mr. H. W. Clark, chemist of the Massachusetts State Board of Health, Boston.

The report of the Committee on Apportionment of Charges for Private Fire Protection, and the Means of Controlling the Supply Thereto was then called for. This committee consisted of Byron I. Cook, Edward V. French, J. C. Hammond, Jr., Charles K. Walker, John C. Chase, F. H. Crandall and Henry A. Fiske. This committee having failed to agree, three separate reports were presented, one by Messrs. Crandall, Walker and Hammond; another by Messrs. French, Fiske and Cook, and a third by Mr. Chase. Each member of the committee then stated his reasons for taking the stand he did, and the matter was also discussed by other members of the association. The motion to accept these reports and to have them printed as part of the proceedings of the convention was carried. At the afternoon session the subject of these reports was again called up. Mr. Crandall stated that the committee had labored under great difficulty from the fact that little expression of opinion had been made by members of the association. He thought it desirable at this time that some action should be taken which would show what that sentiment was. A motion to accept the report presented by Messrs. Crandall, Walker and Hammond was then made, but was afterwards laid upon the table. Upon motion of Mr. Frank C. Kimball, superintendent of water works, Knoxville, Tenn., it was voted to appoint a new committee of three representing both public and private companies to confer with similar committees of the American Water Works Association, the Central States Water Works Association, and the various associations of fire underwriters, with the view of considering adequate means for the payment and control of water for private fire protection. The president stated that this committee would be appointed before the adjournment of this meeting.

A paper entitled "The Physical Properties of Water" was next read by Mr. Allen Hazen. At the conclusion of this paper Mr. Hazen described a device for measuring the turbidity of water. The report of the Committee on "Uniform Statistics" was next presented and was adopted in full by the Association. At the Thursday evening session Mr. Desmond FitzGerald, engineer, Sudbury Department Metropolitan Water Works, Boston, gave an account of "What an Engineer Saw in Venice." This was accompanied by lantern slides. An historical address entitled "Twenty Years After—A Retrospect," was next read by Mr. R. C. P. Coggeshall, superintendent of water works, of New Bedford, Mass. An excursion to the works of the Metropolitan Water Commission at Clinton, Mass., was made by the members of the association on Friday.

Personal Notes.

Mr. William C. Ogden has been elected civil engineer of Dover, N. H.

Mr. O. M. Rankin has tendered his resignation as city engineer of Ballard, Wash.

Mr. George W. Shock has been elected superintendent of the South Bend, Ind., water works.

Mr. E. E. Batton has been appointed chief draftsman in the civil engineer's office of the Detroit water board.

Mr. C. C. Radabaugh has resigned his position as superintendent of the Alexandria, La., electric light and water works plant.

Mr. George G. Earl, M. Am. Soc. C. E., has been re-elected general superintendent of the Sewerage and Water Board of New Orleans.

Mr. E. P. Mobley, roadmaster of the eastern half of the Eastern Division of the Chicago Great Western Railway, has been appointed division engineer of the Southwest Division with headquarters at Des Moines, Ia., to succeed Mr. W. B. Causey, resigned.

Mr. Freeland Howe, Jr., has resigned his position as assistant bacteriologist at the testing station of the Spring Garden Water Works, Philadelphia, to accept an appointment as chemist and bacteriologist in the laboratories of the filtration works at Harrisburg, Pa.

Mr. Wm. C. Whitner has resigned the duties of chief engineer of the Catawba Power Co., Rock Hill, S. C., to become chief engineer of the power and lighting department of the Virginia Passenger & Power Co., of Richmond. This corporation is an amalgamation of the Richmond Passenger & Power Co., the Richmond Traction Co., the Virginia Electric Railway & Development Co., and the Southside Railway & Development Co. It owns valuable water powers in Richmond and Petersburg, which will be developed as rapidly as possible.

A Leaky Sewer of 12-inch vitrified pipe in the town of Clinton, Mass., is stated by the Metropolitan Water and Sewerage Board to have furnished 200,000 gallons of water per day to the sewage filtration plant before any house connections at all had been made.

The Extension of the Septic Tank System at Exeter, Eng., is designed to serve a population of 47,000, the maximum flow of sewage and storm water provided for being 2,500,000 imperial gallons per day. There are three grit chambers, six septic tanks and twelve bacterial contact filters, all built in concrete. The main outfall sewer discharges into the grit chambers, which are 18x6 feet and 3 feet deep. From these the sewage is delivered to each of the tanks through four submerged inlets. Each tank is 180x36 feet, and 8 feet deep below the springing of the concrete covering arches. The effluent passes off through slotted pipes laid horizontally across the ends of the tanks 3½ feet below the springing. It was only after 5 years' continuous use that it became necessary to remove any deposit from the experimental tank erected in 1896, so it is not expected that the new tanks will require to be cleaned of sludge except at long intervals. Each filter is about 1,000 square yards in extent, the total area being about 2½ acres. They are filled with ½-inch furnace clinker to a depth of 3½ feet. The tank effluent will be distributed, according to "The Surveyor," over each filter in turn by 11 lines of stoneware channels laid on top of the filtering material. The final effluent will be collected by agricultural drain pipes laid on the floor. These beds are arranged in groups of four, each group surrounding a central gear chamber. Two of the groups will ordinarily form the working set, and the tank effluent will be automatically delivered to each filter in turn. The discharge valve will meanwhile be closed and the tank effluent will remain in the filter about an hour and a half. The filling and emptying of the filters is effected automatically by means of the alternating gears, consisting of levers from which the admission and discharge valves are suspended. The discharge valve lever has an actuating bucket at one end and a counter-weight at the other, and the admission valve is opened by a weighted float. The work has been carried out under the direction of the inventor of the system, Mr. Donald Cameron.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Findlay, O.—Bids will be received by the Water Wks. Trus. until Sept. 17 for furnishing material and constructing a conduit to supply water for the city water works. Approximate quantities: 4,325 tons of cast-iron pipe, 15 tons of special castings, 9,000 ft. of well connections, about 11 miles of 24-in. vitrified pipe, 24, 20 and 8-in. gate valves, etc. Wm. Demland, Secy.

Water bonds amounting to $150,000 are stated to have been sold.

De Smet, S. D.—The Mayor writes that bids will be received until Oct. 1 for constructing a water works and an electric light plant. Estimated cost, $20,000.

Chamberlain, S. D.—See "Government Work."

Chester, Pa.—Geo. Hodkinson, of Chicago, Ill., is stated to have secured the contract for a filter plant for the New Chester Water Co., to be erected on Harrisons Hill. Wm. G. Chadwick, Supt.

Prosper, Tex.—The Prosper Water Works Co. has been incorporated; capital $4,000. Incorporators: W. C. Naugle, W. R. Mathers and A. T. Bryant.

Tonawanda, N. Y.—The citizens are stated to have voted Sept. 4 to issue $30,000 bonds to improve the water works.

New Castle, Del.—Prominent citizens and property holders are reported to be agitating a movement for new water works. The intention is to supply the city with pure water taken from a series of artesian wells.

Atlanta, Ga.—The Bd. of Water Comrs. on Sept. 5 decided to ask the City Council to authorize a bond issue of $400,000 with which to make improvements at the water works, to consist of a new reservoir, a 20,000,000-gallon pump for the river station, a 36-in. main connecting the river station and the new reservoir, and also new filters.

Burlington, Ia.—Local press reports state that the Citizens Water Co. on Sept. 2 purchased the plant of the Burlington Water Co. The Citizens Water Co. was incorporated Aug. 12 by W. W. Baldwin, Edward Hagemann and others, to acquire, operate, improve and extend the existing system of water works in Burlington, by and with the consent of the city and under a contract with the city.

Newark, Ark.—E. H. Williamson writes that there is talk of constructing water works, at a cost of about $5,000.

Arlington, N. J.—A press report states that an ordinance has been introduced in the Boro. Council of North Arlington, granting the Union & Bergen Water Co. a franchise to run water pipes through North Arlington

Price, Utah.—Reuben C. Miller, of the Town Council, is reported to be figuring with an engineer on the cost of constructing water works.

Marseilles, Ill.—The Marseilles Water & Light Co., Marseilles, is reported incorporated with a capital of $10,000, to operate a system of water works. Incorporators: Mark A. N. Earle and Wm. S. Hammond, Jr.

Minden, La.—It is reported that the establishment of water works is under consideration.

Lonaconing, Md.—The Midland-Elk Lick Water Co. is stated to have petitioned the Council for a franchise to pipe the streets and furnish water.

Meadville, Pa.—W. A. Doane, City Engr., writes that $1,000 has been appropriated by Council for further tests of wells for new supply.

Carthage, S. D.—The Town Bd. is reported to be investigating the cost of water works.

Centralia, Ill.—The City Council is stated to have passed an ordinance authorizing an extension of the water mains into the Parkside addition.

Jamaica, L. I., N. Y.—The Bd. of Estimate is stated to have decided Sept. 5 to appropriate $40,000 for construction of distributing main in the 1st Ward, Queens Boro.

Manzanola, Colo.—The Artesian Water Co. is stated to have petitioned the Council for a franchise to furnish the city with water.

Boalsburg, Pa.—The Boalsburg Water Co. has been incorporated; capital, $2,600. Directors: J. M. Wieland, P. S. Ishler and J. A. Fortney, Boalsburg.

Wheeling, W. Va.—Local press reports state that Michael McKinney, Supt. Water Works, estimates the total cost of constructing a new main from the pumping station to the reservoir at $58,028.

Wyandotte, Mich.—See "Power Plants, Gas and Electricity."

Fremont, O.—The Water Works Trustees have decided to advertise for bids for a 100-120-H.-P. air compressor to obtain a supply of 2,000,000 gals. of water per day from a system of wells.

Allentown, Pa.—The Secy. of the Water Comrs. writes that it is proposed to secure a water supply from Schantz's Spring, the work to cost about $200,000. Bids will be asked in about 3 months. G. J. S. Kohler, Pres.; J. Howard Martz, City Engr.

Hawkesbury, Ont.—Denis Doyle, Town Clk., writes that the Montreal Pipe Foundry Co., Montreal, Que., has secured the contract for 750 tons of cast-iron pipe at $38 per ton and special castings $3 per 100 lbs.

Chicopee Falls, Mass.—The Committee on Fairview Water Supply has reported favorably to Bd. of Aldermen for an appropriation of $35,000 to be met by bond issue if passed by 1903 Legislature.

Yellow Springs, O.—The Ohio Water Delivery & Irrigation Society has been formed here, to promote the preservation of water and to encourage its delivery to farms and villages by pumping stations and by pipe lines along the highways. John Bryan, Pres., Yellow Springs.

Galveston, Tex.—At a meeting of the City Comrs. Sept. 2, C. G. Wells, City Engr., and A. S. Drewry, Supt. Water Wks., submitted estimates of the cost of an additional water main pipeline across the bay. A 20-in. pipe would cost $83,000; 24-in. pipe, $91,000, and 30-in. pipe $106,000. It was reported back for further estimate of 8 and 12-in. pipes and cost of a pumping station to be erected at Virginia Point.

Woodward, Okla. Ter.—A charter is reported to have been issued to the Woodward Water & Milling Co., of Woodward, for a term of 20 years, to sink wells, for water, salt, coal, gas, oil or any other mineral in or near Woodward; capital, $30,000. B. W. Key, J. W. Magee and John Garvey, all of Woodward, are reported interested.

Questa, N. M.—A press report states that Duane Wheeler has been engaged to survey an irrigation canal for the Taos County Irrigation & Improvement Co., at Questa.

Portland, Ore.—Local press reports state that D. D. Clarke, Engr. Water Com., estimates the cost of lowering submerged pipe lines, total length to be lowered 1,620 ft. 28-in. pipe, $17,200, and 24-in. pipe $15,500.

Waco, Tex.—The City Council is stated to have passed a resolution authorizing the Mayor to appoint a commission to study the water question, to determine the cost of building an independent system and to ascertain what the present system, owned by private parties, can be bought for. The resolution also authorizes the employment of John W. Maxcy as engineer to advise the Bd. of Water Comrs. as to the construction or purchase of water works.

Pittsburg, Pa.—Local press reports state that Director J. Guy McCandless has sent to Common Council an estimate of the cost of the proposed sand filtration plant; the estimated cost is $3,719,000. This does not include the cost of covering the filter beds, which it is estimated will cost about $800,000 more.

Thomson, Ga.—Ira E. Farmer, Mayor, writes that the town is now engaged in boring two deep wells to be used as a source supply. If the well is a success they will be in the market for pumping machinery, and also for the construction of a system of water works. Engineer not yet named. The cost of wells and water works will approximate $15,000.

Marshall, Tex.—The citizens are stated to have voted Sept. 4 to issue $25,000 bonds for improving the water works.

Minneapolis, Minn.—Water bonds amounting to $250,000 were sold Sept. 6.

Black River, N. Y.—Eaton & Brownell, of Carthage, are stated to have been selected to make a survey with specifications and estimates, for water works and a sewerage system.

Berkley, Va.—Geo. Hornung, Gen. Mgr. of the Norfolk County Water Works, is reported to be making surveys across the Southern branch of the Elizabeth River to lay a water main to supply Berkley with Lake Kilby water.

Washington, D. C.—Bids were opened Sept. 6 by the Comrs. D. C., for 30, 36 and 48-in. cast iron pipe and specials, as follows: *a*, 6,000 long tons straight pipe; *b*, 135 tons of specials: U. S. Cast Iron Pipe & Fdy. Co., *a* $32.70, *b* $117, total $211,995; Camden Iron Wks., *a* $35.90, *b* $78, total $225,930.

Cle Elum, Wash.—The citizens are stated to have voted to issue $9,500 bonds for the construction of water works.

Chanceford, Pa.—A charter is stated to have been granted to the Hillside Water Co. for the storage and transportation of water and water power for commercial and manufacturing purposes in Lower Chanceford, office to be at Lancaster. Directors: Jacob Hill Bryne, W. F. Jack, and others, all of Lancaster.

Platteville, Colo.—The State Land Bd. is stated to have granted C. L. Walker a reservoir site at Platteville. The reservoir is to cover 14⅓ acres and is to be built for irrigation purposes.

Middleport, N. Y.—The Village Trus. are stated to have granted F. A. Dudley's Co. a perpetual franchise for water works, the company agreeing to furnish five taps free for fire purposes.

Philadelphia, Pa.—Bids are wanted Sept. 17 (readvertisement) for constructing Lardner's Point Pumping Station No. 2. Wm. C. Haddock, Dir. Pub. Wks., Bureau of Filtration.

Local press reports state that Wm. C. Haddock, Dir. of Pub. Wks., is to receive bids until Sept. 18 for the high service pumping station to be erected at Delaware Ave. and Race St.

Stoneboro, Pa.—Bids are wanted Sept. 22 for constructing a gravity water works system, to consist of a 224,000,000-gal. concrete reservoir, 12,000 ft. of 6-in. and 2,000 ft. of 4-in. cast iron pipe, 75 taps with boxes and necessary valves and Ts. Frank McSweeney, Boro. Treas.

Beaumont, Tex.—It is reported that the Water Works Co. of Beaumont will probably extend its lines to the Big Sand River.

Monticello, Minn.—J. L. White writes that the National Construction Co., of South Bend, Ind., has secured the contract for an air lift water works system, for $10,000.

Stephenville, Tex.—The citizens are stated to have voted to issue $10,000 water works bonds.

Gas, Kan.—This city has voted $30,000 for water works, and has employed Burns & McDonnell, of Kansas City, Mo., to prepare plans and specifications for same.

Whittier, Cal.—A press report states that N. W. Stowell, of Los Angeles, has purchased the East Whittier Land & Water Company's pumping plant, 14 miles of ditches and 126 acres of water bearing land, and will expend about $40,000 in improving and extending the system.

Lincoln, Ill.—The Lincoln Water & Light Co. has been incorporated, with a capital of $250,000, to operate a light and water plant. Incorporators: Ralph Blaisdell, P. B. Warren and Geo. H. Withrow.

Albuquerque, N. M.—It is stated that the Socorro Investment & Promotion Assoc. will petition the City Council for a franchise to lay irrigation pipes in this city for the purpose of conveying water from its pumping plants for irrigation purposes, and also for an electric light and power plant. The company will also pump water to the east side of the Rio Grande to irrigate that section.

Corvallis, Ore.—Sidney Smith, of Portland, is stated to have petitioned for a water works franchise. He proposes to pipe water from the mountains for a distance of 15 miles, if the City Council will grant him a franchise.

Milwaukee, Wis.—Bids were opened Sept. 5 as follows for 8-million-gal. pumping engine: Holly Mfg. Co., $45,000; Barr Pumping Eng. Co., $65,000; Allis-Chalmers Co., of Chicago, Ill., plan A, $29,400; plan B, which was accepted Sept. 9, $31,700.

Baldwins, L. I.—The following bids were opened Sept. 11 for a pumping plant at Millburn Engine House, Baldwins, L. I.: Henry R. Worthington, $51,000 and $59,000; Snow Steam Pump Wks., $50,000. Bids were also received as follows for two boilers: Jas. Reilly Repair & Supply Co., $12,376; Edwin Burhorn, $11,400; J. Edw. Ogden Co., $11,800.

Grossdale, Ill.—Bids will be received by the Bd. of Local Improv. until Sept. 16 for furnishing and laying 43,000 lin. ft. of 6-in. and 8,000 lin. ft. of 4-in. mains, 121 double nozzle hydrants, and 42 valves and valve boxes. W. B. Ewing, C. E., 1003 Chamber of Commerce, Chicago.

Baraboo, Wis.—Bids will be received by the Health & Water Com. until Sept. 25 for furnishing machinery and constructing a brick power house for the new water supply; also for drilling two 16-in. wells, 400 ft. deep. W. G. Kirchoffer, Engr. in charge.

North Milwaukee, Wis.—Bids will be received by the Village Bd. until Sept. 19 for furnishing 466 tons of cast-iron water pipe, as follows: 313 tons of 8-in., 122 tons of 6-in. and 31 tons of 4-in. W. E. Chase, Village Clk.

Cleveland, O.—Bids are wanted Oct. 3 for construction, delivery and erection in the boiler house at Kirtland St. Pumping Station, of 6 water-tube boilers equipped with superheaters, chain-gate mechanical stokers, brickwork and their appurtenances. Chas. P. Salen, Dir. of Pub. Wks.

Gibbon, Minn.—Bids will be received by E. F. Maetzold, Village Recorder, until Sept. 26 for a 6 H.-P. gasoline pumping engine.

Ballard, Wash.—The Pacific Coast Pipe Co., of Ballard, is stated to have secured the contract for laying the water mains for about $10,000.

Bennett, Ia.—C. H. Meredith, of Cedar Rapids, is reported to be preparing plans for water works.

Litchfield, Ill.—Henry J. Croft, City Clk., writes that it is proposed to extend the water mains.

Pittsburg, Pa.—Bids will be received by the Co. Comrs. until Sept. 19 for erecting a mechanical filtration plant in the County Jail. W. E. Thompson, Co. Compt.

SEWERAGE AND SEWAGE DISPOSAL.

Wooster, O.—Bids will be received by J. B. Minier, City Clk., until Sept. 20 for constructing a sewer in Beall Ave., including necessary manholes, catchbasins, etc.

New Orleans, La.—Geo. G. Earl, Gen. Supt. Sewerage and Water Bd., writes that all bids opened Aug. 12 for sewers were rejected Sept. 3.

Thompsonville, Conn.—Local press reports state that bids will be received by the Sewer Comrs. until Sept. 20 for constructing a sewer in Elm and North Main Sts., requiring 3,100 ft. of 8-in. pipe.

Des Moines, Ia.—Bids are wanted Sept. 17 for constructing an 18-in. pipe sewer in 2 streets. J. E. Stout, Clk. of Bd.

Muscatine, Ia.—Bids are wanted Sept. 18 for constructing a stone sewer in Oak St. Jas. J. Ryan, City Engr.

Long Island City, N. Y.—Bids will be received until Sept. 18 by Jos. Cassidy, Boro. Pres., for furnishing material and constructing 2,435 lin. ft. of 12, 15 and 18-in. pipe sewer in Hamilton St., and for furnishing material and constructing several small pipe sewers in other streets.

Toledo, O.—Bids are wanted Sept. 22 for constructing 8 and 10-in. circular pipe sewers and 20-in. circular brick sewer with 4-in. shell in portion of several streets. Chas. H. Nauts, City Clk.

Chamberlain, S. D.—See "Government Work."

Glassport, Pa.—D. V. Ault & Co. are stated to have secured the contract for sewers on Bway. and Vermont Aves. for $9,392.

Providence, R. I.—The Bd. of Aldermen is stated to have passed a resolution adding $100,000 to the sewer appropriation. It will be expended on the general system of sewers.

Seneca Falls, N. Y.—The question of constructing sewers and new pavements is under consideration. It is reported that the length of proposed sewerage system would be 14¾ miles, and the estimated cost of construction $68,000.

Youngstown, O.—City Engr. F. M. Lillie is reported to be preparing plans for the Oak St. sewerage system.

Millville, N. J.—A company of Millville capitalists are stated to have petitioned the Council for a franchise to sewer the town.

Peoria, Ill.—The Crescent Stone Co., 117 N. Jefferson Ave., is stated to have secured the contract for constructing the Persimmon St. sewer for $17,000. The Bd. of Local Improv. is stated to have ordered the City Engr. Dept. to prepare an estimate for a sewer in Monson and Sanford's addition.

Hyattsville, Md.—The City Council is reported to be discussing the establishment of a sewerage system.

Glenville, O.—The City Council is stated to have authorized the Clerk to secure bids for a trunk sewer in Doan St.

Pittsburg, Pa.—A charter is reported to have been filed in the Recorder's office of the Monongahela Valley Sewer Co. by Attorney John N. Radcliffe, W. R. Murphy and others, to construct and maintain sewers, culverts, conduits, pipes, with all necessary inlets and appliances for surface and undersurface and sewerage drainage in Jefferson Township, Allegheny County.

St. Paul, Minn.—The following bids are stated to have been opened by the Bd. of Pub. Wks., Sept. 2, for the Dearborn St. and Stryker Ave. sewers: P. Doherty, $14,564; Wm. J. Preston, $13,825, and P. J. Rogers, $15,800.

Virginia, Minn.—There is talk here of constructing a sewerage system.

Qu'Appelle, N. W. Ter.—The citizens are stated to have voted Aug. 29 to construct a sewerage system, to cost $6,000.

Eatontown, N. J.—The Monmouth Sewer Co., of Eatontown, is reported incorporated, with a capital of $100,000, to construct and maintain sewer systems. Incorporators: Jas. Steen, Eatontown, and Ira H. Carpenter, Asbury Park.

Brooklyn, N. Y.—See "Paving and Roadmaking."

Dunmore, Pa.—M. J. Gibbons, of Scranton, is stated to have secured the contract for constructing sewers in Dunmore, for $56,771.

Hartford, Conn.—City Engr. F. L. Ford is reported to have suggested to the Street Comrs. the construction of a trunk sewer for the relief of Franklin Ave., at a cost of about $50,000.

Milwaukee, Wis.—See "Bridges."

South Bend, Ind.—O. A. Garner, of Knox, Engr. of the Reclamation Co., of Knox, writes that it is proposed to construct a drainage canal about 17 miles in length to reclaim the Kankakee marsh; probable cost of work, $95,000.

Waukegan, Ill.—The City Council is stated to have passed an ordinance providing for a sewerage system in the south side, to cost $30,000.

Portland, Ore.—Local press reports state that the City Engr. has about completed surveys for the Cook Ave. sewer system in Albina District.

Elyria, Colo.—The Town Council of Elyria is stated to have appointed a committee to confer with the Globeville Town Council regarding the extension of the Delgany St. sewer. The sewer empties into the Platte between the two towns, and citizens of both places are endeavoring to have it extended beyond the town limits.

Warsaw, Ky.—E. F. Layman is stated to have been selected by the Town Bd. to make an extended survey providing for its topographical reconstruction and improvement. The survey contemplates a complete drainage and sewerage system, paved streets and sidewalks.

Vailsburg, N. J.—The Council is stated to have decided to establish a local sewer system in the borough to connect with the joint trunk sewer.

Lowell, Mass.—The City Council on Sept. 2 passed an ordinance providing for an additional appropriation of $38,000 for sewers.

Wyandotte, Mich.—See "Power Plants, Gas and Electricity."

Brooklyn, N. Y.—In regard to the proposed sewer from 92d St. and N. Y. Bay to 11th Ave. in addition to the item which appeared in this column last week, Ch. Engr. H. R. Asserson, of the Dept. of Sewers, further states that as bids will soon be asked, prospective bidders are advised to post themselves as soon as possible on the material which will be encountered at the tunnel level; cost of proposed work is, as stated, $665,000.

Boston, Mass.—The following bids were opened Sept. 4 by the Boston Transit Commission for side walls and sewer in State St.: Lawler Bros., Charlestown, $38,835; Jones & Meehan, Boston, $29,765; Chas. King & Co., Boston, $26,820; Shailer & Dunfee, Boston, $26,420; Patk. McGovern, Roxbury, $25,349; Met. Contg. Co., Boston, $23,557; E. W. Everson & Co., Providence, $22,170; Gow & Foss, Boston, to whom the contract was awarded, $21,235. The detailed tender of the successful bidder includes 2,400 cu. yds. earth excav. and backfilling at $5.25; 500 cu. yds. concrete at $11; 30 cu. yds. brick masonry at $18.

Harrisburg, Pa.—The following bids are reported opened Sept. 3 by Bd. of Pub. Wks. for constructing Paxton Creek sewer: S. M. Neff, 120 Liberty St., N. Y. City, contract awarded, $167,227; Jas. J. Lynch, Harrisburg, $233,404; Chas. Fisher & Wm. H. Lynch, Harrisburg, $272,250; David Peoples, 25th and Callowhill Sts., Phila., $244,984; B. J. Sullivan, 14 So. Broad St., Phila., $279,446.

Henderson, Ky.—Bids are wanted Sept. 16 for constructing 2,600 ft. of 30-in. pipe sewer. Geo. D. Givens, Chmn. Sewer Com.

Montevideo, Uruguay.—Bids will be received until Dec. 15 by the Uruguayan Government at Montevideo for sanitary work in Montevideo Harbor, including the following: A rock tunnel 1,278 metres in length, 3m. 65 in height and 3m. in width; a main collector 1,557 metres 60 by 1,283, 30m. in length, oval profiles 1.80m. and 1m. 70 in height respectively; a secondary collector 2,016m. in length, varying its oval profiles from 1.70m., 1m. 25 and 0 m. 98 in height; auxiliary collectors, affluents, etc. Plans, estimates, etc., can be had in Montevideo by applying to the "Ministerio de Fomento."

Guthrie, Okla. Ter.—T. A. White, City Engr., writes that E. N. Ford has secured the contract for 5 sections of main sewer and 13 laterals, for a total cost of $38,000.

Victoria, Tex.—The City Council is stated to have instructed the Water Works Com. to secure estimates for a sewerage system.

Black River, N. Y.—See "Water."

Franklin, Ky.—The City Council is reported to be considering the construction of a sewerage system.

Mountain Lake Park, Md.—It is proposed to lay about 3 miles of terra cotta sewer pipe this fall. L. A. Rudisill, Secy.

Danville, Ill.—Bids are wanted by the Bd. of Local Improv. until Sept. 18 for constructing a sanitary sewer in a portion of Park St.

Boston, Mass.—Bids will be received until Sept. 17 by Jas. Donovan, Supt. of Streets, for sewerage works in Tower St.

Birmingham, Ala.—Local press reports state that the survey of the Valley Creek branch of the Jefferson County trunk sewer has been completed and the County officials are at work securing right of way. As soon as this is completed the contract will be let. The branch runs from East Lake through Woodlawn, Avondale, North Birmingham, Pratt City and Ensley.

Fresno, Cal.—The Com. appointed to consider the outfall sewer matter, is stated to have reported recommending the construction of a septic tank as the best method of sewage disposal. Thos. Dunn, Chmn. Com.

Lancaster, O.—It is stated that bids are wanted Sept. 18 for constructing sewers in 3 streets. H. T. Meehling, City Clk.

Allentown, Pa.—Bids will be received by the Mayor, Fred E. Lewis, until Sept. 16, for constructing a storm-water sewer in portions of Hamilton St.

Marion, Ind.—It is stated that bids are wanted Sept. 16 for constructing a sanitary sewer in 36th St. C. G. Robbins, City Engr.

Washington, D. C.—A press report states that the Comrs. D. C. have awarded to Bernard J. Sullivan & Bro., of Philadelphia and New York the contract for constructing an 18-ft. sewer under the Capitol grounds, B St., and New Jersey Ave. for $216,000.

St. Paul, Minn.—Bids will be received by the Bd. of Pub. Wks. until Sept. 16 for constructing a sewer in Farrington Ave. Bids will also be received by the same Bd. until Sept. 19 for constructing sewers in portions of Dearborne St. and Stryker Ave. R. L. Gorman, Clk.

New York, N. Y.—The N. Y. Sewer Constn. Co. has been awarded the contract for an outlet sewer bet. 92d and 93d Sts., on the basis of the following bid, opened Sept. 9: 150 ft. of 4-ft. wooden barrel sewer at $13; 1,637 ft. of 4-ft. brick sewer at $13, $10.75 and $12.75; 213 ft. of 3.5x2 1/3-ft. brick sewer at $7.25 and $6.50; 75 ft. of 12-in. pipe culvert at $1.50; 3 receivg. basins with granite head, at $150, etc.; total, $25,555. The other bidders were John A. Hadert, $34,932; Jos. Burns, $33,480; F. V. Smith Contg. Co., $29,206; John J. McQuade, $34,660; Wm. E. Welch, $31,014; Walter J. Ford, $38,153; F. Thilemann, Jr., $27,888; Wm. J. Moore, $30,246.

BRIDGES.

Terre Haute, Ind.—The Co. Council has been petitioned to build the bridge over the Wabash River at Ohio St. so that the old one can be used meanwhile. It is reported that the total cost of the bridge will be $200,000.

Pawnee, Okla. Ter.—Bids will be received by the Bd. of Co. Comrs. until Sept. 22 for constructing 3 bridges across Arkansas River, 1 each at Cleveland, Ralston and Blackburn. G. P. Moore, Co. Clk.

Paxton, Neb.—Bids will be received by the Co. Comrs. at Ogallala until Sept. 18 for repairing a wagon bridge across South Platte River at Paxton. O. Reed, Co. Clk.

Ft. Wayne, Ind.—The Co. Comrs. are reported to have approved the erection of a bridge across St. Marys River at a point where residents of Marion, Pleasant, Adams and Wayne Townships have petitioned for it. The Co. Council must now vote the money.

Leeds, Ala.—It is reported that the Seaboard Air Line will build a bridge over the Cahawba River just above this place. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

Peru, Ind.—The Co. Council has appropriated $5,000 to repair bridge across Wabash River at Broad way.

Utica, N. Y.—The matter of bridge construction over the new channel of the Mohawk River at N. Genesee St. and the Miller road is under consideration by this city and the town of Deerfield, and the matter of how the cost is to be divided must be decided soon. P. L. Schultze, City Engr.

Indianapolis, Ind.—The Co. Council is reported to have increased the fund for the College Ave. stone arch bridge over Fall Creek by $5,000, making the total appropriation $80,000, which it is stated will be available after Jan. 1 next.

Muskogee, Ind. Ter.—The City Council is stated to have made some additional stipulations in regard to the proposition of the Colonial Trust Co., of St. Louis, to build a $40,000 wagon bridge across Arkansas River. The Midland Bridge Co., of Kansas City, is also reported to be a close bidder.

South Valley, N. Y.—All bids received Sept. 2 have been rejected by State Supt. of Pub. Wks. Chas. S. Boyd for a bridge over the Alleghany River on the Alleghany Indian reservation in this city, the lowest bid being in excess of money available. New bids will be received Sept. 15.

Atlantic City, N. J.—It is reported that two $5,000 bridges will be required on the line of the proposed turnpike from Atlantic City to Pleasantville.

Shreveport, La.—The City Council is reported to have passed an ordinance providing for a bridge over Cross bayou.

Pittsburg, Pa.—Repairs to the Point bridge over the Monongahela River are being contemplated. J. G. McCandless, Dir. Dept. Pub. Wks.

Batavia, N. Y.—See "Electric Railways."

Washington, D. C.—The War Dept. is reported to have approved, through Chief Clk. Scofield, the appropriation of $65,000 for reconstruction of pier No. 5 of the Aqueduct bridge over the Potomac River at Georgetown.

Appleton, Wis.—A. E. Heldeman, City Clk., writes that O'Keefe & Orbison, of Appleton, have secured the contract for constructing a stone bridge at John St., bids for which were opened Sept. 3, for $34,750.

Phoenixville, Pa.—See "Electric Railways."

Milwaukee, Wis.—It is reported that Pres. A. J. Earling, of the Chicago, Milwaukee & St. Paul R. R., has agreed to give the city right of way for the 27th St. viaduct and a $25,000 bonus in addition.

The Finance Com. of the Common Council has recommended the passage of an ordinance for $150,000 bridge bonds and $100,000 sewerage bonds, the bridge bonds to be devoted to building a bridge to Jones Island.

Pueblo, Colo.—Local press reports state that the contract for the Northern Ave. viaduct has been awarded to the Ericson Const. Co. for $6,967, and $4.50 per yd. for extra cement work.

Lafayette, Ind.—It is reported that a petition has been presented to the Co. Comrs. for a bridge across the Wabash River at Granville.

Seattle, Wash.—City Engr. Thomson is stated to have estimated the cost of a pile bridge and approaches at Railroad Ave. from Broad to University St. at $44,000.

It is reported that the contract for the Latona bridge has been awarded to J. A. Bailey for $49,079.60.

Portland, Ore.—Joseph Buchtel, of the East Side Improvement Assoc., is reported to be in favor of replacing the Grand Ave. bridge over Sullivan's Gulch with a steel truss structure.

New Brunswick, N. J.—A. Atkinson, City Engr., writes that the following bids were opened by the Bd. of Freeholders Sept. 3 for the construction of a bridge over Raritan River connecting Perth Amboy and South Amboy: Sandford & Harris, Hoboken, $146,950 (awarded); F. R. Long Co., Hackensack, $135,000, $142,000, $146,000, $149,000 and $124,000; American Bridge Co., New York, N. Y., $148,000; Berlin Construction Co., East Berlin, Conn., $148,900. The bridge will be 4,082 ft. long and 26 ft. wide.

Hume, N. Y.—See "Paving and Roadmaking."

West Stewartstown, N. H.—It is stated that an iron bridge will be put in to replace the railroad bridge over the Connecticut River, recently burned.

Kansas City, Kan.—City Engr. McAlpine is stated to have received plans for the proposed viaduct over the Union Pacific and Rock Island tracks on 10th St. They call for 3 spans and an iron trestle and stonework, with a total length of 1,100 ft., to cost about $90,000, the expense to be borne by the Union Pacific, the Rock Island and the Metropolitan St. Ry. Co.

Somerville, Mass.—It is reported that a bridge is to be built over the R. R. tracks at Sycamore St. and one at School St.

Morgantown, W. Va.—The Canton Bridge Co. is reported to have been awarded the contract for a 467-ft. bridge over Deckers Creek at Walnut St. for $18,630.

Steelton, Pa.—It is reported that a bridge over a mile long and costing $250,000 will be built over the Susquehanna River in this city.

Aurora, Ill.—It is reported that the Elgin, Aurora & Southern Traction Co. will build a bridge across Fox River on the road between Coleman and Five Islands, to replace present structure. Theo. North, Ch. Engr.

Detroit, Mich.—It is reported that Park Comr. Bolger has awarded contract for the canal bridge at the head of Belle Isle to Thos. J. Kennedy for about $8,000.

Anderson, Ind.—The Co. Comrs. have appropriated $18,000 for a wagon bridge over White River at Delaware St., and the contract is to be let this fall.

Danville, Ill.—Local press reports state that the cost of the proposed West Main St. bridge will be apportioned as follows: The township, $6,000; the city, $3,000; the street car company, $3,000, and the Co. $12,000; total, $24,000.

Valley, Neb.—The Co. Comrs. are considering the advisability of building a steel bridge over the Platte River. Probable cost, $15,000.

Pittsburg, Pa.—The War Dept. is being urged to compel the raising of the bridges over the Allegheny River in the interests of navigation.

Berkeley, Cal.—It is stated that plans are being completed for a stone bridge and gateway at the Telegraph Ave. entrance to the university grounds, for which $10,000 has been donated.

Davenport, Ia.—A petition is being circulated for the construction of a bridge across Rock River.

Providence, R. I.—It is estimated that $750,000 will be needed for highway work. Of this amount $400,000 is recommended by the City Council Com. on Highways for the East Side Viaduct, $260,000 is for the maintenance and repair of streets and $75,000 for building new streets.

Augusta, Ga.—Local press reports state that the construction of 2 bridges across the canal is being considered.

Wausau, Wis.—The Council is said to be considering a tax levy of $15,000 for the purpose of building a bridge to connect the 1st and 7th Wards.

Oregon City, Ore.—Press reports state that the Tualatin bridge has been destroyed; loss about $5,000.

Reading, Pa.—The Committees on Law and Railroads have under consideration the building of a bridge at Front St.

Camden, N. J.—It is stated that $20,000 has been appropriated for a bridge to be built across Cooper's Creek at Baird Ave.

Milwaukee, Wis.—Chas. J. Poetsch, City Engr., writes that the Milwaukee Steel Structural Co., of Milwaukee, submitted the lowest bid for constructing a bridge at Muskego Ave. for $93,800.

Peoria, Ill.—Numerous bridges will be needed in Peoria Co. to replace those washed out by recent floods.

Modesto, Cal.—C. D. Swan, Co. Aud., writes that the Pacific Construction Co., of San Francisco, has secured the contract for a bridge across Stanislaus River for $14,000.

Omaha, Neb.—Press reports state that the American Bridge Co. has secured a contract from the Illinois Central R. R. Co. to furnish 2,100 tons of steel for the bridge to be built by the R. R. Co. across Missouri River in this city. The bridge is to have a draw span 520 ft. long, and 11 spans, each 50-ft. long.

Watervliet, N. Y.—Chas. S. Boyd, State Supt. of Pub. Wks., Albany, writes that Snell Bros. & Hanigan, of Fonda, have secured the contract for the repair of approaches of the 14th St. bridge, at Watervliet, for $12,235.

Westmoreland, Kan.—It is stated that bids are wanted Sept. 16 for constructing a 60-ft. span iron bridge, steel joints, 14-ft. roadway, across Rock Creek. A. P. Scritchfield, Co. Clk.

Newark, N. J.—It is reported that the Bd. of Wks. has approved plans for the D. L. & W. R. R. bridge over Broad St. It will be a steel girder bridge, 110-ft. span and 8-ft. depth, and will carry three tracks. W. K. McFarlin, Ch. Engr., Hoboken, N. J.

Ellendale, N. D.—Bids will be received by H. J. Oberman, Co. Aud., until Oct. 6, for constructing a steel bridge across James River, 250 ft. long and 16 ft. wide.

PAVING AND ROADMAKING.

Trenton, N. J.—Bids will be received by the Common Council until Sept. 16 for paving with sheet asphaltum on Belgian block, portions of several streets. C. Edw. Murray, City Clk.

New York, N. Y.—Bids are wanted Sept. 18 (readvertisement) for furnishing material and constructing a sidewalk at the City Prison Tombs. Thos. W. Hynes, Comr. Dept. of Correction.

Buffalo, N. Y.—Bids will be received by the Dept. of Pub. Wks. until Sept. 19 for paving Kingston Pl. and Riverside Ave. Francis G. Ward, Comr. of Pub. Wks.

San Francisco, Cal.—See "Government Work."

New Brighton, S. I., N. Y.—Bids will be received by the Pres. of Richmond Boro., 1st Nat. Bank Bldg., St. George, New Brighton, unt.. Sept. 19 for regulating, grading and macadamizing a portion of Hamilton Ave., requiring 4,700 sq. yds. of macadam pavement, 1,000 ft. of bridgestone, 2,000 lin. ft. of curbstone, etc. Louis L. Tribus, Acting Pres. & Comr. of Pub. Wks.

Jefferson Barracks, Mo.—See "Government Work."

Glassport, Pa.—Bowman Bros., of McKeesport, are stated to have secured the contract for paving Bway. Ave. for $7,500.

Seneca Falls, N. Y.—See "Sewerage and Sewage Disposal."

Morgantown, W. Va.—The Monongahela Co. Comrs. are stated to have appropriated $10,000 to macadamize 2 miles of road under the supervision of the U. S. Dept. of Agriculture.

Tacoma, Wash.—The contract for paving Pacific Ave. is stated to have been awarded to the Warren Construction Co. at $11,612. The improvement consists of removing the present surface pavement of bituminous rock and relaying a 2-in. layer of bituminous macadam on the old concrete foundation.

New Orleans, La.—An ordinance is stated to have been introduced in Council Sept. 2 providing for the paving of Canal St. with asphalt, from Liberty St. to Metairie ridge.

Des Moines, Ia.—The City Council on Sept. 2 is stated to have authorized the paving of 15th and State Sts., with brick and on Sept. 9th Council ordered the paving of Walnut, 12th, 5th and Maple Sts. with asphalt, about 52,000 sq. yds.

Omaha, Neb.—The Park Bd. is stated to have petitioned the Co. Comrs. for co-operation in the paving of 30th St. from Fort St. to Florence with brick or other pavement instead of macadam.

Toronto, Ont.—It is stated that City Engr. C. H. Rust is about to recommend the paving of Esplanade St. with granite at a cost of about $96,000.

Beloit, Wis.—J. A. Heineman, of Chicago, Ill., is reported to be the lowest bidder for brick paving, which includes nearly 2 miles of streets, his figures being $42,868.

Crookston, Minn.—City Engr. Ralph is stated to have submitted to Council the cost of the proposed macadam paving to be laid in the residence streets. The total cost of the granite macadam paving is estimated at $66,537, excavating work $1,352 and curbing $14,092.

St. Paul, Minn.—The contract for paving Robert St. with brick has been awarded to P. J. Ryan, of St. Paul, for $23,150. The Barber Asphalt Co. is stated to have secured the contract for paving Ramsey St. with asphalt, for $15,450.

Jacksonville, Ill.—It is proposed to pave N. Pine St. with brick at a cost of $7,200.

Newark, N. J.—The Barber Asphalt Paving Co. is stated to have secured the contract for paving a portion of Camden St. with asphalt, for $7,697.

Pittsburg, Pa.—The Co. Comrs. are stated to have prepared petitions for the improvements of the following county roads: Boston, Freeport, Lovedale, Leetsdale, Persimmon and Imperial.

Alexandria, Va.—Bonds to the amount of $32,000 are stated to have been sold Sept. 1. The money to be used for street and other public improvements.

Brooklyn, N. Y.—Chief Engineer Lewis, of the Bd. of Estimate on Sept. 5 is reported to have recommended the following improvements for Brooklyn: Paving Barbey St., cost $23,500; regulating Barbey St., $16,000; sewer in Ovington Ave., $14,840; regulating 50th St., $7,000; paving with asphalt Hinsdale St., $18,000; paving with asphalt Jerome St., $21,500; paving with asphalt Cleveland St., $7,000; regulating Hill St., $6,400.

Cincinnati, O.—F. H. Kirchner & Co. are stated to have secured the contract for paving Taylor Ave. with brick for $11,331.

The Bd. of Pub. Service is stated to have received a petition for paving a portion of Rockdale Ave. with Bitulithic asphalt.

The Bd. of Pub. Service is stated to have directed Engr. Stanley to prepare specifications and estimates for the paving with asphalt McMillan St., from May to Auburn Ave.

Nashville, Tenn.—An ordinance is stated to have been introduced in Council providing for the paving of Russell St. with Warren bitumen macadam, to cost about $25,000.

Washington, Pa.—Wm. H. McEnrue writes that the citizens on Aug. 30 voted to issue $150,000 bonds for street improvements.

Pontiac, Ill.—John Cherry is stated to have secured the contract for paving Mill and Lincoln Sts., for $17,630.

Fredericksburg, Va.—Civil Engineer Dickinson, of Charlotteville, is reported to be surveying the streets of this city preparatory to beginning the work of paving. The material to be used in improving the streets has not yet been decided upon.

Allentown, Pa.—The Barber Asphalt Paving Co. is stated to have secured the contract for paving Tilghman St. with asphalt at $2 per sq. yd.

Marshalltown, Ia.—The City Council is stated to have decided to pave S. 3d Ave. and Jerome St. with asphalt.

Yonkers, N. Y.—The contract for paving Alta Ave. with bituminous macadam is stated to have been awarded to the Warren Bros. Co., for $12,970.

Latonia, O.—The Town Trus. are reported to have under discussion the advisability of voting on a $30,000 bond issue for further street improvements.

Hume, N. Y.—It is reported that the town will issue $25,000 road and bridge bonds.

Warsaw, Ky.—See "Sewerage and Sewage Disposal."

Leavenworth, Kan.—Bids will be received until Sept. 17 for paving and repaving Broadway, as advertised in The Engineering Record.

W. G. Neely, City Engr., writes that the following bids were opened Sept. 3 for *a* 8,650 ft. curbing, *b* 6,615 cu. yds. regrading, *c* 19,062 sq. yds. paving: R. J. Boyd, Kansas City, Mo., *a* 55 cts., *b* 53 cts., *c* $1.63; John McGuire, Leavenworth, *c* $1.4775; Thos. Jones, Leavenworth, *a* 49 cts.; Chas. Stanton, Leavenworth, *a* 49 cts.; W. M. Edwards, Kansas City, Mo., *a* 54 cts., *b* 28 cts., *c* $1.54; The Everette Co., Atchison, Kan., *a* 52 cts., *b* 30 cts., *c* $1.47; Ramsay & Ramsay, Topeka, *b* 30 cts., *c* $1.48; John Ritchie, Topeka, *c* $1.47; Chapin & Graver, Leavenworth, *a* 49 cts., *b* 30 cts., *c* $1.445.

Council Bluffs, Ia.—James Wickham, of this place, has been awarded the contract for about 5,000 sq. yds. paving with Galesburg brick on 6-in. concrete at $1.89 per sq. yd.

South Bend, Ind.—Robert, Hoban & Roach, South Bend, have been awarded a contract for 23,388 sq. yds. brick paving, with Nelsonville block, at $1.33; total, $32,904. Other bidders on this block were: Jas. Nelson, South Bend, $1.35; Garrigan Bros., Toledo, O., $1.40; H. P. Streicher, Toledo, $1.33; W. W. Hatch & Sons, Goshen, Ind., $1.43.

Niagara Falls, N. Y.—Bids will be received by the Bd. of Pub. Wks. until Sept. 19 for paving with asphalt on portions of 4th, 5th and 11th Sts., and with brick on a portion of 13th St. Walter McCulloh, City Engr.

Atlantic City, N. J.—Bids will be received by the Bd. of Chosen Freeholders until Oct. 1 for constructing the proposed elevated gravel road across the meadows, between Pleasantville and Atlantic City, a distance of about 4 miles, to include bulkheading, bridging and pumping sand for filling. Fred Schuchardt, Dir.; J. J. Albertson, Engr., Magnolia, N. J.

Ironton, O.—Bids are wanted Sept. 18 for improving portions of 6th St. by grading and paving. Geo. H. Davies, City Clk.

Allentown, Pa.—Bids will be received by Mayor Fred. E. Lewis until Sept. 16 for paving a portion of Penn St. with Trinidad Pitch Lake, Bermudez or Alcatraz sheet asphalt.

Terre Haute, Ind.—Local press reports state that bids will be received by the Bd. of Pub. Wks. until Sept. 17 (readvertisement) for improving a portion of 9th St.

Maryville, Mo.—It is stated that bids are wanted Sept. 20 for vitrified brick paving on sand foundation as follows: 12,296 sq. yds. paving, 7,144 lin. ft. curbing, 1,302 cu. yds. sand, 3,293 cu. yds. excavation. Geo. Custer, City Engr.; E. H. Bainum, City Clk.

Lewiston, Idaho.—Local press reports state that bids will be received by the City Council until Oct. 6 for $10,000 street improvement bonds. It is stated that bids will be asked soon by the City Council for improving East Main and Fifth Sts.

Buffalo, N. Y.—Bids will be received by Wm. H. Daniels, Co. Treas., until Sept. 23 for $102,918 Erie Co. good roads bonds.

Holland, Mich.—The annual appropriation bill passed by the Common Council is reported to contain an estimate of $60,000 for the paving of 8th St. and $24,000 for paving River St. It is expected that this improvement will be made next spring.

Little Rock, Ark.—The Arkansas Asphalt Co., of Little Rock, is stated to have secured the contract for paving W. Marham St. at the following bid per sq. yd.: 17,400 sq. yds. asphalt, 90 cts.; 2,900 cu. yds. concrete at $4.86, and 3,900 cu. yds. excavation at 65 cts.

Burlington, Ia.—The Council has decided to pave a portion of Main St. with brick.

Dunkirk, N. Y.—H. A. Holstein, Asst. Engr., writes that bids are wanted Sept. 30 for repaving 4,100 sq. yds. on E. 3d St. and for paving 1,520 sq. yds. on Lion St. Bids will be received on brick, asphalt and macadam. J. P. Groesch, City Clk.

Iowa City, Ia.—Wm. Horrabin is stated to have secured the contract for paving Burlington St. with brick, at $1.63 per sq. yd.

Pennygrove, N. J.—It is stated that two of the main streets will be macadamized, at a cost of $12,000.

Springfield, Ill.—The Bd. of Pub. Improv. is stated to have decided to report favorably on the paving of Glenwood Ave.

Rouse's Point, N. Y.—It is stated that $5,000 will be expended by the village for macadamizing.

Portsmouth, Va.—The Virginia-Carolina Construction Co., of Norfolk, is stated to have secured the contract for 7,500 sq. yds. of granolithic pavement at $1.52½ per sq. yd.

Providence, R. I.—See "Bridges."

Jersey City, N. J.—Bids will be received by the Bd. of St. & Water Comrs. until Sept. 16 for improving. Manhattan Ave. by repaving 2,245 sq. yds. of Belgian. Geo. T. Bouton, Clk.

Kenmore, N. Y.—Bids will be received by the Village Bd. of Trus. until Sept. 22 for paving Tremaine St.

Cedar Rapids, Ia.—Bids are wanted Sept. 16 for macadamizing portions of several streets. W. L. Cherry, Chmn. Pub. Improv. Com.

Galesburg, Ill.—The Bd. of Local Improv. is stated to have recommended the paving of Holton St. with block, at a cost of about $31,000.

Portland, Ore.—The Trinidad Asphalt Co. is stated to have secured the contract for asphalt paving on 7th St. between Burnside and Taylor Sts., for $22,023.

Laporte, Ind.—Henry Opperman, of Michigan City, is stated to have been appointed as viewer for the gravel road improvement between Waterford and the Pine Lake cemetery north of Laporte; the work will cost between $35,000 and $40,000.

Tipton, Ia.—M. Earl Clark, City Clk., writes that bids are wanted until Sept. 22 for 8 blocks of brick repressed block paving. W. D. Wardle, Engr. in Charge.

Peoria, Ill.—Bids will be received by the Bd. of Local Improv. until Sept. 16 for grading, curbing and paving with brick on a portion of James St. Approximately 3,482 cu. yds. of excavation, 4,794 ft. of combined curb and gutter, 8,448 sq. yds. of paving, etc. H. E. Beasley, City Engr.

Oskaloosa, Ia.—C. Leighton, City Clk., writes that Geo. H. Carlon & Son, of Oskaloosa, have secured the contract for 21,000 sq. yds. of brick paving, at $1.41 per sq. yd.

Memphis, Tenn.—Bids were opened Sept. 6 for paving 14 streets, aggregating 92,786 sq. yds., and are reported as follows: Memphis Asph. & Pavg. Co., $1.24 per sq. yd. 5-yr. maintenance, $1.48 10-yr. maintenance; Parker-Washington Co., Kansas City, Mo., Trinidad asph., $1.45 with 5-yr. main., $1.55 with 10-yr.; Southern Pavg. & Constn. Co., Chattanooga, Bermudez Lake and Trinidad asph., $1.26 and $1.49 with 5-yr. and 10-yr. main resp.; R. B. Parke Co., Louisville, Ky., Ky. rock asph., $1.15 with 5-yr. main.; Louisiana Improvement Co., New Orleans, Trinidad asph., $2.50 and $2.75 with 5 and 10-yr. main. and $2 no guarantee; C. P. White, Boonville, Ind., $1.16 and $1.05 for 5-yr. main. and $1.19 and $1.08 for 10-yr., according to streets.

Crawfordsville, Ind.—Nolan & Slattery, of this place, have been awarded the contract to pave Market St.; the detailed bid reported is as follows: 1,600 ft. curb at 32.5 cts., 440 stone headers at 20 cts., 3,775 cu. yds. excav. at 22.5 cts., 10,200 sq. yds. paving at $1.425; total, $15,992.

Williamsport, Pa.—The Coryell Constn. Co. has been recommended for the award of a contract for brick paving with Guise brick on present macadam pavement on Willow, Court and West Sts., at $1.27 per sq. yd. Bids are reported for Park St. pavement, opened Sept. 5, as follows: Coryell Constn. Co., Guise brick on 6-in. foundation, $1.85; on 4-in. found., $1.75; creo-resinate wood block, 3-in., blk., 6-in. found., $2.70; 3-in. blk., 4-in. found., $2.55; 4-in. blk., 6-in. found., $3.10; 4-in. blk., 4-in. found., $2.75; Ezra Rathmell, Guise brick, 6-in. found., $1.87; John H. Welteroth, Guise brick, 6-in. found., $2.90; Sicilian Asph. Co., 1½-in. surf., 4-in. conc. found., $2.40; 6-in. found., $2.60; 2½-in. surface, 4-in. found., $2.75; 6-in. found., $3.

Rochester, N. Y.—The following bids are reported received for paving Central Park and Barrington St.; *a*, Rock Asph. Pavemt. Co.; *b*, Whitmore, Rauber & Vicinus; *c*, Rochester Vulcanite Pavemt. Co.; *d*, Brayer & Albaugh; *e*, H. N. Cowles; *f*, Lauer & Hagaman; *g*, H. B. Hooker & Son; *h*, Thos. Holahan; *j*, Wm. Fuller. Central Park: Asph., *a* $26,489, *b* $26,853, c $27,320; brick, *d* $31,849, *e* $26,402, *a* $28,800, *f* $29,248, *b* $29,147, *g* $29,909, *h* $30,232; macadam, *e* $37,905, *g* $26,626, *b* $42,906, *f* $45,248, *d* $44,432, *h* $34,048. Barrington St.: Asph., lowest, *b* $9,536; brick, lowest, *b* $10,328; macadam, lowest, e $8,430.

Boston, Mass.—City Engr. Jackson received the following bids Sept. 10 for the Oakland St. grade crossing. The contract calls for telford macadam roadway in Oakland St. and gravel roadway in connecting highways: Thos. J. Welch, $15,815 (awarded); H. P. Nawn, $16,219; H. A. Henderson Co., $16,572; Jas. Doherty, $16,604; Jas. J. Caughlan, $17,211; Jones & Meehan, $17,477; W. H. Ellis, $17,701; D. E. Lynch, $18,348; T. J. Bradley, $19,117; Barnes, Ruffin Co., $19,749; J. C. Coleman, $22,960.

New York, N. Y.—The Uvalde Asph. Pavg. Co. has received 14 contracts for asphalt paving, on basis of bids opened Sept. 9, at $1 to $1.30 per sq. yd., total $61,911; the Asph. Constn. Co., 6 contracts, at $1 to $1.17 per sq. yd., total $41,507; the Continental Asph. Pavg. Co., 6 contracts at $1.30 to $1.60 per sq. yd., total $35,980; Barber Asph. Pavg. Co., 2 contracts at $1.14 and $1.60, total $9,416.

Bids were opened Sept. 11 as follows for paving Henry St. with asphalt on present pavt. relaid as foundation, the work including 9,100 sq. yds. asph. and 9,200 sq. yds. stone pavt. relaid: Continental Asph. Pavt. Co., $1.40 per sq. yd. for asph., 35 cts. for relaying stone pavt., $20,145 total; Asph. Constn. Co., $1.25 and 30 cts. for asph. and foundation, $18,001 total; Barber Asph. Pavg. Co., $1.38 and 40 cts., $20,448 total; Sicilian Asph. Pavg. Co., $1.40 and 35 cts., $20,63 total; Uvalde Asph. Pavg. Co., contract awarded, $1.02 and 38 cts., $17,201 total.

POWER PLANTS, GAS AND ELECTRICITY.

Prospect, O.—Bids are wanted Sept. 25 for furnishing incandescent electric lights for a period of 10 years. Neil J. Gast, City Clk.

De Smet, S. D.—See "Water."

Prescott, Ariz.—The City Council is stated to have passed an ordinance granting Geo. S. Porter, Jr., a franchise to construct and operate a gas plant in Prescott.

Watervliet, N. Y.—The Hudson River Electric Co. is stated to have secured a franchise to establish an electric light plant in Watervliet.

North Amherst, O.—It is stated that the question of building an electric plant to cost about $8,000 is being considered by Council.

Goshen, Ind.—The Council is stated to have granted the Hawks Electric Co. a franchise to operate an electric lighting plant in Goshen.

Concord, N. H.—It is stated that Concord is just at the expiration of a 10 years' electric lighting contract with the Concord Electric Co., and is considering making a change in the system.

St. Albans, Vt.—The Vermont Light, Heat & Power Co. has been incorporated, with a capital of $200,000. E. E. Carpenter, of Worcester, Mass., and J. J. Flynn, of Burlington, Vt., are reported interested.

Monticello, Ind.—Chas. Meeker, of Lafayette, is reported interested in the construction of a power plant at Horseshoe Bend, about 8 miles south of Monticello. It is proposed to furnish electricity for power and lighting to Delphi, Lafayette and Monticello.

Baird, Tex.—The Baird Electric Light Co., of Baird, has been incorporated, with a capital of $5,000; by J. B. Harmon, Harry Mey and others.

Kenosha, Wis.—It is reported that the Kenosha Gas & Electric Co. will enlarge its electric light plant and construct a new power plant.

Carberry, Man.—The Town Council is stated to have accepted the proposition of E. S. Harrison, of Winnipeg, to install an electric light and telephone plant in Carberry.

Osceola, Neb.—Geo. Kannow is stated to have petitioned for a franchise for an electric light plant.

Kutztown, Pa.—A press report states that the Electric Light Co. has increased its capital from $15,000 to $50,000, and will make improvements.

Chisholm, Minn.—John Costin, of Virginia, Minn., is stated to have secured a franchise for an electric light plant.

Decatur, Ill.—B. S. Brooks, of Decatur, is stated to have secured the contract for erecting a power house for the James Millikin Univ. for $21,366.

St. Joseph, Minn.—It is reported that the Public Service Co., of St. Cloud, Minn., will install a lighting plant here.

Denver, Colo.—The Denver Highlands Electric Co., of which Robt. H. Porter is Pres. and Mrs. Emma A. Arbuckle Sec., is stated to have notified the City Council that they would in the near future ask for a franchise to operate in all parts of this city.

Santa Fe, N. M.—A press report states that Atty. Eugene A. Fiske and A. Gibson, of Santa Fe, are interested in the establishment of immense water turbines on upper Pecos for generation of electricity. The idea is to furnish Las Vegas and Santa Fe with electricity generated by waters of the Pecos.

Mobile, Ala.—The paving contracts for which bids were opened Aug. 28, as reported last week, were awarded Sept. 6 to the Southern Pavg. & Const. Co., Chattanooga, Tenn., both for asphalt and vitrified brick, amounts $75,057 and $38,908, respectively. The detailed bids are given in accompanying tables, A in that for asphalt bids being R. B. Parke & Co., Louisville, Ky., offering Ky. rock asph.; B, Green River Asph. Co., St. Louis, Ky. rock asph.; C, Louisiana Improvement Co., New Orleans, Trinidad land; D, Southern Pavg. & Const. Co., Chattanooga, Trinidad lake asphalt:

Bids for Asphalt Paving.

Items and Quantities.	A	B	C	D
4-in. concrete, 37,001 sq. yds.	$.65	$.43	$.11	$.40
Asphalt, 36,384 sq. yds.	1.15	1.26	1.80	1.34
Straight curb, 18,787 ft.	.48	.45	.46	.42
Circular curb, 616 ft.	.48	.45	.60	.42
Cement gutter, 2,992 ft.	.60	.20	.75	.35
Curb and gutter, 2,560 ft.	.75	.70	.85	.90
Totals	$78,922.07	$72,877.15	$82,994.25	$75,056.59

Bids for Vitrified Brick Paving.

Items and Quantities.	Southern Pav. & Const. Co., Chattanooga.	Gilsonite Con. Co., St. Louis.	White & Elchel, Evansville.
4-in. concrete, 4,350 sq. yds.	$.40	$1.00	$1.00
Brick grout filler, 4,350 sq. yds.	1.35	1.28	1.02
Brick sand grout filler, 14,500 sq. yds.	1.42	1.54	1.55
Curb, 2,456 ft.	.42	.48	.61
Curb and gutter, 10,747 ft.	.90	.70	.84
Totals	$38,908.29	$40,952.17	$41,789.87

Wyandotte, Mich.—The Bd. of Wks. is reported to have been instructed to furnish plans for an electric plant, water mains and sewers.

Monessen, Pa.—A number of business men are stated to have organized a company and will apply for a charter for an electric light plant.

Council Bluffs, Ia.—W. H. Fritchman, Mgr. Citizens Gas & Electric Co., writes that the size of the building to be erected is 62x42 ft. The machinery consists of 4 10x10 (diameter) purifying boxes, station meter, station governor, etc. The capacity of the new plant will be approximately 125,000 cu. ft. per day of 24 hours. The machinery part has not yet been contracted for, but will be during the next two weeks.

Paducah, Ky.—H. D. Fitch, of Bowling Green, is stated to have secured a franchise for a heating plant; cost of proposed plant will be about $80,000.

Ephrata, Pa.—The Boro. Secy. is stated to have been instructed to communicate with engineers in reference to plans and specifications for proposed electric light plant, to cost about $15,000.

Clayton, Mo.—Representatives of the Missouri & Meramec Water Co., which proposes to connect the Missouri and Meramec rivers with a power canal through St. Louis County, are stated to have petitioned the Co. Comrs. for a franchise.

Atlantic City, N. J.—The People's Gas Co. has been incorporated, with a capital of $150,000. Incorporators: Winfield S. Lannaster, John W. Berry, and others, all of Atlantic City.

Montreal, Que.—Local press reports state that the Montreal Light, Heat & Power Co. contemplates constructing an extensive system of conduits for the purpose of conveying heat in the commercial section of the city.

Fremont, Neb.—The City Council is stated to have decided to purchase an alternator to be installed at the municipal electric light plant at a cost of $4,000. It will supply 3,600 incandescent lights of 16 c. p. each.

Farmington, Mo.—The following bids were received for a water-power and steam plant, for which plans and specifications were issued by the Lanfketter-Bendit Mercantile Eng'g Co., St. Louis: Spradling & James, Farmington, Mo., contract awarded, $25,721.80; P. H. Porter, Clinton, Ky., $26,175; W. C. Porter, Birmingham, Ala., $27,252; G. Jaeger, Rich Hill, Mo., $26,685; Myers Construction Co., St. Louis, $27,650.

Detroit, Mich.—The Public Ltg. Comn. opened bids as follows Aug. 29, for one 900-H.-P. engine, one 600-Kw. alternator and one 60-Kw. exciter; Bradley Mfg. Co., Williams engine (a) with Westinghouse alternators, $24,000; (b) with Stanley alternator, $25,000; (c) with General Electric alternator, $24,250; for alternator and exciter, Brown Corliss Eng. Co., $9,850; Bullock Elec. Mfg. Co., $11,000; General Electric Co., $12,095; Stanley Elec. Mfg. Co., $14,518; Warren Electric Co., $10,900; Westinghouse E. & Mfg. Co., $13,200; Great Lakes Eng'g Co., engine, $18,080.

San Pedro, Cal.—It is stated that bids are wanted Oct. 14 for the purchase of a 50-year gas plant franchise. O. C. Abbott, City Clk.

Milwaukee, Wis.—Building permits have been issued for a 7-story brick building for the Johnson Electric Co., to be erected on Jefferson and Michigan Sts., to cost $100,000 and also for a solid brick power plant for the Milwaukee Electric Ry. & Light Co., to be erected on Commerce and Poplar Sts., to cost $100,000. H. J. Essen is the architect for both buildings.

Grand Rapids, Mich.—The village of East Grand Rapids is stated to have granted a 30-year franchise to the Grand Rapids Gas Light Co. to light the village and to lay mains for domestic purposes.

Turtle Creek, Pa.—The Rose Hill Electric Light & Power Co. is stated to have petitioned the Council for a franchise.

Lumberton, N. C.—It is reported that A. P. McAllister, Town Clk., has been directed to secure estimates for an electric light plant.

Watertown, Wis.—The plant of the Watertown Electric Light Co. is reported to have been sold to the Watertown Electric Co. It is the intention of the new company to utilize the water power of the dam in connection with the present plant, and furnish power night and day for manufacturing plants. F. E. Woodard, Pres., Watertown; P. L. Utley, Secy., Grand Rapids.

Albuquerque, N. M.—See "Water."

Carthage, Tex.—The electric light plant owned by J. C. Whitney at Carthage is stated to have been destroyed by fire Sept. 3; it is reported that it will be rebuilt at once.

Ballard, Wash.—It is stated that the Citizens' Light & Power Co. will construct a gas plant.
The City Council is stated to have decided to construct an electric light plant, at a cost of $25,000.

Easton, Pa.—The Council is stated to have granted a franchise to the Easton & Phillipsburg Steam Heat & Power Co.

Cincinnati, O.—The Councils of Lockland and Wyoming are stated to have approved the transfer of the franchise of the old Wyoming electric plant to the Cincinnati Gas & Electric Co. It is reported that the Gas Co. will remodel it and use it as a power station for the villages in the Mill Creek valley.

Holdenville, Ind. Ter.—It is reported that a franchise to establish an electric light plant has been granted to F. H. Tathwell and C. R. McBinder, of Shawnee, Okla. Ter. About $10,000 will be expended.

Lincoln, Ill.—See "Water."

Norfolk, Va.—It is stated that bids will be received by the People's Light & Power Co. until Nov. 15 for an electric light plant, to cost about $100,000. John G. Tilton, Pres.

Taylorville, Ill.—Bids are wanted Sept. 24 for furnishing material and constructing an electric light plant. Leroy Anderson, City Attorney; Owen Ford, Consulting Engr., 710 Security Bldg., St. Louis, Mo.

ELECTRIC RAILWAYS.

Mercer, Pa.—The Council is stated to have granted a franchise to the East End St. Ry. Co.

Marquette, Mich.—Wm. K. Rhodes, of Cleveland, O., is reported interested in the construction of an electric railway between Marquette and Negaunel, a distance of 13 miles.

Albany, Ind.—The Council is stated to have granted a franchise to the Muncie & Portland Traction Co.

Davis, Ind. Ter.—W. H. O'Brien, with his surveyor, J. S. Brazelton, of Gainesville, Tex., is reported to be here surveying for an electric railway to be built from Sulphur Springs to Davis and Turner Falls on Turner Creek. It is also reported to be the intention of the promoters to build a power house with dynamos for generating electricity immediately at the falls on Turner Creek.

Turtle Creek, Pa.—The Turtle Creek Valley St. Ry. Co. is stated to have petitioned the Council for a franchise to construct an electric railway from Turtle Creek to Wilkinsburg.

Piqua, O.—The Springfield, Piqua & Sidney Traction Co. has applied for a franchise to construct, operate and maintain an electric railroad on several streets of this city, and bids for said franchise will be received by the City Council until Sept. 19. Bert A. Reed, City Clk.

Rochester, N. Y.—The Rochester & Southern Traction Co. is reported to have been organized in Rochester to build a trolley line in the Genesee Valley, with Rochester and Hornellsville as the terminal point; the length of the line will be about 60 miles.

Albion, N. Y.—The Albion Ry. Co. is stated to have petitioned the Highway Comrs. for a franchise to construct an electric line from the east end of East State St. to Mt. Albion Cemetery, on Cemetery Ave.

Marion, Ind.—It is stated that the Ft. Wayne & Southwestern Traction Co. is considering the extension of its line to Marion by way of Warren and Van Buren. S. L. Nelson, Mgr. Ft. Wayne.

Troy, N. Y.—The State R. R. Comrs. are stated to have granted the Troy, Rensselaer & Pittsfield Ry. Co. permission to construct its line.

Tarentum, Pa.—The Council is stated to have granted a franchise to the Leechburg, Apollo, Freeport & Tarentum St. Ry. Co.

Amherst, Mass.—The Amherst & Sunderland St. Ry. Co. is stated to have petitioned the Selectmen for permission to extend its line from East Amherst to West Pelham; probable cost of work, $9,000.

Toledo, O.—John O. Zubel, of Marion, Mich., and J. H. Southard, of Toledo are reported interested in the construction of an electric railway from Toledo to Ann Arbor, touching at Petersburg, Milan and Dundee.

Bentonville, Ark.—The Kansas City, Bentonville & Southeastern R. R. Co. has been incorporated, with a capital of $150,000, to construct and operate a railroad of either steam or electric power, from Bentonville to a point on the Missouri and Arkansas boundary line, then to Pineville and Rutledge. Incorporators: A. M. Campbell, Chas. Haney and F. M. Wyatt, all of Bentonville.

San Bernardino, Cal.—The Superv. are stated to have granted W. R. Hervey, of Los Angeles, a franchise for an electric railway from the south line of the city of Colton to the south county line.

South Bend, Ind.—The South Bend Northern Ry. Co. has been incorporated, with a capital of $10,000, to conduct an electric line from South Bend to the State line between Indiana and Michigan. Directors: Clyde Smith, E. F. Gaffney and others.

Batavia, N. Y.—A press report states that work will probably soon begin by the Genesee & Orleans Electric Ry. on its proposed line from Batavia to Oak Orchard. A 500-ft. steel trestle, 40 ft. high, to cost about $30,000, will span Marsh Creek at its junction with Oak Orchard Creek. Houston Barnard, of Rochester, is reported to be Consulting Engr.

Princess Anne, Md.—The Princess Anne & Deals Island Light, Power & Ry. Co. is reported organized, with a capital of $200,000, to construct an electric railway from Princess Anne to Deals Island, a distance of about 19 miles. Hampden P. Dashield, Pres.

Texarkana, Ark.—E. J. Spencer, of St. Louis, is stated to have secured a franchise here. He recently received a franchise from the Council of Texarkana, Tex., and work on the proposed line will soon begin.

Mt. Ayr, Ia.—Lyman Waterman is reported interested in the construction of the Mt. Ayr & Creston El. Ry.

Phoenixville, Pa.—The Town Council is reported to be considering the granting of franchises to the Audubon and Black Rock St. Ry. Companies. The former proposes to run to Perkiomen, to connect with the Black Rock Co., which will enter town by way of the North Side. The trolley people offer to pay half the cost of a new steel bridge at Gay St. A new bridge will also be built across the Schuylkill River.

Belvidere, N. J.—The Warren Co. Bd. of Freeholders are stated to have granted a franchise to the Easton & Washington Traction Co. The company will construct a line 43 miles in length, which will connect Easton, Hackettstown, Belvidere and Clinton, with Washington as a center.

Lexington, Ky.—It is stated that the Bluegrass Consolidated Traction Co. has completed plans and specifications for the proposed interurban electric road from Lexington to Frankfort by way of Versailles, and bids for the work of construction will be received at once. Harold C. Beatty, Secy.

Riverside, Cal.—The City Trus. have granted Wilcox & Rose a franchise for an electric railway out Colton Ave. to the county line and on 8th St.

Waterville, Me.—The State R. R. Comrs. are stated to have granted permission to the Waterville & Oakland Electric R. R. Co. to construct its line.

Columbus, Ind.—Morton Hall and Albert Morris are stated to have petitioned the Co. Comrs. for a franchise for an electric line from Columbus to the southwest county line near Azalia and Reddington.

Newark, N. J.—Henry Dickson, of 22 Clinton St., is stated to have secured the contract for an extension to the power house on River St., for the North Jersey St. Ry. Co. Architect, Thos. Cressey, 800 Broad St.; probable cost, $100,000.

Maysville, Ky.—G. F. Kennedy, of Sardinia, O., is reported interested in the construction of an electric railway from Maysville to Columbus.

Dayton, O.—The Bd. of City Affairs is stated to have granted the D. L. & C. and the South Park R. R. companies certain rights in the southern section of the city.

Pekin, Ill.—Knight & Johnston are stated to have petitioned the Council for a franchise to construct an electric railway into Pekin and Peoria from Bloomington.

Hutchinson, Kan.—It is stated that the conversion of the Hutchinson horse car system into an electric railway, and the extension of the line a distance of 8 miles is being considered.

Muncie, Ind.—J. S. Lamon, of Anderson, is stated to have secured the contract for constructing a line between Muncie and Alexandria, for the Union Traction Co.

Dayton, O.—The Dayton & Western Traction Co. is reported to have amended its charter to permit it to run a line from New Paris to the Indiana line, to lease other lines and furnish electricity for all purposes. C. M. Corrello, Ch. Engr., West Alexandria, O.

Sterling, Ill.—The City Council is stated to have granted a franchise to the Sterling, Dixon & Eastern Ry. Co.

Ridgefarm, Ill.—The Town Bd. is stated to have granted Stone & Webster, of Boston, Mass., a franchise for an electric railway.

Cincinnati, O.—Dennis Dwyer, Pres. of the Cincinnati & Northeastern Traction Co., is stated to have petitioned the Co. Comrs. for a franchise to operate a road on the Reading, Cincinnati & Dayton turnpike.

Grafton, W. Va.—The City Council is stated to have granted B. F. Bailey, Chas. H. Straub and others, of Grafton, a franchise for the construction of a railway through the city.

Davenport, Ia.—The City Council is stated to have granted franchises to the John F. May Co., The Illinois & Iowa Ry. Co. and the Davenport & Western Ry. Co.

Belton, Tex.—The Belton & Temple Electric Ry. Co. has been incorporated, with a capital of $100,000, to construct, operate and maintain an electric railway from Belton to Temple, a distance of 8 miles. Incorporators: M. Yoakum, Dallas; A. F. Bently, Temple, and C. F. Denny, of Belton.

Hamilton, O.—The Cincinnati, Hamilton & Indiana Traction Co. is stated to have petitioned the Butler Co. Comrs. for a franchise from Hamilton through Darrtown and Oxford to College Corner, O.

Oregon City, Ore.—The Oregon City & Suburban Ry. Co. is stated to have petitioned the City Council for a franchise to construct a railway, telephone and telegraph line on Washington, Center, 12th, 14th and Water Sts.

RAILROADS.

Atlanta, Ga.—Major J. W. Bushnell, Engr. in charge of construction of the Birmingham & Atlanta Air Line, which is to be built by the Seaboard, is stated to have begun a survey of the new line from Atlanta to Birmingham. W. W. Gwathmey, of Portsmouth, Va., is Ch. Engr. Seaboard Air Line.

Hopkinsville, Ky.—The Louisville & Nashville R. R. Co. is reported to be making a new survey in North Christian County to change its roadbed ten miles and leave the present town of Crofton, now on the railroad, 2½ miles to the west. It is estimated that the change will cost $600,000. R. Montfort, Ch. Engr., Louisville.

Deepwater, W. Va.—A certificate is stated to have been issued to the Deepwater R. R. Co. to extend the road from its present terminus at Glen Jean, W. Va., through Fayette, Raleigh, Summers, Wyoming, Mercer and Monroe Counties to the Virginia line.

Appollonia, Wis.—The Chippewa River & Northern Ry. Co. has been incorporated, with a capital of $50,000, to construct a railroad 24 miles in length from Appollonia, in Gates Co., to a point in Sawyer County. Incorporators: Wm. H. Phipps, David Humbird and others.

Worcester, Mass.—A press report states that about $200,000 will be expended in improvements on the Worcester, Nashua & Portland division of the Boston & Maine R. R. H. Bissell, Ch. Engr., Boston.

Melrose, Ia.—Wm. Kenefick, of Kansas City, is reported to have secured the contract for constructing about 30 miles of railroad for the Iowa & St. Louis R. R. Co. from the Missouri State line, 18 miles s. w. of Centerville, to Melrose.

Maryville, Tenn.—The preliminary survey of the railroad to be built by the Smoky Mountain Timber & Improvement Co. is stated to have been completed from Marysville to the mountains in Monroe County along Citico Creek. O. L. Nichols, of Coudersport, Pa., is reported to be in charge of the surveys.

Grafton, W. Va.—The City Council is stated to have granted the Buckhannon & Northern Ry. Co. a franchise to construct a line through the west side of the city on the banks of the Tygarts Valley River.

Chicago, Ill.—The Chicago, Illinois & Indiana Ry. Co. has been incorporated, with a capital of $25,000, and principal office in Chicago, to construct a line from Chicago Heights to a point in Cook Co. on the boundary line between Ill. and Ind. east of Hammond, Ind., and from Chicago Heights to Indiana Harbor, Ind. Incorporators: Jacob Ringer, Wm. Wilhartz, and others, all of Chicago.

Fredericksburg, Va.—The preliminary survey of the Fredericksburg & Rappahannock R. R., from Washington, Va., through Culpeper and Stafford Counties, by way of Falmouth, to deep water on the Potomac River, is stated to have been completed, and work on construction will soon commence.

Alpena, Mich.—The Alpena & Western Ry. Co. is reported organized to build a railway from Alpena to Charlevoix, about 125 miles; capital, $1,000,000. Directors: Richard R. Metheany, Grand Rapids; T. N. Goodbourne, Alpena; A. H. Frost, East Jordan, and others.

PUBLIC BUILDINGS.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Sept. 17 for erecting a stable and toolhouse in Burnet Woods. Geo. F. Holmes, Clk.

Willard, N. Y.—Bids will be received by the Comn. in Lunacy, Capitol, Albany, until Oct. 15 for ventilating system in attic of north wing of Main Building, and plumbing improvements in the Branch, Infirmary and Detached Buildings Nos. 1 and 4 at the Willard State Hospital, Willard. T. E. McGarr, Secy.

New York, N. Y.—Bids are wanted Sept. 18 for furnishing material and making alterations and improvements to various buildings on the Almshouse Grounds, Blackwell's Island. Homer Folks, Comr. Dept. of Charities.

Pittsburg, Pa.—Bids will be received by the Dept. of Pub. Safety until Sept. 16 for erecting an engine house in the 32d Ward. A. H. Leslie, Dir.

Boston, Mass.—Goodwin & Weston, of Boston, have secured the contract for erecting 4 new buildings and connecting corridors at the Women's Dept. of Insane Hospital, Austin Farm, for $198,800 for red brick, and $8.50 extra per cu. yd. for excavation below grade.

Bedford, Ind.—The Co. Comrs. are stated to have asked the County Council to appropriate $25,000 for a new jail.

Brookfield, Mass.—A press report states that the Town Hall recently built at a cost of $60,000 was destroyed by fire Sept. 4.

Lawton, Okla. Ter.—H. J. Vandenburg, of Guthrie, is stated to have secured the contract for erecting the Comanche Co. Court House for $30,000.

Gallipolis, O.—Frank L. Packard, of Columbus, is stated to have been selected to prepare plans for building the Ohio Hospital for Epileptics in Gallipolis.

Baltimore, Md.—Baldwin & Pennington, 44 South St., are stated to be preparing plans for a stone church for St. Catherine Catholic Society.

Kentland, Ind.—Elmer Danner, of Kokomo, is stated to have secured the contract for erecting a $50,000 court house at Goodland.

Jersey City, N. J.—Cornelius Zabriskie is stated to have offered the city $150,000 toward the erection of a city hospital.

Denver, Colo.—Brown & Schrepferman are stated to have secured the contract for erecting St. Vincent's Orphanage, for about $75,000.

Hancock, Mich.—A press report states that plans have been prepared for St. Joseph's Hospital, to be erected at Hancock, to cost $100,000.

Springfield, O.—The Co. Bldg. Com. is stated to have decided to reject all bids recently received for the new county building. It is stated that plans have been changed, cutting out much terra cotta work; probable cost, $60,000.

Woonsocket, R. I.—It is stated that a $25,000 police station will be erected in Woonsocket.

Riverside, Cal.—Court house bonds amounting to $150,000 have been sold.

Lake Charles, La.—It is stated that plans are being prepared for a $20,000 city hall.

Decatur, Ill.—T. C. Link, 308 N. 6th St., St. Louis, Mo., is stated to have completed plans for the Wabash R. R. hospital to be erected here, at a cost of about $55,000. A. Robertson, Div. Supt., Decatur.

Beatrice, Neb.—It is stated that bids are wanted Sept. 23 for erecting a library. A. H. Kidd, Secy. Library Bd.

New York, N. Y.—Bids will be received by Homer Folks, Comr. Dept. Pub. Charities, until Sept. 23, for furnishing material and making alterations and additions to the N. Y. City Training School for Nurses at Blackwell's Island.

Jefferson, Ga.—It is stated that bids will be received by the Co. Comrs. until Oct. 21 for erecting a jail.

Schenectady, N. Y.—Ellery R. Porter, of North Adams, is stated to have secured the contract for erecting the Emmanuel Baptist Church, for $26,684.

Buffalo, N. Y.—The lowest bid opened by the Armory Bd. at New York, Sept. 9, for erecting the 65th Regt. Armory is stated to have been submitted by Mosier & Summers, of Buffalo, for $473,718.

St. Louis, Mo.—Dir. of Wks. Isaac S. Taylor will receive bids until Sept. 16 for erecting the Mines and Metallurgy Bldg., 525x750 ft., for the La. Purchase Exposition. Theo. C. Link, Archt., 308 N. 6th St.

Hazlehurst, Miss.—Bids are wanted Oct. 6 for erecting a jail. W. M. Ainsworth, Pres. Bd. of Superv. W. S. Hull, Archt., Jackson, Miss.

Harrisburg, Pa.—The following bids are reported opened Sept. 6 by the Capitol Comn. for the construction of the Pennsylvania Capitol: *a*, total bid; *b*, additional if dome be covered with granite; *c*, deduction if Indiana limestone substituted for granite; *d*, deduction if white marble be used: Henderson & Co., Ltd., Phila., *a* $4,138,980, *b* $190,000, *c* $340,000; Doyle & Doak, Phila., *a* $3,885,000, *b* $192,000, *c* $400,000, deduction if King of Prussia marble be used $460,000; Wm. Miller & Son and Roydhouse, Airy Associated Contg. Co., Phila., *a* $3,548,000, *b* $275,000, *c* $298,000; Colonial Constn. Co., Phila., *a* $3,640,000, *b* $124,000; Payne Co., Phila., *a* $3,600,000, *b* $110,000, *c* $270,000, *d* $300,000; Norcross Bros., Boston, *a* $3,920,000, *b* $120,000, *c* $250,000.

BUSINESS BUILDINGS.

Harrisburg, Pa.—A permit is stated to have been issued to the Philadelphia & Reading Ry. Co. for the erection of a passenger station on Market St., to cost $110,000. Wm. Hunter, Ch. Engr., Philadelphia.

Ft. Smith, Ark.—Hoffman & Blakely are reported to be preparing plans for a $40,000 wholesale grocery house to be erected here.

Glenwood Springs, Colo.—It is stated that the Denver & Rio Grande Ry. Co. is to erect a depot here to cost about $50,000. F. B. Clark, Supt. Bldgs. & Bridges, Denver.

St. Louis, Mo.—The Mail Order Publishing Co. is reported to be considering the erection of a building to cost, with site, about $300,000.

Paterson, N. J.—The Citizens Trust Co. is to erect a bank and office building on Market and Hamilton Sts. Henry F. Bell, Pres. Architects, Ackerman & Ross, 156 5th Ave., New York, N. Y.

Herman Gatgea will erect an office building at 137 Ellison St. Architect, M Houman, Central Bldg.

Charlotteville, Va.—It is stated that the Chesapeake & Ohio R. R. Co. will erect a $25,000 depot on Main St. C. E. Doyle, Gen. Mgr., Richmond, Va.

Toledo, O.—A. Bentley & Sons, 419 Madison St., are stated to have secured the contract for constructing the plant of the Donovan Wire & Iron Works. The buildings will be 4 in number and cost about $30,000.

Wichita, Kan.—It is stated that the Frisco R. R. Co. will erect new passenger and freight depots at Wichita. E. M. Roquette, Ch. Archt., St. Louis, Mo.

Grand Rapids, Mich.—Frank P. Allen & Son, of Grand Rapids, are stated to have prepared plans for a brick storage building 76x260 ft., for the Fred Macey Co., Ltd.; it will cost $40,000.

Cleveland, O.—Fugman & Uhlrich, 89 Euclid Ave., are stated to be preparing plans for a 7-story building for the Winton Automobile Co. to be erected on Huron St. and Euclid Ave., to cost $40,000.

DWELLINGS.

Buffalo, N. Y.—Green & Wicks, 110 Franklin St., are stated to have prepared plans for a dwelling for John J. Albright to be erected on W. Ferry St. near Delaware Ave., to cost about $100,000.

Wilmington, Del.—Baker & Dallett, Crozer Bldg., Philadelphia, Pa., have prepared plans for a residence for Henry P. Scott, of Wilmington, to be erected at Reybold Station, on the Delaware City Ry. It will be 4 stories, of pressed brick and marble trimmings, and will cost $30,000.

Detroit, Mich.—Louis Kamper, 10 Miner Bldg., is stated to have prepared plans for 8 residences for Hugo Scherer and Fred E. Wadsworth, to be erected on their subdivision just east of the Country Club, extending from the south side of Jefferson Ave. to the Detroit River, to cost in all about $80,000.

Omaha, Neb.—It is stated that plans have been prepared for a residence on 33d and Douglas Sts. for F. A. Nash, to cost $25,000.

Milwaukee, Wis.—Fernekes & Cramer, 1301 Pabst Bldg., are stated to be preparing plans for a $60,000 flat which the Koeffler Estate will erect on Jefferson and Knapp Sts.

SCHOOLS.

Lancaster, O.—Bids will be received until Sept. 30 by C. B. Adams, Secy. Bd. of Trus., for furnishing labor and material for the roofing and galvanized iron work on the Employees' Building for the Boys' Industrial School at Lancaster; also for the labor only on the following: carpenter work, and setting of iron, brick work and preparing mortar for same. Richards, McCarthy & Bulford, Archts., Columbus, O.

Sherman, Tex.—Bids are wanted Sept. 25 for erecting a school. A. M. Ross, Clk.

Anadarko, Okla. Ter.—Gov. Ferguson is stated to have approved an appropriation of $20,000 for a school at Anadarko.

Oklahoma, Okla. Ter.—A press report states that plans have been adopted for a building, the first of a number to be erected here for the Epworth Univ.; the new building will cost about $300,000. Rev. S. G. Thompson, of Oklahoma, is reported to be Chmn. of the Joint Bd. in charge of construction.

Opelika, Ala.—R. E. Hudson, of Opelika, is stated to have secured the contract for erecting a school here, to cost $26,000.

St. Marys, Ind.—It is stated that the Sisters of Providence at St. Mary's of the Woods will build a $30,000 structure to be used as a training school for young women.

Sacramento, Cal.—School bonds amounting to $150,000 are stated to have been sold.

Winchester, Mass.—The plans of H. D. Hale, 13 Exchange St., Boston, are stated to have been accepted for a $125,000 high school.

Summit, Ill.—Wm. C. Krieg, 84 Washington St., Chicago, is stated to have prepared plans for an 8-room school for Summit.

Milwaukee, Wis.—Bids are wanted Oct. 1 for erecting a school on Aner Ave. G. W. Porth, Compt.

Springfield, O.—Bids will be received by the Bd. of Educ. until Sept. 29 for $35,000 bonds. Oliver H. Miller, Clk.

Springfield, Mass.—J. I. Kelley & Son are stated to have secured the contract for erecting an addition to the Tapley School for $23,952.

Athens, O.—The plans of Frank L. Packard, of Columbus, are stated to have been approved for a $45,000 building at the Ohio University at Athens.

Chicago, Ill.—The Bd. of Educ. is stated to have taken out a permit to erect a 3-story brick school on Coraella St., to cost $110,000.

Toledo, O.—Miller & Conrad are stated to have secured the contract for erecting the Notre Dame Academy on Monroe and Bancroft Sts., for about $35,000.

Worcester, Mass.—Rev. Jas. P. Tutle, pastor of St. Anne's R. C. Church, is stated to have authorized John W. Donohue, 115 State St., Springfield, to prepare plans for a parochial school and parish hall to be erected on Gage St.

STREET CLEANING AND GARBAGE DISPOSAL.

Brooklyn, N. Y.—Bids will be received by John McG. Woodbury, Comr. of Street Cleaning, N. Y. City, until Oct. 13, for the final disposition of ashes, street sweepings and rubbish and light refuse, in the Boro. of Brooklyn, for a period of 5 years.

Atlanta, Ga.—Bids are wanted Oct. 10 (change of date) for the collection of all garbage and nightsoil for a period of 5 years from Jan. 1, 1903. Bids are also wanted for the cremation of all garbage and nightsoil for a period of 5 years. Address Dr. E. H. Richardson, Secy. Bd. of Health.

Washington, D. C.—Local press reports state that Warner Stutler, Supt. of Sts., in his report to the District Comrs., asks that the appropriation for the next fiscal year for street cleaning be $230,000, and for collection and disposal of garbage, etc., $150,000.

Baltimore, Md.—The Baltimore Utilization Co. has been incorporated, with a capital of $125,000, to reduce garbage, etc., for fertilizer purposes; also to manufacture and sell fertilizers. Incorporators: Frank A. Furst and Fred. M. Felden, of Baltimore, Md., and Redmond B. Newton, of Philadelphia, Pa.

GOVERNMENT WORK.

Chicago, Ill.—Bids will be received until Oct. 8 at the office of the Chicago Bldg., Treas. Dept., Washington, D. C., for the drainage, plumbing and gas fitting of the Post Office, Court House, etc., at Chicago Address Henry Ives Cobb, Archt., U. S. Gov. Bldg., Chicago.

Anniston, Ala.—Bids were opened as follows Sept. 10 by the Treas. Dept., Washington, for installing plumbing, heating, ventilating and electric apparatus in Post Office: A. Stockman, Birmingham, $43,000; Gude & Walker, Atlanta, Ga., $28,900; Miles & Bradt, Atlanta, $28,256; Congress Const. Co., Chicago, $31,893; Fonde Bldg. Co., Mobile, $28,500; A. B. Stannard, N. Y. City, $47,584.

Elmira, N. Y.—Flahire & Krawl, Elmira, were lowest bidders for heating and ventilating apparatus for post office, in amount $4,329, with $660 additional for pipe covering.

Ft. Morgan, Ala.—Bids will be received by L. Cravens, Q. M., until Sept. 17 for sinking an artesian well at this post.

Buffalo, N. Y.—Bids are wanted Sept. 17 for excavating at Ogdensburg Harbor, N. Y. Maj. T. W. Symons, Corps Engrs., U. S. A.

Chamberlain, S. D.—Bids will be received until Sept. 25 by the Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C., for furnishing material and constructing a brick dormitory, with plumbing, acetylene gas piping and steam heat, and extensions to the water and sewer systems at the Chamberlain School, S. D. For further information apply to John Flinn, Supt., Indian School, Chamberlain.

San Francisco, Cal.—Bids will be received until Oct. 11 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing 80,000 sq. ft. of asphalt pavement at the Navy Yard, Mare Island, Cal.

Philadelphia, Pa.—Bids are wanted Oct. 11 for constructing a brick and steel building at the Navy Yard, League Island, Pa. Appropriation now available, $214,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Jefferson Barracks, Mo.—Bids will be received at the Quartermaster's Office, St. Louis, Mo., until Oct. 6 for constructing roads and granitoid walks at Jefferson Barracks. Address Capt. W. C. R. Colquhoun, Acting Depot Q. M.

Rock Island, Ill.—The following bids were opened Aug. 30 by Maj. C. McD. Townsend, Corps of Engrs., U. S. A., for construction and repair of dams and shore protection on upper Mississippi River, *a* from Rock Island to Burlington, where ratio of rock to brush work is 1:2, and *b* from Burlington to Hannibal, rock to brush, 1:15: A. J. Whitney, Rock Island, *a* $1.19 per cu. yd. rock, 35 cts. per cu. yd. brush; Fetter & Crosby, La Crosse, Wis., *a* and *b*, $1.19 for rock and 39 cts. for brush; Albert Kirchner, Fountain City, Wis., *a* 97 and 28 cts. for rock and brush, respectively, being an average of 51 cts. per cu. yd., at which recommendation for award was made, allowing for 68,627.4 cu. yds. of work according to appropriation: *b* 98 and 29 cts., an average of 56.6, award likewise recommended, allowing for 61,837.4 cu. yds. of work.

Louisville, Ky.—Bids are wanted Oct. 4 for office and warehouse at Lock No. 1, Barren River, Ky. Maj. E. H. Ruffner, Corps Engrs., U. S. A.

Memphis, Tenn.—The following contracts are reported awarded according to bids opened Sept. 2 by Capt. E. E. Winslow, Corps of Engrs., U. S. A., for levee work: Near Helena, Ark., 90,000 cu. yds., Dresbach Bros., at 18.35 cts. per cu. yd.; Ferguson loop, 160,000 cu. yds., M. J. Roach, at 19.90 cts.

Plattsburg Barracks, N. Y.—Bids are wanted by the Quartermaster until Oct. 10 for constructing Hospital Steward's Quarters at this post.

Elmira, N. Y.—Bids will be received until Oct. 10 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for installing a conduit and electric wiring system for the U. S. Post Office and Court House at Elmira.

Wilmington, Del.—Bids were opened Sept. 11 by Col. Jared A. Smith, Corps of Engrs., U. S. A., for dredging, as follows: Coast Jetty Co., 17 Bway., N. Y. City, 25 and 20 cts. per cu. yd.; Atlas Dredging Co., Wilmington, 16, 13 and 14 cts.; John L. Grim, Phila., 19, 16 and 17 cts.

Baltimore, Md.—Bids were opened Sept. 11 by Col. Peter C. Hains, Corps of Engrs., U. S. A., for dredging as follows: *a*, Southwest Harbor; *b*, Curtis Bay: American Dredging Co., Phila., *a* 16½ cts. per cu. yd., *b* 13½ cts.; Morris & Cumings Dredging Co., N. Y. City, *a* 17½ cts., *b* 13.2 cts.; Md. Dredging & Contg. Co., Balto., *a* 14½ cts. (awarded), *b* 13 cts.; Sanford & Brooks Co., Balto., *b* 12.75 cts.

New York, N. Y.—The following bids were opened Sept. 11 by Col. S. M. Mansfield, Corps of Engrs., U. S. A., for the removal of 15,000 cu. yds. rock in Hudson River: Dunbar & Sullivan, Buffalo, contract awarded, at $3.35 per cu. yd., total $50,250; P. Sanford Ross, Inc., Jersey City, $4.75; Phelan & Co., Syracuse, $5.19; R. G. Packard Co., N. Y. City, $3.94; Kirk, Driscoll & Co., Syracuse, $5.30.

Bids were also received at same time from Kirk, Driscoll & Co. for 150,000 cu. yds. dredging at 28 cts., total $42,000; and for dike work including 3,850 cu. yds. large rubble stone, 6,600 cu. yds. ordinary rubble stone, 2,400 cu. yds. quarry spalls, 600 cu. yds. paving stone; total of bid, $56,690.

Chattanooga, Tenn.—Bids will be received until Oct. 8 at the Constructing Q. M. Office, Custom House & Post Office Bldg., Chattanooga, for constructing, plumbing, heating and gaspiping about 65 frame buildings, constituting new military post to be built in Chickamauga Park, near Chattanooga. Address H. J. Slocum, Capt. Cav., Q. M.

Washington, D. C.—Bids are wanted by the U. S. Comn. of Fish & Fisheries, Washington, until Sept. 22 for constructing an aquarium on 6th and B Sts. Geo. M. Bowers, Comr.

Memphis, Tenn.—Local press reports state that bids will be received by Capt. E. E. Winslow, Corps Engrs., U. S. A., until Sept. 30 (readvertisement) for constructing Modoc Loop levee, aggregating 150,000 cu. yds.

Burlington, Ia.—Major Townsend is reported to have recommended that the bid of Albert Fichner, of Fountain City, be accepted for improving the Burlington Harbor and the harbor between Burlington and Hamilton; his bid for the 2 contracts is reported to be $70,000.

Tampa, Fla.—Bids are wanted Oct. 6 for dredging at Orange Mills Flats, St. Johns River, Fla. Capt. Herbert Deakyne, Corps Engrs., U. S. A.

Ft. Lawton, Wash.—Bids are wanted Oct. 3 for constructing several buildings, including plumbing, gaspiping and heating at this post. Address Maj. G. S. Bingham, Q. M., U. S. Army, Seattle, Wash.

Sandusky, O.—The following bids were opened Sept. 5 by Maj. Dan C. Kingman, Corps of Engrs., U. S. A., Cleveland, for dredging the harbor: A. W. A. McGillis & Co., Cleveland; B. L. P. & J. A. Smith Co., Cleveland; C. John J. Stang, Toledo, recommended for award; D. Buffalo Dredging Co., Buffalo; E. G. H. Breymann & Bros., Toledo:

Dredging.

[illegible]	120,000 cu. yds.	200,000 cu. yds.	50,000 cu. yds.	40,000 cu. yds.	5,000 cu. yds. rock.	Totals.
A......	$.25	$.14	$.16	$.28	$6.15	$107,950
B......	.28	.14	.22	.40	7.25	124,850
C......	.19	.16	.19	.19	.75	75,650
D......	.24	.14	.18	.35	8.00	119,800
E......	.23½	.12⅝	.17½	.29½	6.00	104,000

MISCELLANEOUS.

Ithaca, Mich.—Bids will be received by Parker Merrill, Co. Drain Comr., care S. Thompson, North Star Township, until Sept. 18 for constructing "Hass and Brown Drain." Total length about 3 miles.

Galveston, Tex.—J. W. O'Rourke & Co., Denver, Colo., have been awarded the contract for the construction of the seawall, 17,593 ft. long, of granite concrete on a piling foundation, with sandstone riprap protection, for $1,193,318.80, taking $350,000 in seawall bonds as part payment and agreeing to complete in 15 mos. The detailed bids, opened Sept. 5, are given in the accompanying table:

Items and Quantities.	J. W. O'Rourke & Co., Denver, Colo.	J. W. Thompson, St. Louis.	Parker, Washington Co., San Antonio, Tex.
Sand excav., 106,000 cu. yds.	$.20	$.16	$.28
Round piling, 754,560 lin. ft.	.20	.15½	.19
Sheet piling, 3,800 M. ft.	30.00	25.00	31.50
String piece, 70,372 M. ft.	30.00	24.00	42.75
Reinforcing rods, 264,000 lbs.	.05	.03½	.04½
Vitrified pipe, 300 lin. ft.	.20	.50	.45
Granite concrete, 102,109 cu. yds.	7.00	7.76	8.66
Limestone concrete, 102,109 cu. yds.	6.60	7.76	7.84
Sandstone concrete, 102,109 cu. yds.	6.60	7.76	7.54
Sandstone riprap, 86,700 tons.	2.10	2.58	2.30½
Limestone riprap, 92,000 tons.	2.10	2.58	2.50
Granite riprap, 110,000 tons.	2.10	2.58	2.48
Totals:			
Granite concrete and granite riprap.	$1,247,249	$1,316,164	$1,464,837
Limestone concrete and limestone riprap.	1,168,605	1,269,724	1,338,307
Sandstone concrete and sandstone riprap.	1,157,475	1,256,050	1,277,518
Granite concrete and sandstone riprap.	1,198,319	1,256,050	1,391,880
Granite concrete and limestone riprap.	1,209,449	1,269,724	1,422,037
Time, months	15	12	18
Payment in bonds.	$350,000	$500,000	$600,000

New York, N. Y.—Bids are wanted Sept. 18 (readvertisement) for furnishing material and erecting a stone wall to complete the inclosure of the entire block and prison buildings on Leonard, Elm and Franklin Sts., including gateways, yard work, etc. Thos. W. Hynes, Comr. Dept. of Correction.

Holly, Mich.—Bids will be received until Sept. 18 by A. B. Bixby, Co. Drain Comr., at the office of M. Chase, in Holly, for cleaning out, straightening and deepening "Patterson and Holly Drain."

St. John, N. B.—The Bd. of Wks. is reported to have recommended that D. W. Clark & Son receive the contract for constructing the McLeod wharf, for $49,487.

Lafayette, Ind.—The Co. Council is stated to have decided on the improvement of Main St. levee and sidewalk. The proposed improvement of the Main St. levee is to be of asphalt, and sewerage, all water draining to the river instead of the bottom lands, as is now the case. The roadway will not be less than 60 feet, with a sidewalk on the south side; estimated cost of work, $18,000.

Syracuse, N. Y.—Three bids were opened Sept. 2 by Bd. of Contract & Supply, for improving Onondaga Creek, as follows: John Kelley, recommended for award, $26,380; Syracuse Improvement Co., $35,390; Wm. T. O'Connor, $28,595. The detail of the lowest bid is reported as follows: Bailing and draining, $10,000; clearing, $500; clearing and grubbing 2 acres, $200; 43,500 cu. yds. excav. at 28 cts.; 800 cu. yds. embankment at 25 cts.; 1,000 cu. yds. riprap at $2; 250 cu. yds. concrete at $5; 100 ft. 8-in. sewer pipe at 50 cts.

New York, N. Y.—Bids will be received by the Dept. of Docks & Ferries until Sept. 23 for dredging on the North River, between 18th and 20th Sts., also between 21st and 23d Sts.; for rebuilding the pier at E. 32d St., known as pier No. 80, E. R.; for furnishing and delivering sand and broken stone for concrete. McDougall Hawkes, Comr. of Docks.

Oakland, Cal.—The following bids are reported opened Sept. 2 for the construction of the tunnel between Alameda County and Contra Costa County, *a*, Alameda end, *b*, Contra Costa end: Clark & Henry, Stockton, *a* $37,578, *b* $51,388; Healy, Tibbetts & Co., *a* $28,290, *b* $39,243; E. B. & A. L. Stone, *a* $32,049, *b* $45,260; A. B. Munson, *b* $39,185; San Francisco Constn. Co., *b* $39,504.

NEW INDUSTRIAL PLANTS.

The Kennedy & Moorelock Stave Co., Memphis, Tenn., is erecting a stave and heading plant at So. Memphis, in which 160 H.-P. in boilers, a 100-H.-P engine and a 3-room dry-kiln, each room to be 20x104 ft., will be installed.

The Buffalo & Susquehanna Iron Co., 59 Erie County Bank Bldg., Buffalo, N. Y., is proceeding to build, at Stony Point, two 20x80-ft. blast furnaces and eight hot-blast stoves. Installing boilers, engines and other necessary machinery.

William J. Copp, Fort William, Can., is interested in a company which has begun the erection of a foundry for stoves, ranges and general castings at that place. The plant will include a 2-story, 55x110-ft. mounting shop, a 2-story, 50x40-ft. office building, a molding room about 75x125 ft., and other necessary buildings.

The Fairweight Standard Scale Co., 20 Franklin St., Danville, Ill., will erect a manufacturing plant to cost not less than $20,000.

The Commercial Envelope & Box Co., Binghamton, N. Y., is erecting a 4-story, 60x250-ft. factory, in which a 50-H.-P. gas engine will be installed. It is also expected to build a folding board mill.

The Monarch Refrigerating Co., 239-261 Michigan St., Chicago, contemplates building a large addition and enlarging the capacity of its power plant.

The Wolverine Brass Works, Grand Rapids, Mich., are erecting an 80x28-ft. foundry.

The John-Peaslee Shoe Co., Pontiac, Ill., will erect a 3-story and basement, 48x156-ft. brick factory and install an engine of about 75 H.-P.

The Laidlaw-Dunn-Gordon Co., Cincinnati, O., is building a 37x57-ft. power plant and installing a 110-Kw. direct-connected generator and tandem compound engine. A similar unit will be added later, and additional machinery as required. The company is also considering the addition of a machine shop.

The Wright Taper Roller Bearing Co., 809 Mutual Life Bldg., Buffalo, N. Y., will erect a 3-story, 216½x44-ft. factory, with 40x75 and 65-ft. additions. The capacity of the power plant to be installed will be about 225 H.-P.

The Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N. S., is building at Sydney Mines a blast furnace and 80 retort coke ovens, with the necessary stock sheds, engine houses, etc. The erection of an open-hearth plant will be begun next spring.

The Bloom-Kloeb Mfg. Co., Cridersville, O., is arranging to build a 60x100-ft. foundry.

The foundry plant to be built by the Lane & Bodley Co., Cincinnati, O., will include a 120x300-ft. foundry, arranged to permit of extension; flask and pattern shop; pattern warehouse and power house. The power plant will be of about 300 H.-P., and there will be installed traveling and jib cranes ranging to 30 tons, cupolas, blowers, elevators, casting cleaning appliances, tramway, core ovens, sand mixing and sifting appliances, foundry pneumatic tools, ladles, trucks, molding machines, heating and lighting appliances.

Margolius & Co., Norfolk, Va., will erect a 75x175-ft. factory and are in the market for an 80-H.-P. engine and a 100-H.-P. boiler.

The Norton Electrical Instrument Co., Manchester, Conn., is erecting a 2-story and basement, 32x100-ft. factory, to be run by electricity of about 50 H.-P.

The International Lace Co. will erect a mill at Gouverneur, N. Y., to cover about 200x675 ft. and to be provided with steam and electrical power plant and also with electricity transmitted from Hannawa Falls. A steam heating plant, water tower and sprinkler system will be installed. J. S. Lesser & Co., 511 Broadway, New York, are interested in the company. Williams & Johnston, Ogdensburg, N. Y., archts.

W. T. Joyner, Garysburg, N. C., is interested in the formation of a company, with a capital of $50,000 to build a cotton mill.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Sept. 15.	Fairmont, W. Va. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 16.	Grossdale, Ill.	Sept. 13
Sept. 16.	Biloxi, Miss.	Sept. 6
Sept. 16.	Pierce, Neb.	Sept. 6
Sept. 16.	W. Alexandria, O.	Sept. 6
Sept. 16.	Kirkwood, Mo.	Sept. 6
Sept. 17.	Findlay, O.	Sept. 13
Sept. 17.	Philadelphia, Pa.	Sept. 13
Sept. 17.	Eden Valley, Minn.	Sept. 6
Sept. 17.	Edmonton, Alberta, N. W. T.	Sept. 6
Sept. 18.	New York, N. Y.	Aug. 30
Sept. 18.	Pumping station, Philadelphia, Pa.	Sept. 13
Sept. 19.	Pittsburg, Pa.	Sept. 13
Sept. 19.	North Milwaukee, Wis.	Sept. 13
Sept. 22.	Stoneboro, Pa.	Sept. 13
Sept. 23.	McRae, Ga. Adv., Eng. Record, Sept. 13.	Sept. 13
Sept. 23.	Philadelphia, Pa.	Sept. 6
Sept. 25.	Chamberlain, S. D.	Sept. 13
Sept. 25.	Baraboo, Wis.	Sept. 13
Sept. 26.	Gibbon, Minn.	Sept. 13
Sept. 30.	Winnipeg, Man. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 1.	De Smet, S. D.	Sept. 13
Oct. 3.	Cleveland, O.	Sept. 13
Oct. 3.	Weiser, Idaho	Sept. 6
Oct. 22.	El Paso, Tex.	Sept. 6
Dec 1.	Pumps, Seguin, Tex.	July 26
———	Bozeman, Mont.	Sept. 6

SEWERAGE AND SEWAGE DISPOSAL.

Sept. 15.	Norristown, Pa. Adv., Eng. Record, Sept. 6.	Sept. 6
Sept. 16.	Henderson, Ky.	Sept. 13
Sept. 16.	Allentown, Pa.	Sept. 13
Sept. 16.	Marion, Ind.	Sept. 13
Sept. 16.	St. Paul, Minn.	Sept. 13
Sept. 16.	Irvington, N. J. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 17.	Des Moines, Ia.	Sept. 13
Sept. 17.	Boston, Mass.	Sept. 13
Sept. 17.	Brooklyn, N. Y.	Sept. 6
Sept. 17.	Cleveland, O.	Aug. 30
Sept. 17.	Two Rivers, Wis.	Aug. 30
Sept. 18.	Long Island City, N. Y.	Sept. 13
Sept. 18.	Lancaster, O.	Sept. 13
Sept. 18.	Danville, Ill.	Sept. 13
Sept. 19.	St. Paul, Minn.	Sept. 13
Sept. 19.	Grand Rapids, Mich. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 20.	Wooster, O.	Sept. 13
Sept. 20.	Thompsonville, Conn.	Sept. 13
Sept. 20.	Eaton, Colo.	Sept. 6
Sept. 20.	Youngstown, O.	Sept. 6
Sept. 22.	Toledo, O.	Sept. 13
Sept. 22.	Vincennes, Ind.	Sept. 6
Sept. 22.	Ft. Keogh, Mont.	Sept. 6
Sept. 25.	Newark, N. J. Adv., Eng. Record, Sept. 13.	Sept. 13
Sept. 25.	Chamberlain, S. D.	Sept. 13
Sept. 29.	La Grange, Ga. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 1.	Boston, Mass. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 10.	Ridley Park, Pa. Adv., Eng. Record, Aug. 16.	Aug. 16
Dec. 15.	Montevideo, Uruguay	Sept. 13

BRIDGES.

Sept. 16.	Westmoreland, Kan.	Sept. 13
Sept. 18.	Paxton, Neb.	Sept. 13
Sept. 18.	Terre Haute, Ind.	Sept. 6
Sept. 20.	Doylestown, Pa.	Sept. 6
Sept. 20.	Philadelphia, Pa.	Sept. 6
Sept. 20.	Terre Haute, Ind.	Aug. 30
Sept. 22.	Pawnee, Okla. Ter.	Sept. 13
Sept. 23.	Harrisburg, Pa.	Sept. 6
Sept. 23.	Reading, Pa.	Sept. 6
Sept. 23.	White Haven, Pa.	Sept. 6
Oct. 1.	Castroville, Tex.	Aug. 23
Oct. 6.	Ellendale, N. D.	Sept. 13
Oct. 13.	Victoria, B. C. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct. 15.	Yellowstone Park, Wyo. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Nov. 5.	Chicago, Ill.	Sept. 6

PAVING AND ROADMAKING.

Sept. 16.	Jersey City, N. J.	Sept. 13
Sept. 16.	Trenton, N. J.	Sept. 13
Sept. 16.	Cedar Rapids, Ia.	Sept. 13
Sept. 16.	Allentown, Pa.	Sept. 13
Sept. 16.	Peoria, Ill.	Sept. 13
Sept. 16.	Peekskill, N. Y.	Sept. 6
Sept. 17.	Leavenworth, Kan.	Sept. 13
Sept. 17.	Terre Haute, Ind. Adv., Eng. Record, Sept. 13.	Sept. 13
Sept. 18.	New York, N. Y.	Sept. 13
Sept. 18.	Ironton, O.	Sept. 13
Sept. 18.	Cincinnati, O.	Aug. 30
Sept. 18.	Niles, O.	Aug. 30
Sept. 19.	Buffalo, N. Y.	Sept. 13
Sept. 19.	New Brighton, S. I.	Sept. 13
Sept. 19.	Niagara Falls, N. Y.	Sept. 13
Sept. 20.	Maryville, Mo.	Sept. 13
Sept. 20.	Janesville, Wis.	Aug. 30
Sept. 20.	St. Louis, Mo.	Aug. 23
Sept. 22.	Kenmore, N. Y.	Sept. 13
Sept. 22.	Tipton, Ia.	Sept. 13
Sept. 22.	South Bend, Ind.	Sept. 6
Sept. 29.	Fremont, O.	Sept. 6
Sept. 30.	Dunkirk, N. Y.	Sept. 13
Oct. 1.	Atlantic City, N. J.	Sept. 13
Oct. 6.	Jefferson Barracks, Mo.	Sept. 13
Oct. 11.	San Francisco, Cal.	Sept. 13

POWER, GAS AND ELECTRICITY.

Sept. 17.	Cheviot, O.	Aug. 23
Sept. 22.	National Home, Wis.	Aug. 30
Sept. 23.	McRae, Ga. Adv., Eng. Record, Sept. 13.	Sept. 13
Sept. 24.	Taylorville, Ill.	Sept. 13
Sept. 25.	Prospect, O.	Sept. 13
Oct. 1.	De Smet, S. D.	Sept. 13
Oct. 3.	Weiser, Idaho	Sept. 6
Oct. 7.	Chattanooga, Tenn. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 14.	San Pedro, Cal.	Sept. 13
Oct. 15.	Chicago, Ill.	Aug. 23
Nov. 1.	Macon, Ga.	Aug. 30
Nov. 15	Norfolk, Va.	Sept. 13

GOVERNMENT WORK.

Sept. 15.	Riprap, etc., Philadelphia, Pa. Adv., Eng. Record, Aug. 23 to Sept. 13.	Aug. 23
Sept. 15.	Tampa, Fla. Adv., Eng. Record, Aug. 23 to Sept. 6.	Aug. 23
Sept. 15.	Htg. P. O., Abilene, Tex. Adv., Eng. Record, Aug. 9, 16.	Aug. 9
Sept. 16.	Lighthouse, Philadelphia, Pa. Adv., Eng. Record, Aug. 30, Sept. 6.	Aug. 30
Sept. 16.	Htg. P. O., Oakland, Cal. Adv., Eng. Record, Aug. 9, 16.	Aug. 9
Sept. 17.	Buffalo, N. Y.	Sept. 13
Sept. 17.	Ft. Morgan, Ala.	Sept. 13
Sept. 17.	Newport, R. I. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 17.	New York, N. Y. Adv., Eng. Record, Aug. 23 to Sept. 13.	Aug. 23
Sept. 17.	Wiring P. O., Abilene, Tex. Adv., Eng. Record, Aug. 9, 16.	Aug. 9
Sept. 18.	Piers, Cleveland, O.	Sept. 6
Sept. 18.	Chicago, Ill. Adv., Eng. Record, Aug. 23 to Sept. 13.	Aug. 23
Sept. 18.	Wiring P. O., Oakland, Cal. Adv., Eng. Record, Aug. 9, 16.	Aug. 9
Sept. 19.	Ft. Totten, N. Y. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 19.	Brunswick, Ga.	Aug. 30
Sept. 20.	St. Louis, Mo.	Aug. 23
Sept. 22.	Washington, D. C.	Sept. 13
Sept. 22.	New Orleans, La.	Sept. 6
Sept. 22.	Ft. Keogh, Mont.	Sept. 6
Sept. 22.	Portland, Me. Adv., Eng. Record, Aug. 23 to Sept. 13.	Aug. 23
Sept. 24.	Chicago, Ill.	Aug. 23
Sept. 25.	Chamberlain, S. D.	Sept. 13
Sept. 25.	Dredging, New York, N. Y. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 26.	Dredging, Cleveland, O.	Sept. 6
Sept. 26.	Washington, D. C. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 27.	Savannah, Ga.	Sept. 6
Sept. 29.	Louisville, Ky.	Sept. 6
Sept. 29.	Dredging, Portland, Me. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 29.	Ledge excav., Portland, Me. Adv., Eng. Record, Aug. 30 to Sept. 13.	Aug. 30
Sept. 30.	Memphis, Tenn.	Sept. 13
Sept. 30.	Dredging, Boston, Mass. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Sept. 30.	Indianapolis, Ind. Adv., Eng. Record, Aug. 23, 30.	Aug. 23
Oct. 1.	Washington, D. C. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct. 1.	San Francisco, Cal.	Aug. 30
Oct. 3.	Ft. Lawton, Wash.	Sept. 13
Oct. 4.	Louisville, Ky.	Sept. 13
Oct. 6.	Jefferson Barracks, Mo.	Sept. 13
Oct. 6.	Johnson City, Tenn. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 6.	Tampa, Fla.	Sept. 13
Oct. 6.	New York, N. Y. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct. 7.	Joplin, Mo. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct. 8.	Chicago, Ill.	Sept. 13
Oct. 8.	Montgomery, Ala. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 8.	Chatanooga, Tenn.	Sept. 13
Oct. 9.	Newport News, Va. Adv., Eng. Record, Aug. 30, Sept. 6.	Aug. 30
Oct. 10.	Mobile, Ala. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 10.	Plattsburg Barracks, N. Y.	Sept. 13
Oct. 10.	Elmira, N. Y.	Sept. 13
Oct. 11.	San Francisco, Cal.	Sept. 13
Oct. 11.	Philadelphia, Pa.	Sept. 13
Oct. 11.	Dry dock, Charleston, S. C.	Aug. 23
Oct. 14.	Aberdeen, S. Dak.	Aug. 30
Oct. 15.	Yellowstone Park, Wyo. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct. 16.	Tampa, Fla. Adv., Eng. Record, Sept. 6, 13.	Sept. 6

BUILDINGS.

Sept. 15.	Car barns, Sault Ste. Marie, Mich. Adv., Eng. Record, Sept. 13.	Sept. 13
Sept. 16.	Engine house, Pittsburg, Pa.	Sept. 13
Sept. 16.	Pub. bldg., St. Louis, Mo.	Sept. 13
Sept. 17.	Pub. bldg., New York, N. Y.	Sept. 13
Sept. 17.	Pub. bldg., Cincinati, O.	Sept. 13
Sept. 17.	Pub. bldg., Winchester, Ind.	Sept. 6
Sept. 17.	School, Buffalo, N. Y.	Sept. 6
Sept. 18.	Library, Nashville, Tenn.	Sept. 6
Sept. 18.	Library, Oskaloosa, Ia.	Sept. 6
Sept. 19.	School, Rapid Cty, S. D.	Sept. 6
Sept. 20.	School, La Junta, Colo.	Sept. 6
Sept. 22.	Pub. bldg., Nat. Military Home, Ind.	Sept. 6
Sept. 22.	Pub. bldg., New Braunfels, Tex.	Aug. 30
Sept. 23.	Pub. bldg., Nat. Military Home, Kan.	Aug. 30
Sept. 23.	Library, Beatrice, Neb.	Sept. 13
Sept. 23.	Pub. bldg., New York, N. Y.	Sept. 13
Sept. 24.	Pub. bldg., Brooklyn, N. Y.	Sept. 6
Sept. 24.	Htg. city hall, Newark, N. J. Adv., Eng. Record, Sept. 13.	Sept. 6
Sept. 25.	School, Shnerman, Tex.	Sept. 13
Sept 25.	Hospital, Columbus, O.	Aug. 30
Sept. 26.	School, Columbus, O.	Sept. 6
Sept. 29.	School, Deadwood, S. D.	Aug. 30
Sept. 30.	Hospital, Raybrook, N. Y. Adv., Eng. Record, Sept. 13.	Sept. 13
Sept. 30.	School, Lancaster, O.	Sept. 13
Oct. 1.	School, Milwaukee, Wis.	Sept. 13
Oct. 6.	Jail, Hazlehurst, Miss.	Sept. 13
Oct. 6.	City Hall plans, Houston, Tex.	Aug. 9
Oct. 7.	Court House, Miami, Fla.	Aug. 16
Dec. 2.	Capitol work, St. Paul, Minn.	Aug. 16
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Oct. 15.	Hospital, Willard, N. Y.	Sept. 13
Oct. 21.	Jail, Jefferson, Ga.	Sept. 13
———	Factory, Baltimore, Md.	Sept. 6

MISCELLANEOUS.

Sept. 18.	Holly, Mich.	Sept. 13
Sept. 18.	Ithaca, Mich.	Sept. 13
Sept. 19.	El. ry. franchise, Atlanta, Ga.	Sept. 13
Sept. 20.	Cleveland, O.	Sept. 6
Sept. 20.	Garb. disposal, Adams, Mass.	Aug. 30
Sept. 23.	Dredging, New York, N. Y.	Sept. 13
Sept. 27.	R. R. work, Toronto, Ont.	Sept. 6
Sept. 30	Harbor, Port Adelaide, S. A.	July 5
Oct. 1.	Levee work, Pointe-a-la-Hache, La.	Sept. 6
Oct. 8.	R. R., Portuguese East Africa	Aug. 30
Oct. 9.	Dry dock machinery, Portland, Ore.	Sept. 6
Oct. 10.	Garb. disposal, Atlanta, Ga.	Sept. 13
Oct. 13.	Garb. disposal, Brooklyn, N. Y.	Sept. 13
———	R. R. work, Chicago, Ill.	Aug. 30

THE ENGINEERING RECORD.

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Unreasonable Contract Requirements by the Government.

On August 20th the Chief of the Bureau of Yards and Docks announced that proposals for a masonry dry dock at Charleston, S. C., would be received on October 11th, and issued specifications for the information of contractors who might desire to bid for the work and for the execution of it by the successful bidder. This is not a new procedure for the Bureau of Yards and Docks. Indeed, a number of dry docks have recently been constructed or attempted to be constructed by that Bureau. At least some of the circumstances attending the construction of such work at Norfolk and Boston are quite fresh in the minds of engineers and contractors. The operations necessary for the beginning and the conduct of this class of constructions should be familiar to the Navy Department, and it is fair to presume that the character of specifications requisite for the prompt and efficient execution of such contracts is known to the Bureau of Yards and Docks, at least to a reasonable extent. Inasmuch as the authorized cost of the Charleston dock may reach as much at $1,250,000, it is a matter of some interest therefore to the public to ascertain the real character of the proposed specifications and contract for this dock, in view of the developments which have taken place at Norfolk and Boston, Philadelphia and Mare Island, to go no further. It is even more interesting to the civil engineering profession, for the reason that the present Chief of the Bureau of Yards and Docks is the first civil engineer who has held that position.

One of the first and most marked of the features of these specifications to impress one is their indefiniteness in those particulars most essential not only to intelligent and economical bidding from a contractor, but also to efficiency in the execution of the work and the safety of the dock after completion. If there is any one thing which experience in foundation and other similar constructions has brought forth it is the imperative necessity of the most complete and careful sub-surface examinations at the site of the proposed structure. It is further evident that the construction of a dry dock is practically foundation work of the most pronounced character, almost the whole of it necessarily being a sequence of sub-aqueous operations. Every well informed civil engineer of experience need not be told that in such a case the most complete and careful set of borings or other similar examinations should be made, with a record in detail of every feature disclosed at every point. Yet in these specifications there is practically a confession in terms that no such conclusive information is available, either for the contractors or for the guidance of the engineers in the actual performance of the work.

It is of the very essence of the functions of the responsible engineer of work, especially of so great a work as this, to elaborate in complete detail by plans and specifications precisely what is to be done, the various general dimensions of the structure, the different grades and classes of work with definite quantities on which to base comparative bids, and all other information of a quantitative character which goes to make up an accurate and correct description. In this specification, however, in paragraph 3, the bidder is advised that should he be successful, his lump sum proposal is expected to cover any omission of work or materials required, any mis-description, or almost any other fault, negligence or incompetency, if it exists, of the engineering authority designing the work and writing the specifications. In other words, the lump sum bid is expected not only to cover all legitimate work under the contract, but to insure the United States Government against the negligence, incompetency, or other shortcomings of its own officers. It is a truly remarkable feature of a set of specifications issued from the highest office of construction in the United States Navy, and it sets the pace for much which follows. A contractor must find out as he proceeds with the work what is to be done and how it is to be done, essentially compelling him to make his proposal a gamble, on the results of which will depend his profit or his loss.

It is apparently expected by the Chief of the Bureau that this condition of things will necessitate certain changes in the contract plans and specifications, and he is probably right. If such changes vary the cost of the work by more than $300, "as estimated by the civil engineer in charge," the latitude of the contractor is abruptly closed. It is made his duty to find out the errors in the plans and specifications which have emanated from the Bureau, and presumably to show how they should be corrected so far as they affect the progress of the work, but he is to have absolutely no voice in determining the cost of all these changes. Paragraph 17 prescribes that a board of three subordinates of the Chief of the Bureau of Yards and Docks shall make the determination of cost based upon prices ruling at the time the estimate is made, and if this determination is approved by the Chief the contractor must accept it "in full satisfaction for all work done under the contract." There probably could not be devised a method of constructing a great work like this in which more uncertainty, more inefficiency and less fairness and justice to the contractor could enter, nor could there be found a more unbusinesslike, unsafe and wasteful procedure for the Government. In the first place such procedures effectively repel the most experienced, responsible and skilful contractors from bidding at all, and those who do bid must either court almost certainty of heavy loss or bid so high as to reach extravagance. It is practically impossible under such circumstances for the Government to secure a successful work without inflicting loss on the contractor on the one hand, or escape being saddled with a defective and unsuccessful work at the price of an extravagant profit to the contractor on the other.

We are not disposed to be ungraciously critical or hypercritical of the Bureau of Yards and Docks; indeed, the Engineering Record labored effectively for the rational system of placing a civil engineer at its head, and it is no less convinced now than then that the system is correct and calculated to secure the most efficient results for the Government, but the procedures of that office must be consistent with the best business methods of civil engineering practice. Any civil engineer who fails to know what he wants and how to get it is not discharging his duties in an efficient and proper manner, whether he be found in the navy or out of it. It is his duty to secure complete, accurate and reliable information concerning every feature of the work which he undertakes to do and assume proper responsibility for it. If there are certain details of that information which it is not feasible for him to complete, and, consequently, corresponding details of the work which cannot be accurately set forth by the specifications, and there may be such in numerous works, he should assume the responsibility of the situation himself and not attempt to shift it to the contractor.

It is a wrong system to start with to attempt to construct a masonry dry dock, such as that contemplated at Charleston, for a lump sum compensation, especially if there are involved such uncertainties as those which the Chief of the Bureau of Yards and Docks describes in his specifications. Compensation for such work should be made on the basis of unit price for all the different classes of work or material involved in the entire construction. This leaves the engineer all the legitimate freedom which he needs to adapt the plans and specifications to every exigency which may arise, with perfect justice to the contractor and with the greatest economy to the Navy Department.

If the responsible engineer is qualified to perform his duties his estimate based upon a schedule of unit prices may be made to represent with practical accuracy the entire cost of the work far more nearly than any lump sum guess based upon such incomplete and defective information as the Charleston specifications seem to be based upon. Changes in the details of plans must occasionally be made in this class of engineering works, but they should be intelligently and fairly provided for, so as to make an adequate compensation to the contractor for any extra work which he may have to perform, or possibly the reverse adjustment, and that is perfectly consistent under proper plans and specifications with the highest degree of economy in the complete execution of the work. The invitation to receive proposals should be recalled, exact and adequate information should be completed, then the plans and specifications should be so revised as to encourage reasonable bids and afford efficient methods of contract proceedings, together with fair compensation to the contractor.

There are other general characteristics of these specifications which might be sharply criticised, but the points set forth illustrate clearly their general character. A further criticism of some of the technical details of the specifications will be made in a succeeding issue of The Engineering Record.

A Large Power Development Project recently undertaken to furnish light and power in a leading Southern city has an aspect as instructive as a fable by Æsop. The river has several good sites for a station, one of which a local promoter has been keeping before the public. Every step in his plans has been explained in the newspapers for the admiration of his fellow citizens. But one of them was wicked, organized a rival company and began building a station at a nearby site before the promoter found he was undermined, and realized too late that silence is golden.

The Eighteen Mile Creek Viaduct.

Bridge No. 9 of the New York, Chicago & St. Louis Railroad crosses Eighteen Mile Creek on a steel viaduct about 700 feet long and nearly 100 feet in maximum height. The original structure had pin-connected spans which carried one track of the New York, Chicago & St. Louis Railroad and one track of the Western New York & Pennsylvania Railway, and has recently been replaced without interrupting traffic on either road, by a plate girder viaduct using the old masonry piers and having the same center line. The new structure comprises seven 30-foot towers and eight 60-foot deck plate-girder spans, the latter proportioned for two 136-ton locomotives followed by a train load of 4,000 pounds per lineal foot on each track, and for a dead load of 1,200 pounds per lineal foot, quantities which produce a maximum moment of 1,575,000 pounds and an end shear of 116,000 pounds. The 30-foot spans are proportioned for a dead load of 900 pounds per lineal foot and develop moments and shears of 458,500 and 69,750 pounds respectively.

Each tower has four columns, battered about 1 : 9 in vertical transverse bents, and seated on separate masonry piers close to the surface of the ground. Four of the towers are about 91 feet and one is about 79 feet high from top of pier to base of rail; all are divided into three vertical panels by horizontal longitudinal and transverse struts and have rigid X-bracing in every panel. The other two towers are about 25 feet high and each face is X-braced in a single panel. Each tower has one fixed and one sliding seat for a 60-foot span, and the masonry abutments, about 690 feet apart, have fixed and sliding girder seats at the opposite ends of the viaduct.

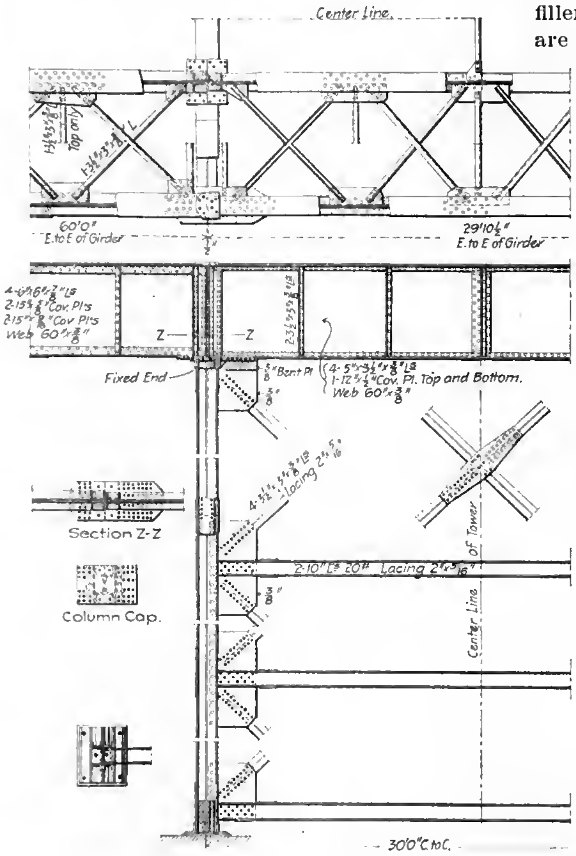
In the tall towers the maximum column compression is 380,900 pounds and the corresponding section is four 6x4-inch Z-bars and one 11½x⅝-inch web plate. At the base of the column, the web and side plates are extended to form vertical transverse gusset plates which distribute the load on a 30x38-inch base plate resting on a 32x40-inch bed plate with a ¼-inch sheet lead filler between it and the pier top. The ¾-inch cap plates are about 2 feet wide transversely and 3 feet long, and have holes for 40 field rivets connecting them to the bottom flanges of the longitudinal stringers. The columns are spliced at the bottom of the upper story with two 11x½, two 10x⅜, and four 3½x⅜-inch plates, shop-riveted to the lower sections and forming jaws which are field-riveted to the upper sections.

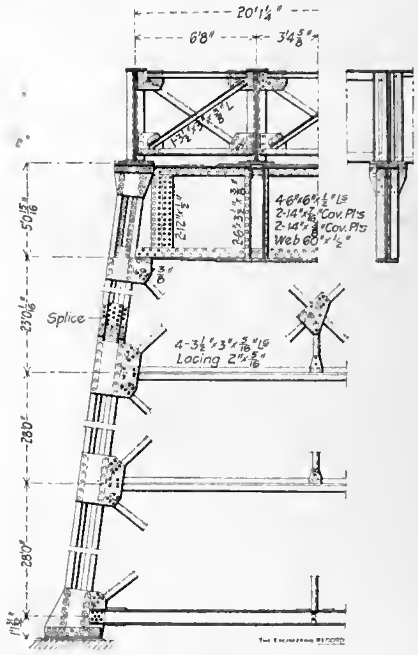
The two upper transverse horizontal struts have I-shaped cross-sections made with two pairs of 3½x3-inch angles, latticed. All other horizontal struts are made with two 10-inch channels, latticed. Pairs of rectangular connection plates with the corners clipped off are shop-riveted to the webs and flanges of the columns and form jaws which engage the ends of all struts and diagonals and are field-riveted to them. The upper longitudinal connection plates are made very long and have horizontal top flange angles which are shop-riveted to the lower flanges of the 30-foot main girders. The transverse struts are from 27 to 41 feet long and are calculated for a maximum compression of about 48,000 pounds. They are supported in the middle by vertical suspension angles from the intersection of the diagonals in the X-bracing of the panels above. The transverse X-braces are pairs of 3½x3-inch angles and the longitudinal X-braces have I-shaped cross-sections made with double pairs of 4x3½-inch angles, latticed. In all panels, one diagonal is cut at the center to clear the other one, which is continuous, and has jaw plates shop-riveted to the end of one section which engage and are field-riveted to the other section and to the other diagonal.

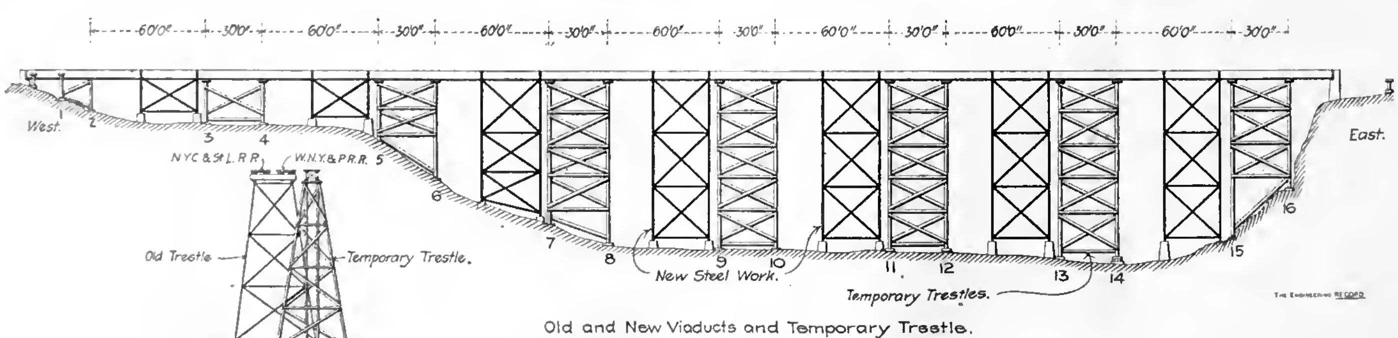
The web plates are not continuous in the upper sections of the columns but are cut off about 5 feet below the cap and replaced by plates about 3 feet wide which project beyond the inner flanges of the column in the planes of the webs of the transverse girders and are spliced to them with two cover plates with four vertical rows of rivets. These plates form jaws to receive the girder webs and have one row of shop rivets in the column plate and three rows of field rivets, thus securing sufficient spring to facilitate field assembling. The ends of the bottom flange angles are field-riveted to the extended column web plate and to horizontal shelf angles on the upper edges of the connection plates for the sway-brace diagonals.

The transverse girders have vertical stiffeners on both sides of the web in the planes of the inner lines of the longitudinal girders. Each stiffener is a pair of 6x3½-inch angles 8 inches apart, back to back, with their narrow flanges riveted to the girder web. A U-plate 12 inches wide is riveted between the tops of the stiffener angles to form a seat flush with the under side of the top flange angle. This seat projects 6 inches beyond the edge of the flange cover plate and is fillered up flush with its top to form an extended bearing for the lower flanges of the inner longitudinal girder, which has a 12x30-inch shoe plate seated on one end of a 24x30-inch bed plate across the top of the flange and fillers. In the outside stringers the shoe plates are about 20 and 38 inches long for the 60-foot and 30-foot girders respectively, and have four rows of rivets outside the flange angles engaging the bed plates at the fixed ends and corresponding bolts through slotted holes at the sliding ends.

A clearance of 1 inch is left between the ends of the 30-foot and 60-foot spans at the expansion ends, and of ½ inch at the fixed ends, and the joints between the top flanges are covered by short top plates with their edges bent down vertically to engage the edges of the flanges. The pair of longitudinal girders on each side of the center line of the viaduct are connected by vertical transverse sway-brace frames about 7 feet apart, and by top and bottom zig-zag angles between them in the planes of the top and bottom flanges. The pairs of stringers are connected together across the center line of the viaduct at every second panel, by single transverse horizontal angles in the planes of the top and bottom flanges and without any sway-brace







Old and New Viaducts and Temporary Trestle.

THE EIGHTEEN MILE CREEK VIADUCT, NEW YORK, CHICAGO & ST. LOUIS RAILROAD.

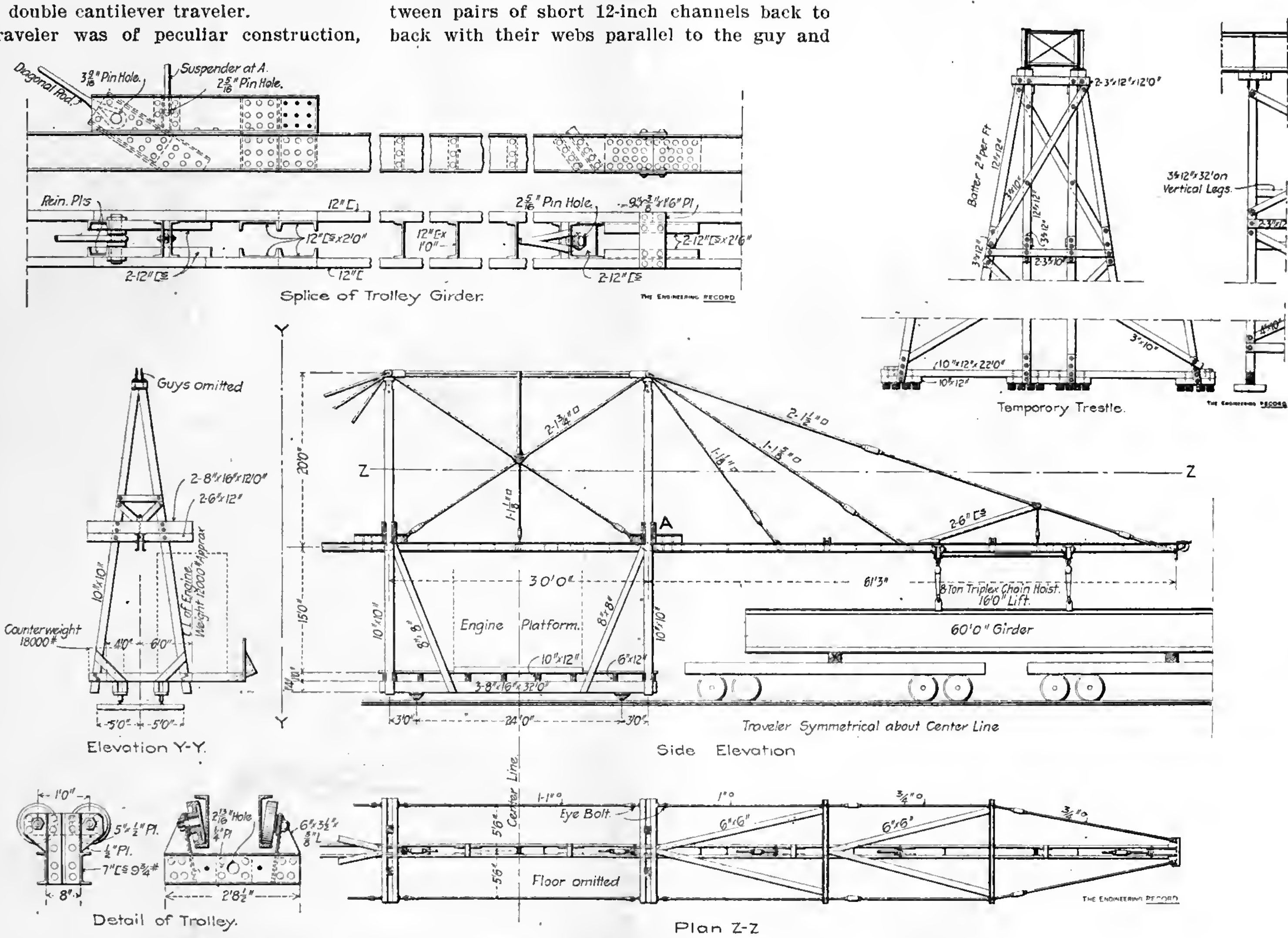
diagonals. All these braces are single 3½x3-inch angles.

Preliminary to the erection of the new structure a single-track wooden trestle viaduct was built as close as possible to the old viaduct, and interlocking with it. The new towers were placed between the old ones and had their columns on one side seated on the center line of the old viaduct. The tower tops were just outside the tops of the old towers, as shown in the cross-section, and supported lines of longitudinal girders borrowed temporarily from the new structure. Traffic was abandoned on the adjacent track of the old viaduct while the temporary trestle was being built and its members and the girders were handled at track level from one end of the structure. When the temporary trestle was completed all the train traffic was diverted to it, the old viaduct was dismembered and the new one was erected by an overhead double cantilever traveler.

The traveler was of peculiar construction, channels 12 inches apart back to back. It was made from 12-foot lengths of old stringer channels, shop-spliced with short lengths of 12-inch channels riveted across the joints, inside, back to back and had top flange cover plates. The channels were separated and stiffened by 12-inch lengths of vertical 12-inch transverse channel diaphragms with their flanges riveted to the backs of the main channel webs. The girder was shipped in three sections, the middle one being 36 feet long and reaching across the tower bents from which it was supported by suspension rods to the cross struts. The end sections were cantilever arms about 60 feet long and spliced to the center section with vertical and horizontal channels as shown in the detail.

Each cantilever arm was supported by three adjustable guy rods from the top of the tower. The lower ends of the guys were engaged between pairs of short 12-inch channels back to back with their webs parallel to the guy and projecting above the upper flange of the girder. At the ends they converged to the ends of the girder.

Two trolleys, each with four inclined wheels, ran on the upper surfaces of the lower flanges of the girder. Each trolley was provided with a shackle from which an ordinary tackle could be suspended for handling the columns and struts, and was also provided with a pin connection for an 8-ton triple chain hoist with a 16-foot lift. These trolleys were spaced by a 15-foot tie and used with the hoists to handle the 60-foot girders, which were brought on cars under the rear arm of the traveler, lifted clear, traversed to the end of the forward cantilever and lowered to place. The trolleys were traversed by the hoisting engine operating a tail rope led around a sheave at the extremity of the cantilever arm. The traveler had a total capacity of 24,000 pounds on a 15-foot wheel base,



PLANT USED IN ERECTING THE EIGHTEEN MILE CREEK VIADUCT.

and consisted of a tower about 38 feet high which supported a single horizontal trolley track about 155 feet long over all and 18 feet above the viaduct rails. The tower consisted of two A-shaped transverse timber bents 10 feet wide at the base and mounted on a pair of triple sills 32 feet long and 6 feet apart on centers. They were braced transversely by cross pieces and longitudinally by diagonal rods and knee braces. The ends of the tower cantilevered 3 feet beyond each of the four double-flange wheels which supported it on the standard-gauge track, and its sills carried floorbeams which cantilevered 3 feet beyond them on one side and 9 feet on the other side. They carried an 8x30-foot floor with the hoisting engine set on it outside the sill and counterbalanced by an 18,000-pound weight on the short ends of the floorbeams.

The overhead trolley track consisted of a single horizontal girder with two lines of 12-inch their flanges riveted obliquely across the backs of the girder channels. Their webs were bored to receive the pins in the ends of the guy rods. The upper ends of the guy rods were engaged by pins through pedestals riveted to pairs of transverse channels shouldered into the tops of the tower bents. The pedestals on the two bents were connected by an I-shaped tension strut made of two pairs of 3x2½-inch angles latticed, which equalized the reactions between the two sets of guys. The trolley girder was stiffened transversely by trussing in a horizontal plane. Wooden transverse struts were fitted to have their inner ends bear against the web at the tower bents and through their outer ends horizontal longitudinal eye-bolts were were placed to engage the ends of tension rods 11 feet apart, parallel with the girder on each side. These rods were pin-connected to the ends of spreader struts which were riveted between short vertical pairs of channels project- or of 14,000 pounds at the extremity of one arm. When in use for heavy loads the feet of the inclined posts in the tower bents were firmly wedged against blocking and were lashed securely to the completed structure to provide anchorage against eccentric loads.

After the new structure was completed except the track nearest the temporary viaduct, the traffic was diverted from the latter to the new track already laid and the girders were removed from their temporary position on top of the wooden towers and set in their permanent positions in the new structure, thus completing it and restoring the two tracks to service without having stopped any trains. In changing the last set of girders it was only necessary to reverse the process of erection. The girders were lifted by hoists on the forward arm of the traveler, run back to the end of the rear arm and thence lowered to cars on the traveler and material track underneath, which had previously served for the train traffic. The cars were run back on land and unloaded and the succeeding girders were handled in the same manner. When all were removed from the old temporary structure the traveler advanced to the end of the new viaduct alongside the completed track and receiving the girders under its rear arm lifted and passed them forward and lowered them to their final position in the regular way, advancing on the viaduct to the end of each successive span.

The viaduct was designed, constructed and erected for the New York, Chicago & St. Louis Railway Company, under the direction of Mr. E. E. Hart, engineer, by the King Bridge Company, of Cleveland, in accordance with the specifications of the New York, Chicago & St. Louis Railroad.

"Fair, Just and Reasonable Water Rates."

A few weeks ago there was printed in this journal a digest of the report of Mr. Chester B. Davis, M. Am. Soc. C. E., which was adopted at San Antonio, Tex., as a means of settling a controversy as to equitable charges for water supplied by a private company. A controversy of the same nature is now taking place between the officials of Memphis and the Artesian Water Company, and, in half of the latter a report has just been prepared by Mr. Thomas T. Johnston, which is full of interest. The following abstract of its leading features has accordingly been prepared and is here presented as an ex parte statement worthy of study even by advocates of the municipal control of all public utility services.

The basis of any estimate of just rates must be sought primarily in the amount of investment, according to Mr. Johnston. This item includes, in his opinion, the cost of planning and financing the enterprise, the preliminary legal expenses, the cost of construction and, under certain circumstances, depreciation and renewals. Whether an expenditure be classed as an investment and thus included in the capital account or whether it be termed a maintenance charge makes a difference, of course, since, if it is charged to investment, it requires an annual sum from the revenues, while if charged to maintenance it disappears. But no matter what it is called, it is represented in one way or another on the books in a sum to be met out of the revenues. It should be added that a sinking fund provision is impracticable in Memphis for local reasons.

It is held to be a mistake by Mr. Johnston not to include the amount of depreciation or cost of renewals in the investment account. This opinion, commonly held in England but rarely advocated here, he explains as follows: "This mistake doubtless is a consequence of not distinguishing between the provisions made in annual revenue for preserving the value of the plant at its original cost, and the failure to make such provisions in annual revenue. Every expense incurred, no matter what its nature, must go to investment account, unless that expenditure is at once refunded, and must remain in the investment account, with accrued compound interest, until it is refunded. Depreciation or renewals, and even cost of construction and any other expense, may not properly be an item of investment account if the equivalent money has been refunded to the investor. It is proper to contemplate that if the industry should cease, that the investor should have returned to him in the end every dollar of outlay he has made, and meantime he should have had a reasonable interest on the money and proper compensation for his services. Of course, if in the interim between beginning and closing the industry the investor has secured a revenue that is unduly large, and which exceeds 'a reasonable interest on investment and proper compensation for his services,' then just to such extent may it be equitable to make deductions from the money he should have when the industry terminates."

This view naturally leads to the following opinion of the propriety of considering obsolete portions of the plant in determining the sum upon which the rates for the service should be based: "It is questioned sometimes whether the cost of 'modifying the installation' is a proper investment charge. For instance, a pumping station may have been used at one time in the history of the plant, and was the best that could be had properly for the service at the time. Subsequent events, which could not have been certainly anticipated, or which were not anticipated, even if it was practicable, may have led to the abandonment of said pumping station. It seems perfectly clear that unless the investor had been fully reimbursed for his investment in said pumping station, the cost of the pumping station must stand in the investment account, just to such an extent as there has been failure to reimburse. It is clear that, to begin with, the cost of the pumping station was a legitimate investment charge, and must have been so considered in the fixing of 'fair, just and reasonable rates.' Its abandonment was not anticipated, so that the rates did not include any item for reimbursing the investor beyond a provision of so much revenue as would maintain the pumping station to a value equal to that which it had when new."

In the matter of estimating franchises, the opinion expressed in the report is contrary to that sometimes expressed by representatives of water companies similarly situated. It is clearly stated that no contract or franchise can have a value when it provides for fixing the rates on a "fair, just and reasonable" basis. It has been common to consider that the contract or "franchise" permitting the water company to do business, has a value. This can not be true when such contracts fix the rates on a "fair, just and reasonable" basis. The rates being thus fixed, the company has a less valuable privilege than it would have in buying land or engaging in any other industry. The contract or franchise would or might have value if it contained no limitations as to rates, or if it provided for rates that were not "fair, just and reasonable" to the city. Doubtless in some instances when it has been said that the franchise had a value, something else has been meant, as for instance, the "going value."

The nature of "investment" items being understood, the money values involved becomes a matter of evidence as to the facts, both as to the amount of money invested and as to any reimbursement therefor that may in one way or another have been made.

The annual charges relate to interest on investment and sinking fund, when there is one, operating expenses, maintenance, and the company's services.

Operating expenses when provided for by revenue—that is, when they do not go into investment account—comprise generally all expenses which do not result in a physical result, services as below described being excepted. Salaries, insurance, expendable supplies like fuel, taxes and the like, are included.

When an individual or company promotes, plans and conceives and manages an industry to the end of developing it to a physical and earning existence, it is proper that he should be compensated in money or stocks or bonds, and that the consequent expense should be charged to investment account, for the very good reason that the consequence of such service is continuous, and does not cease with the performance of the work. Not so, however, with the fireman in the boiler-room the consequence of whose labor disappears inside of a day. The value of service of this kind is entirely similar in the case of a water company, though not always expressed in similar language. In valuating a water supply plant, either for its sale or for fixing "fair, just and reasonable rates" it has been said, that in addition to the value of the physical plant, there should be added a "going value." This "going value" is nothing more or less than a measure of the value of the class of services in question.

Services of the individual or corporation, as a whole, for a useful purpose, when compensation therefor is provided for in revenue, becomes a fixed annual charge. That is, compensation is made currently instead of the cost thereof going to investment account, as must necessarily be the case prior to the revenues coming into existence. The services are of the same nature as already referred to, viz.: The service of promotion, planning, conceiving and managing; and are generally of the latter kind.

Compensation for service, while a legitimate annual charge, is not usually independently listed. In fact, no such compensation has ordinarily been made in water works practice, and has only been recognized in some cases where a sale of plant has been made to a city, and on such occasions courts and arbitration boards have recognized it under the name of "going value," or under the erroneous name of value of franchise.

Maintenance includes all annual expense not already referred to, for which provision is made in the current revenues, and in general refers to preserving, by repairs and renewals, the physical plant, so that it will at all times be as valuable as when new. Quite frequently provision is made in the revenues for but a part of such expense, in which event the part not provided for should become an item of investment account. This fact is often overlooked, much to the disadvantage of the investor.

Maintenance nullifies depreciation. It even improves the value of physical installation in some instances, in which event the increase in value should not be a factor in determining interest on investment, nor should it appear, if at any time it is desired to place a value on the industry. If the value of such improvement be deducted from maintenance expenses, provided for in revenues, of course said value should enter into investment account just as any other item.

The revenues should be equal to the annual charges as above described, and it is premised that they are derived from a "fair, just and reasonable rate" for supplying water or delivering whatever product the industry may produce.

This "rate" is to be made up of a number of distinctly different items, each of which may be greater or less according to what the gross revenue is to be. It is, therefore, necessary to determine first what gross revenue per year will be "fair, just and reasonable." It has already been shown that a greater or less portion of the expenditures in any one year may go into investment account, according to whether or not they are provided for in the revenues. It therefore becomes necessary to determine primarily and definitely what class or proportion of the expenditures in any one year it is desired or practicable to provide for in the revenues. If a large extension of the physical installation is to be made, then it may be entirely impracticable to provide for it in the revenue for immediate reimbursement, and it must in part or wholly go to investment account, and stay there to a greater or less degree according to any reimbursement that may from time to time be made.

Good business policy dictates that the annual "revenue" be made to meet the "annual charges" as nearly as it is practicable to anticipate or predetermine them, and for purposes of discussion it will be assumed that no increase of investment account is to be made except for additions to and extensions of the physical installations, and, further, that no attempt is to be made to diminish the existing investment account by providing a sinking fund or otherwise from annual revenues. These premises being adopted, it becomes evident that the question involves a consideration of the past as well as the future. The past is involved only in so far as the existing investment account is concerned. The future is involved in relation to increase of investment account, and as to the annual charges in addition to interest on investment.

The existing investment account which involves the past is the present value of the plant, and this value is determinate and can be represented by but one sum of money. It has been sometimes stated that the value of the plant may be one thing if a sale or purchase be contemplated, and that it may be another thing if the said value is to be used as a factor in fixing water rates. Manifestly, such a statement is incorrect. The investment account, made up in manner and form as hereinbefore stated, is the present value of the plant, and can be nothing more or less. Failure to perceive this fact has led to erroneous methods of estimating the present value of the plant. The present value of the plant can not possibly be determined by what has physical existence at the present time. It can not be reasonably determined by a simple consideration of the present market values of the materials or parts comprising the physical installation. A value very much greater or very much less than the true value might thus be ascertained.

Neither can the simple market values of the materials or parts of the physical installation at any time in the past be taken as a complete measure of the present value of the plant. And, further, in case any market values, past or present, may be a measure of present value, there is no reason for deducting from such market value anything on account of depreciation, unless the revenues of the past have reimbursed the investor to the extent of such estimated depreciation, or unless the revenues of the past have provided a sinking fund that may be used to renew the physical installation to such an extent as it may have depreciated in value.

Services rendered in the past, the present evidence of which are not in physical form, and the performance of which can be discovered only by examining past records, must form a part of the present value of the plant.

Finally, all of the elements of investment account as hereinbefore described, must be considered in determining present value, no matter what the purpose of ascertaining said value may be.

The present value of the plant has been agreed upon in view of a sale to the city. This does not necessarily mean that the sum will be the total cost of the plant to the city. It may be that the water rates of the past have not been sufficient to meet all proper annual charges, as hitherto defined, and consequently that a further sum would be needed for repairs and renewals in order to bring the plant up to a condition of permitting the best economy in operation. This is no fault of the water company, if it be the case, because its rates, fixed by contract, will not have been sufficient to permit a better condition of things; that is, the rates have not been "fair, just and reasonable." In other words, the water consumer has been profiting unfairly at the expense of the proper value of the plant, and in all fairness he should make good his error. Should this further sum need to enter into consideration, it will be a good item of investment account, and may be merged with other investment accounts to be involved in the future.

The remaining portions of the report are of such a local nature that it is unnecessary to refer to them.

Alternating-Current Electric Railway Operation.

An important innovation in power distribution and application for interurban electric railway service has been undertaken by the Washington, Baltimore & Annapolis Railway Company, which is to operate, by alternating current apparatus throughout, a 40-mile line between Washington and Baltimore with a 15-mile branch to Annapolis. The equipment will be the new system which the Westinghouse Electric & Manufacturing Company has been developing and testing during several years back, under the supervision of Mr. B. G. Lamme, its assistant chief engineer. In the ordinary method of operating street railways, direct current is fed to the trolley line for the car-motors. For city lines and densely populated districts, the current is often generated as direct current, but for long distance inter-urban roads this would involve a cost of copper conductors entirely prohibitive. To meet the latter objection a system has been used thus far in this country involving the generation of alternating currents at high pressures of from 10,000 to 30,000 volts and the transmission of the same to substations, where by means of transformers and rotary converters, the current is supplied to the trolley wire as direct current as the usual railway voltage from 500 to 650 volts. The rotary converters substation, however, has always been an undesirable feature, chiefly on account of the cost of the apparatus and building and the attendance required. The plans that have been proposed to do away with this feature are numerous.

In Europe the polyphase induction motor has been used to some extent, but it implies the use of two or three overhead wires, and, moreover, the characteristics of the induction motor in regard to starting and average efficiency in railway service are said to be not of the best. Other systems which have been proposed involve the use of single-phase motors upon the cars, driving generators which in turn supply power to the motors on the axles. However, this involves the placing of a substation upon the car itself, and so cannot be considered a great improvement over the ordinary alternating and direct current system. Details regarding the new system of the Westinghouse Company are not at hand, but its use is expected to avoid the limitations of the induction motor and the disadvantages of the multiplicity of overhead conductors as well as the great cost of the system just described.

For the road which is now being constructed between Washington and Baltimore, single-phase, alternating current will be generated in a 133x203 foot main power house located at Hyattsville, by three 1,500 kilowatt, single-phase, Westinghouse generators, delivering current at 15,000 volts and driven by cross-compound condensing Hamilton-Corliss engines. This station is of more than average size and is in no sense experimental. The power house will be built of brick with stone and concrete foundation, and will contain in addition two 125-volt direct current generators to be used as exciters for the alternators and a large switchboard with electrically operated oil switches, circuit-breakers, lightning arresters, etc. Current will be distributed from the power house at 15,000 volts to transformer stations located at suitable intervals along the line. These transformer stations will contain only stationary transformers with the necessary switches and fuses, but no moving machinery, and will therefore not require the presence of an attendant. From these stations current will be fed to the single trolley wire at 1,000 volts. The pressure of 1,000 volts which has been adopted for the trolley wire is not a necessary part of the system, as a much higher voltage could have been used if it had been deemed advisable by the engineers of the road.

The cars will probably be sixty feet in length and weigh about 50 tons each. They will be supplied with Master Car Builders' trucks designed for high speed, the track is laid with 80-pound rails and it is expected that the distance of thirty-one miles will be made in 45 minutes, including stops. The cars are to be equipped with four motors, each of 100 horse-power, and it is expected that a normal speed of 40 or 45 miles can be attained, and a speed of 60 miles reached when necessary. The motor, which is the novel part of the equipment and the key to the entire system, is a variable speed motor having characteristics adapted to railway service and reported to be equal in all respects to the present direct-current railway motor.

It is to be remarked that this latest development in electric railroading follows in a path already traced by electric lighting. The first electric lighting systems employed direct current at low voltage, but as the area to be supplied increased, this involved a cost of copper cables. To meet the difficulty alternating current distribution at high voltage was adopted, with rotary converter substations to enable the current to be distributed on the existing mains as direct current. However, most electric power plants now being installed distribute low voltage alternating current directly to the lamps and motors, thus avoiding the expensive rotary-converter substations.

The engineers of the new road are the Cleveland Construction Company, of which Mr. Will Christy is president. The officers of the Washington, Baltimore & Annapolis Railway Company are Mr. W. H. Lamprecht, president, and Mr. Otto Miller, secretary, both of Cleveland. The directors are as follows: Messrs. W. H. Lamprecht, F. T. Pomeroy, F. N. Wilcox and Otto Miller, all of Cleveland, Mr. Will Christy, of Akron, Mr. James Christy, Jr., of Washington, and Mr. W. L. Marbury of Baltimore, Md. It is also stated that Messrs. Henry Everett, E. W. Moore and W. J. Mandelbaum & Company of Cleveland, are largely interested in the enterprise.

The New Ash Carts used by the Street Cleaning Department of New York are required to conform to the following specifications: The body is to be a sanitary one without tailboard, and is to be of ⅛-inch steel, fastened with ⅝-inch rivets, and have 1¾x1¾x3/16-inch angle iron about the sides and front at the top and a ½x3-inch stiffener on the rear edge. The cart body is to hold 1⅝ cubic yards level full. The cart body rests on trunnions, housed in trunnion beds on top of semi-elliptic springs mounted over the cart booms. These springs are to be 32 inches over all and have 8 leaves of 2¾x¼-inch steel each. There is to be a seat board on top of body, and the booms, which are to be of first quality oak, are to have managers attached. The axle is to be 2½ inches square. Wheels are to be Archibald make 4 feet 6 inches diameter, and have 2½-inch spokes and 3x⅝-inch round edge tires.

Notes on Irrigation Engineering.

Extracts from testimony by Elwood Mead before the U. S. Industrial Commission.

Losses of Water by Seepage.—In all of the West except southern California irrigation ditches and canals are unlined. The soil over which the water passes is expected to retain it in its channel; but there are cases where it fails to do this and the losses from seepage and percolation are excessive. Where canals cross strata of coarse gravel, or where there are gypsum deposits, the losses from this cause are very great. In one instance the measurements of the Irrigation Investigation of the Agricultural Department showed a loss in a canal of 75 per cent. of its entire supply in a distance of less than a mile. The following, taken from the report of these investigations for 1899, shows the extent and character of these losses over a widely distributed area:

In practice the losses in canals from percolation, leakage of flumes, evaporation, etc., are an important factor in fixing the average duty of water from a river or an extensive canal system. To determine this average duty the volume should be measured at the headgate, and the acres it irrigates is the duty which canal managers have to consider in determining the area their works will irrigate. This duty is much lower than that obtained by measurements made on laterals or at the margins of the fields where used, the influence of the losses between the headgate and the heads of laterals being greater than has usually been supposed. Where canals cross gravel beds or gypsum deposits the results closely resemble trying to carry water in a sieve. The following table gives the number of acre-feet used in the irrigation of an acre of land where the measurements were made at the canal headgates, and include the loss from seepage and evaporation:

Duty of Water when Losses in Main Canals are Included.

Name of Canal.	Acre-feet.
Pecos Canal, New Mexico	6.61
Mesa Canal, Arizona	3.81
Butler Ditch, Utah	6.24
Brown and Sanford Ditch, Utah	5.32
Upper Canal, Utah	6.30
Amity Canal, Colorado	4.92
Rust Lateral, Idaho	5.06
Average	5.47

A comparison of the duties in the above table with those obtained when the water was measured where used will show that more than twice as many acre-feet were required where the water was measured at the headgate as where measured at the place of use; or, in other words, the losses in the canals from seepage and evaporation amount to more than one-half the entire supply. This is in accord with many of the measurements made on irrigation canals in India. Among those recorded in Buckley's Irrigation Works in India is one which shows that the irrigation of wheat under the Jamda Canal, in Bombay, required 5.6 acre-feet of water for each acre irrigated where the water was measured at the head of the canal, but where the water was measured at the place of use it required, in two experiments, only 2.1 acre-feet and 1.4 acre-feet to irrigate an acre, the loss in the canal being more than 50 per cent. On the Hathmati Canal, in the same country, the loss from the seepage and evaporation was 50 per cent. These losses in transit are much heavier than is the rule on the older canals of India, and are doubtless more general than they will be in this country when the banks of canals are older and when they are operated with greater regard for economy.

The report of Mr. Reed shows that 47.7 per cent. of the water turned in at the head of the Pecos Canal reached the consumers, while 52.3 per cent. was lost through seepage and evaporation. The causes of this loss are explained to be the checking of the velocity in the canal by dams in order to throw water on ground too high to be irrigated without this, certain defects in construction, and the nature of the soil in which the canal is built. The canal has a bank on one side only. This has produced stagnant lakes and pools on the upper side wherever the canal crosses ravines, or where the ground on the upper side is so low that the water overflows it when the canal is filled. Mr. Reed's report also shows the variation in rate of seepage due to the character of the soil, three-fourths of the water entering one section of the canal 1 mile long being lost. To his summary of the causes of the great loss of water there may be added the fact that the water used in this canal is taken from the reservoirs. Its temperature is already above that of most mountain streams, which facilitates alike its rapid filtration and evaporation. It is perfectly clear, owing to the fact that all of the sediment carried by the river is deposited in the reservoirs. This canal affords an illustration of a lower duty on a particular farm, measuring the water at its margin, than the average under the main canal, measuring the water near the headgates. Mr. Reed points out the causes for this, and shows that it does not illustrate the necessities of irrigation, but the possibilities of waste under encouraging conditions.

The water taken into the Mesa Canal during the four years that measurements have been made has varied from enough to cover land to a depth of 5.9 feet in 1896 to 3.8 feet in 1899. A measurement was made in 1899 of the water used on a farm where the land had not before been irrigated, and where more than the average amount of water was required. Owing to the fact that rotation was practiced on the lateral leading to this farm, it is impossible to determine the exact quantity lost in passing through it, but the water delivered at its head for this farm would have covered the land to a depth of only 2.8 feet. The difference between the average depth under the main canal and the depth of water used on this farm was just 1 foot, or a difference in quantity of 1 acre-foot per acre irrigated. Mr. Code estimates that this difference would have been much larger if the loss in transit through the lateral had been determined. As it is, this shows a loss of over 25 per cent.

The construction of the Gage Canal is such as to make losses through seepage practically nothing, owing to the canal being cemented. The loss from evaporation is also small, because the canal is deep and narrow and has throughout its length a uniform cross section, with no pools of still water on the upper side. As compared to losses varying from 25 to 75 per cent. shown in other canals, the loss of only 6 per cent. in this canal has great significance. The water turned into the head would have served to cover the land irrigated to a depth of 2.24 feet, while the mean depth for the water delivered to irrigators' laterals was 2.11 feet, a loss of only 0.13 of an acre-foot per acre irrigated. Canals can only be cemented on earth, as is done in California, in localities where frosts in winter are not severe. There are other remedial measures which can be employed in other sections which will, no doubt, be largely adopted when the extent of the loss from this source is more generally realized. Dumping clay into the canal and causing it to be distributed by agitating the water has been tried with good results on some Nebraska ditches.

The report of the careful and interesting investigations of Professor Fortier at the Montana Agricultural Experiment Station shows that in Middle Creek Canal nearly 22 per cent. of the total flow was lost in seepage in the first 4 miles, while the probable loss in the entire canal was 35 per cent. The conclusions of Professor Fortier are in accord with those of other observers as to both the evils resulting from this loss and the methods by which it may be reduced.

The water taken into Logan and Richmond Canal would cover the entire area it irrigates to a depth of 3.59 feet. The water actually used on the Cronquist farm would have covered it to a depth of only 2.6 feet, the difference between the average duty under the canal and the measured duty on one farm under it being nearly 1 acre-foot of water for each acre irrigated, or a difference of about 28 per cent. It is believed that this can be fairly taken as the loss resulting from the seepage and evaporation in carriage.

The water entering the headgate of the Amity Canal in Colorado would have served to cover all the land irrigated to a depth of 4.92 feet. The water delivered from the Biles Lateral would have covered the land under that lateral to a depth of only 1.82 feet. The difference between the average duty under the canal and the special duty under one lateral is 63 per cent. This seems to indicate that more than one-half of the water taken from the river disappears before it reaches the place of use. An examination of the map of the Amity Canal will show the reason for this excessive loss. The canal is a large, long one and much of the time last season was only partly filled. More than one-half of the time the water flowing through it was spread out in a broad, thin sheet, which reduced its velocity and gave abundant opportunity for the continuous sunshine to raise the temperature. This increase in temperature facilitated both its disappearance in the air and its filtration through the soil. Mr. Berry's report shows that the season of 1899 was unusually windy, making evaporation greater than usual.

Enough water was taken into Canal No. 2 at Wheatland, Wyo., to have covered all the land irrigated to a depth of 2.53 feet, while only enough water was delivered through the J lateral of that canal to cover the two fields on which the water used in irrigation was measured to a depth respectively of 0.7 and 1.55, the apparent loss in the canal being one-half the water entering it. In this case this high rate of loss is what might have been expected. The canal is long. It traverses a steep hillside slope for two miles, in which distance the loss under the lower bank is excessive. In many places the bottom is gravel, through which water escapes freely.

In order to more carefully study the variations in these losses, arrangements were made early last season by Frank C. Kelsey, city engineer of Salt Lake City, Utah, to measure the seepage loss from the Jordan and Salt Lake Canal from the Jordan River. This canal is 29 miles long, with a bottom width of 20 feet. It originally had a grade of 2 feet per mile, but when measured was in bad condition, with a flow of 30 cubic feet per second at the head. The loss in 29 miles was 45 per cent.

The losses from seepage in new canals are excessive. For the past six months 500 inches of water have been flowing in at the head of a 10-mile lateral built at Billings, Mont., in 1899, but as yet not a drop has reached the lower end. On a canal built in Salt River Valley, Wyoming, there was a loss, in 1896, of 10 cubic feet per second in a distance of 100 feet, which continued for several weeks with no apparent prospect of the loss diminishing. This was about one-third of the canal's flow. The canal was then abandoned. The canals which take water from the North Platte River are all subject to excessive losses when first built, because of the sandy soil through which they must pass. In high water, however, this river is heavily charged with a white clay, due to the erosion of its banks. When this is deposited on the sides and bottom of ditches it forms a coating only less impervious than cement, and after a few weeks' operation during high water seepage losses always show great diminution.

Mr. Code reports that the water of Salt River, Arizona, contains a cementing material which in time renders its banks almost water-tight, so long as they remain undisturbed. This has not heretofore been possible on the Mesa Canal, because it has been undergoing constant repairs and improvements.

Filling of Canals by Silt.—The canals taken out of the lower portion of those streams running out on the plains are more or less troubled by the moving sands in the bottom of the stream, that tend to fill them up; and all canals that are taken out of rivers that carry considerable quantities of mud in high waters have to be cleaned out every year. The deposits of mud can be handled as a rule without any excessive expense, but in streams like the North and South Platte and the lower part of the Arkansas the sand question is quite troublesome; and on the lower part of the Rio Grande the question of mud becomes an important factor. The red rise in the Rio Grande occurs when there are torrential rains along certain portions of the river where there is a red soil, and enormous volumes of mud are washed down in the river. Samples of the stream taken at that time have shown as high as 17 per cent. of solid matter. All the ditches have to be closed during the time of the red rise because they would immediately fill up.

At Las Cruces, N. Mex., is one of the oldest ditches, if not the oldest ditch, in the United States. That ditch was formerly a channel cut below the surface of the ground. Now it is raised 4 or 5 feet above the surface of the ground. As the mud which was carried into the ditch was cleaned out each year it was thrown on the banks; and when the banks became so high as to be troublesome they simply let the mud fill up a foot or so in the bottom. In time the ditch got above the stream, and they had to move the head farther upstream. In the period of operation of that canal the head has been moved upstream 3 or 4 miles from the original location. Not only that, but since the time the irrigation began the level of the soil on which the water and mud has been spread has been raised from a few inches to 2 feet—higher, of course, nearer the ditch, and becoming thinner and thinner as you recede from it. The Rio Grande at El Paso has filled up its channel from this cause until the river itself is higher than some of the streets of either El Paso or Juarez.

Filling of Reservoirs by Silt.—A great many streams are torrential in character, carrying an immense flow of water and then running down to nothing. You must store these streams in order to make much use of their waters, and the problem of storage is a complicated one. It involves the question of the sediment in these Southern streams—the silt. It is disastrous to build a reservoir in the channel of a river, and, when you have a large investment in houses and people settled there, to have it filled up and necessitate these settlers moving out. It is simply a waste of energy and a waste of money. That is a question that the Department of Agriculture is studying, and arrangements have been made with the agricultural college of Texas to gather samples from these streams and see what would be the probable result of letting the mud they carry deposit on the soil.

The total evaporation from the water service in the West ranges from 3 to 6 inches per month. Where the waters of the river itself are heavily charged with alkaline salts this evaporation will so concentrate them as to make it injurious; but there are very few instances of that kind. The only one that I know of personally is the Pecos River, and I think that action only occurred in one season. I do not think that would be a very important question. The streams carry so little alkali in the portion of the country where the water is stored that the accumulation would not amount to much. Then the water is discharged every year and there is no cumulative action. It is only the concentration that would take place in a single season.

Unit Costs of Work in Progress.

At the last convention of the American Society of Civil Engineers there was an important discussion on the possibility and desirability of keeping accounts of cost of work in such a manner as to ascertain the unit costs on each class. The importance of such a system of accounting to the engineer and contractor cannot be overestimated, and the full text of the discussion is accordingly reprinted from the "Proceedings" of the Society for August, page 546. The discussion was opened by a short paper by Mr. Samuel Whinery, as follows:

Two questions are embraced in this topic: The first relates to the possibility and the second to the desirability of account-keeping intended to disclose the unit cost of work.

The first of these questions has been practically answered by actual experience. Except possibly in some cases where abnormal conditions prevail, it is entirely possible to keep accounts which will show correctly the unit cost of any work, whether that work be in the nature of surveys or other preparatory operations, or of the construction of engineering structures or of manufacturing. Such accounts are now, not only common, but almost universal, in all well managed enterprises. Like all other forms of accounting, the value of the results attained will depend upon the adequateness of the general plan and details of the scheme of accounts adopted, the fidelity and accuracy with which the original records are made, and the ability and skill with which these records are compiled and deductions made therefrom.

Each of these three subdivisions of the work is of equal importance, and if either is defective, or neglected, the results attained will be unsatisfactory or entirely worthless. To devise a scheme for a cost-keeping account, with all its necessary details, and to prepare full instructions for its operation, is by no means a simple thing, requiring as it does a very intimate knowledge of the method of conducting the particular kind of work on hand. The difficulty increases with the complexity of the work and the number of unit cost items it is considered necessary to ascertain. It is only after one has had an extensive experience on similar work that one can frame a scheme that will be workable and efficient. It must be simple and easily understood; otherwise the employees who must be depended upon to make the original records will get them hopelessly confused; or a disproportionate amount of time and labor will be consumed in making them. It must be explicit in its details and instructions, for the same reason, and it should be so comprehensive as to disclose where every item of money or labor has been expended. But however perfect a cost-keeping scheme may be devised, it will prove worse than useless if not intelligently and implicitly adhered to by those whose duty it is to make the original entries or records. Every cent expended upon the work, whether in the form of cash or labor, must be accounted for and charged to its appropriate item. This sounds simple enough, but only those who have had exasperating experience with the stupid or negligent employee can appreciate how difficult it is to have these original records properly made. Assuming a good system of accounts and accurate original records, their value will depend upon the care and fidelity with which the original information is compiled and made available for use. In the press of other office duties this part of the work is often neglected or postponed until such a mass of it accumulates that it is then abandoned, or it gets into such a state of confusion that it is difficult or impossible to disentangle and tabulate it, and it is then thrown aside as worthless, with the statement that the problem of determining unit cost is hopeless.

It may be confidently asserted that, with the same amount of care and accounting skill necessary and usual in a first-class mercantile establishment, it is possible to determine with accuracy the unit cost of any engineering work.

A knowledge of the unit cost of work is of value in many ways, and accounts which enable us to ascertain it are therefore desirable. To the engineer engaged in designing modern work the important problem is how to accomplish the object sought with the least expenditure of money. Other things being equal, that particular detail will be used which is the cheapest. In order to determine which is the cheaper of two details the unit cost of each must be known. The engineer, therefore, finds it important to accumulate the largest possible fund of cost prices. To the contractor or the manufacturer the question of desirability is synonymous with the question "will it pay," and among the more enterprising and intelligent there can be but one answer. The question of success or failure in these times of sharp competition and low prices may depend upon the accuracy with which cost has been estimated, and this again will depend upon the knowledge of unit cost under the conditions that are to be met. These conditions vary greatly upon different pieces of work, and in different localities, and the estimator needs the accumulated knowledge that comes from habitual cost-keeping. It is important, therefore, that this branch of accounting should never be neglected on engineering work. Furthermore, it is important during the progress of any extensive work. The contractor or the manufacturer who has before him at the end of each week the unit cost of his work during that week can know whether it is being done with proper economy, and, if it is not, he can ascertain the cause and apply the remedy at once, and thus prevent accumulated losses. Accurate accounts will often disclose defective management which may not be detected by personal observation during the progress of work.

Mr. Charles S. Churchill stated that inasmuch as engineering is the power of producing the greatest and most permanent results for the least ultimate cost, even the intimation that actual and detailed costs cannot be determined and kept is a stroke against the foundation of the profession. The keeping of and knowledge of these detailed costs and ultimate values really constitute the greatest care of the successful engineer, and the proper use of this information is of almost equal importance.

To be told that a certain piece of first-class ashlar masonry cost $6.50 per cubic yard may attract attention; but this fact is not of much value unless we know, further, how this cost is made up, as it consists of the price of the stone delivered at $2.35, and labor on the same, with other materials, aggregating $4.15. But we are still not at the bottom, because the cost of cutting different stones varies, and the other materials also vary in cost. Therefore our information is not complete until we know that the amount, $4.15, is made up of cutting, $1.14;

laying, \$2.26; cement, 20 cents; sand, 7 cents; handling, 16 cents; and setting derricks, etc., 32 cents; and, finally, for comparison, it is necessary to know that on this particular work which has been cited the foreman mason received 30 cents, the regular masons, 25 cents, and the helpers 15 cents per hour.

Considerable care is required to keep and compile such figures; but they are of the utmost importance. For example, the cost of cutting a given stone, together with its delivered price, determines whether or not it can be used in a certain work as against stone from a different locality.

The great increase in the earning power of railroad properties in this country is the subject of wide comment. On any given railroad this increase of earning power began with the carefully-planned improvements in grades, alignment and strength of roadway, properly executed by the engineer. It was further secured by having the improvements completed at the lowest ultimate cost; and, finally, by the engineer providing many facilities for keeping down all items of maintenance cost. Referring now particularly to this last factor, we find that a spirit of rivalry exists in every good workman, and this may be brought into practical use, even if the employee be no higher than a track laborer. It is useless to depend wholly, for the best results, on driving such laborers and their foreman; and the same statement applies to every man worthy of employment on a railroad.

On some closely-operated railroads this plan is followed in much detail and with great success. For example, a simple statement is issued monthly by such a railroad, showing the actual cost of such hum-drum work as the putting of a tie in track on each roadmaster's division of the road. A rivalry is at once induced among all the foremen of every division to be the lowest. A similar statement giving the cost of placing lumber in bridges per thousand feet, B. M., in making repairs, brings about the same rivalry among carpenter forces; and all this produces an absolute and proper reduction in cost of maintenance.

Mr. T. Chalkley Hatton stated that there would seem to be only one side to this question: How can any engineer give his client a reliable approximate estimate of the cost of a proposed piece of work, unless he has first taken very careful estimates of the cost of preceding and similar work? Mr. Churchill mentioned the results of taking careful estimates of costs in relation to railroad maintenance and railroad construction, and the care with which such records have been made. The same results had been obtained by the speaker with relation to public work.

Some twelve or thirteen years ago he designed a system of sewers to cost about \$1,750,000, and to be constructed from year to year as the funds might become available. When the work began, no reliable approximate costs of the work could be made, as it was to be done under all kinds of conditions; but, at much expense, a systematic record was kept of the actual cost of excavating each linear foot of trench under each condition, whether in rock or wet ground, and whether in paved and unpaved streets; the actual cost of brickwork per linear foot, for each size of sewer and each foot of pipe; and the cost of each manhole, inlet and every other appurtenance, until, at the end of three years, the speaker had compiled a record of actual costs which enabled him to determine, within 1 or 2 per cent. the probable cost of the remainder of the work. These records were compiled in such a manner as to enable him to determine how many bricks could and should be laid by a bricklayer under the several conditions; how many feet of pipe of the various sizes should be laid per day, and the quantity of cement and hemp required to lay it; how much trench one man should excavate in a day, and how much per cubic yard it cost to remove rock.

At the end of three years it was found that the contractors were making too much profit, and the speaker recommended that the minor portion of the system be built by day's labor, and that the larger work, requiring special plant, should be done by contract. This work proved so successful that it was determined to do all work by day's labor, with the result that the contractor's profit was saved in every instance. A contract would be let out to build in one street a sewer which was of the same nature as was being built upon another street by day's labor; and this proved the case clearly.

The keeping of these accounts had the following result: Each foreman, when his particular work is finished, knows just how much it has cost, and, if this cost exceeds the cost of similar work under another foreman, he knows at once that he is not up to the standard, and a continuance would mean the loss of his job; but, aside from this fear, this system makes each foreman an enthusiastic worker for a reputation, and results in a financial benefit to his employer. If the cost of each superintendent's work is not made known to him, what means has he of knowing whether his work is or is not successful? And unless the engineer keeps a careful record of the cost, he cannot give the foreman such information, and the burden finally falls upon him.

Mr. Oberlin Smith said that it might be of interest to change the point of view to indoor work, and speak of manufacturing cost in factories; the speaker's experience having been more particularly in that line. There is a very common belief that manufacturers make enormous profits; that people who run machine-shops, and make goods that outdoor people have to handle afterward, are getting fortunes —not small fortunes, but big ones. It is a common idea, when people send to a machine-shop to have repairs done or machinery built, that if the charge is made by the hour, at say 50 cents or more, there is a profit of about 100 per cent. The ordinary public, and perhaps even some engineers who do not have to do the work, are apt to say: "Behold! Their men are paid 25 cents an hour, and they charge you 50 cents, a very nice thing in profits." But they ignore the little items of fixed charges, about which much is not generally known by outsiders. These, however, as a matter of fact, sum up to a very large amount. If we consider a medium-sized machine-shop, employing say one hundred or two hundred men, where (there being a good many boys) the wages average, perhaps, only 20 cents an hour, the expense-rate, or hour's burden, that has to be put on each and every hour worked by producers, is usually about the same amount. That is to say, the sum paid for wages upon a job must have about 100 per cent. added to cover ordinary running costs. One modern way, therefore, of finding costs in such establishments is to take the material for any given job, at its actual cost, delivered at the factory, including freight, waste, etc., plus the wages actually paid, plus the "burden" on each hour worked by those men in the factory who really produce something. There are, of course, a good many non-producers whose wages go to expense account. This burden is very often put at 20 cents an hour. It may run as low as 15 and as high as 25, but 20 seems to be a somewhat safe average for the ordinary medium-size machine-shop in the United States. A burden rate is ascertained by taking the total expense of running the business, outside of material bought and wages paid. This usually consists of: interest on capital, or, perhaps, rent; insurance; taxes; commercial expenses of selling (the most variable item in the whole account), including advertising, traveling, bad debts, part of office expenses and salaries of officers and clerks, together with many sundries; repairs to machinery and buildings (a very large item); fuel, oil, light and other consumables; wages of non-producers about a factory, as enginemen, janitors, etc., etc.

These items, added up at the end of the year, divided by the total number of hours' work made by the producing class, will give the hourly burden. Of course, it usually comes out in fractional figures, but an approximate rate, in round numbers, is good enough—if set high enough. The burden for each year is based upon the previous one, and hence cannot be really accurate. It will be seen, therefore, that a machine-shop man who uses medium-size tools may very likely find his work costing him 40 cents an hour, 20 cents for wages and 20 cents for expense. In some shops, however, the wages will average 25 or 30 cents, and so the cost may be 45 or 50 cents. Hence, with a not unusual charge of 50 cents an hour, there is a question whether there is a total net profit of as much as 10 per cent.

In using very large machine-tools the average price per hour is put higher because of the greater amount of room these machines take up, and their greater interest and repair account, to say nothing of their likelihood of standing idle more of their time. The machine-shop man, therefore, sometimes perpetrates a charge of \$1.00 an hour, or more.

Hence the outside public who use machines should understand that the profits on making them are not abnormal. They are moderate, and it takes a good deal of time and care to find out what they are, and much good management to keep things going so that the profit comes out on the right side and does not prove to be a minus quantity.

Mr. Foster Crowell said that there is one consideration of this subject which is important: A great many engineers are deterred from an attempt to ascertain the unit prices of the work in their charge, because they think it is a very difficult operation to collect and arrange the data. That is true if the desire is to have an absolutely accurate account which will balance, but, for the purpose in view, it is not necessary that that degree of accuracy should be attained. If such accuracy were to be attempted it would necessitate a duplicate set of accounts, adding much to the cost, and occasioning very great difficulty in getting the accurate data; but it is quite possible to reach a sufficiently close approximation to the cost, and to the average price. Mr. Oberlin Smith spoke of the figures of cost which he had obtained in a given case, and was quite content to express it in terms of an easy average. He did not think it necessary to go down to a decimal of a cent or even to a cent. Now, if engineers in charge of work educate and instruct their staff to collect certain items of information as the work proceeds, it will be found quite easy at the end of the work to approximate the cost of any one of the items, or all the items, with sufficient closeness for comparison and for reference in undertaking other work of the same kind.

The Specific Heat of Steam should be taken about 0.60, instead of 0.48, according to tests of Prof. C. Bach in the Zeitschrift of the Society of German Engineers of May 17.

The Bacterial Treatment of Trades Waste.

Abstract of a paper read before the Institution of Civil Engineers by Mr. William Naylor.

Although much attention has been paid to the treatment of sewage on bacterial filters, little has been heard, up to the present time, concerning the treatment of trades waste in like manner.

The bare fact that in the majority of cases trades waste is likely to be strongly acid or strongly alkaline, or, worse still, charged with chemicals of an antiseptic character, has deterred many from even entertaining the idea of resort to bacterial methods of treatment in connection therewith. The author was induced to pay special attention to the subject by two causes: first, the oft-recurring statement that the sewage of a particular place was difficult to treat because of the admission to the sewers of trades waste; and second, the unexpected behavior of samples of trades waste left standing in unstoppered bottles.

With regard to the first of these considerations, while it must be admitted that in many cases the cost of sewage-treatment is increased by the influx of trades waste, it is only in rare instances that difficulty has occurred in the treatment at outfall-works, such as to call for radical modification of the methods of treatment commonly applied to domestic sewage. Cases within the author's experience are:—Galvanizers' pickle at Wolverhampton, Tipton and Bilston; refuse from tanneries and glove factories at Colne and Yeovil; alkali-waste at Burnley and St. Helens; brewery-waste at Shepton Mallet and Blackburn; woolen-mill and felt-factory waste at Bradford and Nuneaton; bleachworks-waste at Burnley and Horwich. In only two of these cases has any real difficulty arisen.

Examining these kinds of waste more closely, galvanizers' pickle is a common salt of iron, often used as a precipitant for ordinary sewage. It is true it is occasionally accompanied by some free acid, but this only calls for sufficient lime for neutralization in the precipitation-tanks, and the tank-effluent is then normal. At Wolverhampton, during 2 years' observation, the author never discovered a tank-effluent which failed to putrefy on standing, in spite of the fact that the crude sewage contained, in addition, waste and wash-liquors from ammonia and tar-distillation shift-stop liquors, which are generally assumed to have, and probably will have, sterilizing effects in the absence of considerable dilution.

Alkali-waste may be placed in almost the same category as the Black Country waste, for when the sulphides are precipitated by ferric salts the tank-effluent is normal, and the sulphides in the sludge on exposure are almost immediately oxidized. The sewage of St. Helens has recently been treated successfully on bacterial filters. The waste from tanneries and glove-factories may be regarded simply as strong sewage, that from both Colne and Yeovil being quite amenable to bacterial treatment.

Wool-scouring liquors admitted to sewers cause difficulties of a mechanical rather than a bacterial character. Whether these are crude liquors, or the mother-liquors after recovery of grease, a certain amount of fat is included in their burden, and in the latter case some little free acid. If the acid be not neutralized by the soaps natural to the sewage, a little extra lime at the outfall soon settles this matter; but the greater objection is the fat. Quantity is here an important factor, for whereas at Nuneaton the discharges of a greasy nature from fellmongers, hat-works and wool-scourers, are borne by the sewage to the outfall without preventing the production of a satisfactory effluent by ordinary means, at Bradford the character of the sludge formed, which is more or less an emulsion, has hitherto almost defied pressing or handling in any form. At the same time, evidence that the tank-effluent can be treated satisfactorily on bacterial filters is fairly conclusive, and there are no scientific reasons to the contrary.

Bleach-waste and brewery-waste call for special consideration. At this point it will only be said that, whereas at Burnley and at Blackburn bleach-waste and brewery-waste, respectively, is received into the sewers without giving rise to abnormal developments, at Horwich and at Shepton Mallet bleach-waste and brewery-waste, respectively, is admitted to the sewers with disadvantageous consequences, although at the latter two places the ratio of waste to sewage is much greater.

The number of trades-waste samples drawn and examined by the inspecting staff of the Ribble Joint Committee averages fifty per month. After examination many are kept as exhibits. It has been observed that the majority of these, so long as they are not acid, are subject to distinct changes on standing unstoppered. Slightly alkaline samples become neutral; then follows a deposition of coloring matter; and this is succeeded by the growth of either a mold or a green vegetation. The sample filtered from this is clear, sweet-smelling, and lightly charged with dissolved solids. Time and contact with the air being apparently the all-important elements, trials were made with the object of discovering whether these desirable changes could be hastened by artificial means.

A small bacterial filter was constructed, primarily brought into condition by sewage, and provided with a revolving feeding sprinkler; it was found quite practicable to obtain satisfactory results, especially where the waste had been considerably diluted, that is, where the liquors treated consisted largely of wash-waters. Where much free chlorine was present this was not the case; and where, as in print-works waste, color-shop waste, distillery-waste, or strong brewery-waste, starch-products were dealt with, a "souring" took place which very soon impaired the usefulness of the filter. In the last three waste liquors an acid fermentation is set up spontaneously (due largely to the lactic acid ferment) which actually continues during the sprinkling of the filter. It may of course be contended that this particular fermentation is just as much a purification as any other bacterial change, seeing that the result is the disintegration of certain objectionable constituents of the waste. But the time taken for satisfactory purification and clarification while acid fermentation is proceeding is considerable, some of the stronger liquors requiring eight, nine, and even fifteen successive filtrations.

The introduction of competitive and more active organisms—the anaerobic bacteria of putrid sewage—has the effect of preventing the souring almost completely in liquors containing starch or starch-products. A trial of this was first made with ordinary starch. About 20 pounds of starch were mixed with 10 imperial gallons of hot water forming a paste. One-half of this was mixed with 1 imperial gallon of putrid sewage-sludge, and, after having been left standing for 1 day, was examined. After the expiration of 5 days a further sample was examined and then the mixture was passed through the filter. It may be desirable to mention here that, broadly speaking, the products of starch on inversion by acid are dextrose and dextrin; on conversion by diastase, as in brewing-operations, maltose and dextrin; and by spontaneous fermentation a mixture of these products and others, including acids more or less defined.

The dextrose or maltose produced may be measured by the amount of copper oxide reduced, but the dextrin has no reducing-power. As, however, each of the products maltose, dextrose, and dextrin, has a certain optical activity, the amount of dextrin present with either of the other two products can be determined by subtracting the rotary angle due to the quantity of maltose or dextrose present (as measured by means of copper oxide) from the total rotation due to the mixture of the two. The difference in the composition of the mixture after standing 1 day is little more than that due to the dilution or to experimental error. At the expiration of 5 days, however, there is a decided change. The copper oxide reduced amounts to less than one-half, as does also the rotatory angle. This indicates decomposition of the starch to the extent of one-half or more. The remaining portion of the paste, unmixed with sewage, was unchanged in appearance and gave practically the same figures on inversion as on the first day, but smelled offensively.

After passing the mixture, 5 days old, slowly through the filter once, the copper oxide reduced was diminished to less than one-tenth, and the rotatory angle to less than one-half. The albuminoid ammonia—due, of course, to the added sewage—was then estimated for the first time and found to be 0.16 part per 100,000. The liquid was filtered repeatedly up to five times, the operation extending over about 2 working-days.

The other portion of the starch-paste had now become sour and stinking, though otherwise thick, slimy, and gray as at first, and was passed into the filter; but up to the twenty-first filtration a satisfactory effluent was not obtained, and the activity of the filter was impaired if not destroyed. The effluent was turbid, soured on standing, and gave a blue coloration with iodine, indicative of unchanged starch.

About this time, Mr. John Stanning being anxious to improve the condition of the effluent at the Leyland works of the Bleachers' Association the author, on the success of the experiment described above, suggested treating the worst liquors only, in the same manner, and an attempt was made with kier-liquors. These amount to only about 20,000 imperial gallons daily, but as they are produced by boiling raw cloth, first with lime and afterwards with soda, they are very foul and concentrated, apart from the strong alkalinity (nearly one-tenth normal). The most objectionable feature of the waste was its extreme alkalinity. But in spite of the difficulty experienced in preserving the alkalinity of exposed liquors, and knowing the derision with which practical manufacturers would receive a process of impounding, sprinkling, and filtering alkaline liquors for any purpose, and retaining the alkalinity, the trial was proceeded with.

Eight parts of kier-liquor were mixed with one part of wet sewage-sludge and were allowed to stand for 1 week. A reduction in alkalinity was the only noticeable change due to standing. But, after being sprinkled three times over a 3-foot filter of broken clinker, previously brought into condition by sewage, the change was remarkable, the albuminoid ammonia being reduced to nearly one-quarter and the effluent becoming clear and neutral in reaction. The nitrates present were, in the author's experience, phenomenal; due, of course, to the added sewage. The advantage of standing two weeks was found not so considerable as to justify the expenditure involved in the extra tank-accommodation. It is probable that better results would be obtained for less capital expenditure, if more of the outlay was applied to the provision of larger filtering-area.

In view of these results, it was decided to install filters and to modify the tank system for the treatment of the whole volume of liquors, amounting to 500,000 imperial gallons daily; and although, as these are only now in course of construction, no results can be given, those from a similar but smaller installation at a bleach-works and calico-print works—probably the first installation of its kind—can be cited.

The works are those of Messrs. Peel, Tootal & Co., of Baxenden. In these works the processes are uniform from day to day, and consist of boiling gray cotton cloth, first with lime and afterwards with soda. These boilings are followed by an acid wash, and then a chlorine bath, apart from certain intermediate and final washings. The wash-liquor, therefore, contains lime, soda, chlorine, and the various substances removed from the crude cloth (starchy sizes, china-clay, etc), as well as adventitious dirt from the floors and workshops. Some dyeing is also done, and the waste liquors from the dye-becks also find their way to the main outfall.

For some 3 or 4 years before July, 1900, the firm had struggled with precipitation-tanks and ordinary continuous-flow filters without success. At that time proceedings were instituted under the Rivers Pollution Prevention Act, and as a result it was decided to try bacterial treatment. At the outset, the capacity of the tanks was increased so as to be equal to not less than 3 days' flow. The tanks are common impounding-tanks provided with floating arms, and are all connected and used as one large septic tank.

The continuous overflow from the tank runs into a hopper over the revolving sprinkler, which delivers on to a filter of furnace-ashes of graduated size, the largest of which, forming the bottom layer, pass through a 2½-inch ring, and the smallest, forming the top layer, are retained by a ¼-inch mesh. Each filter has an area of 60 square yards and a depth of 11 feet. When the plant was first put into operation, about 4 tons of old sewage-sludge was delivered into the tanks, and they were then filled with ordinary liquors. After standing until the mass became putrid (*i. e.*, for about 4 days), the ordinary liquors were introduced and the filter was fed. To maintain the putridity, all the works-closets were connected with the tanks, and in case of any falling off in that respect, sewage-sludge was added from time to time. This, however, was not found necessary to any considerable extent.

As is the case with all bacterial filters provided with sprinklers, a small amount of suspended matter is delivered with the final effluent, but in this case it is intercepted by a small sand filter.

The working of the plant has been very satisfactory. The effluent is clear and colorless, in spite of the raw liquors varying from a deep purple to a chrome yellow. It is sweet, neutral, contains nitrates and little albuminoid ammonia; and the effect of the antiseptic free chlorine is nowhere observed. The filter is quite active bacterially, and treats successfully 350 gallons per square yard. A further filter is being installed.

The most noticeable feature in the working of the plant at Messrs. Peel, Tootal & Company's works, is that the free chlorine present in the crude waste does not, as might be anticipated, interfere in the least with the bacterial activity of the filter. Presumably it becomes combined in the septic tank with the products of decomposition set free in the putrid sewage. The bleach-waste discharged into the sewers at Horwich is evidently of such volume as to leave a surplus as the tanks are used at present; though it is possible that if they were used on the septic system the difficulty would disappear. At Burnley, bleach-works waste containing no inconsiderable amount of free chlorine is admitted to the sewers, and a satisfactory effluent is obtained from bacterial filters, but the tanks are of open septic type.

Brewery-waste and distillery-waste is treated with difficulty, if at all, on bacterial filters directly, owing to the formation of acids. A sample of crude beer was sprinkled twenty-three times over a bacterial filter 3 feet deep, the loss due to evaporation being continually made up with water; but on each successive filtration the filtrate was sour, and though a considerable change was effected in the liquor, at the conclusion it was of a dark brown color, muddy in appearance, sour and offensive. Another sample was allowed to stand for 5 days in contact with one-fifth of its volume of wet putrid sewage-sludge from a septic tank, and was then sprinkled over and passed through a filter. After the second filtration, both the optical activity and the reducing-power had disappeared, and the fifth filtrate was an excellent effluent showing a diminution in total solids from 3,200 parts to 200 parts per 100,000. The effluent was clear, sweet, colorless and neutral, but contained a small amount of suspended matter. Five filtrations may appear to be an excessive number, but it must be borne in mind that the strength of brewery-waste would be only about one-fifth, and that of distillery-waste about one-half to one-third of the strength of crude beer.

An average distillery may be considered to discharge about the same volume of waste liquors as an average brewery, namely 25,000 to 35,000 imperial gallons daily, and almost any method of treatment applicable to one is applicable to both.

At the Hook Norton Brewery Company's brewery, Hook Norton, Banbury, a settling-tank and continuous-flow sand-and-gravel filter was used, but with little success, during the 6 years ending 1898. It was then tried intermittently with no better result, and on the suggestion of the author the plant was remodeled in 1900. The flow is reduced, by eliminating all clear water, to about 12,000 imperial gallons of strong liquor per day. This is impounded in a settling-tank for not less than 24 hours in contact with putrid sludge from sewage, or 5 per cent. of domestic sewage is admitted to the tank, and when the putridity has once been established, sewage-sludge is no longer necessary. The contents of this tank, which may be termed an "anti-souring" rather than a septic tank, are pumped continually by a pulsometer delivering into the hopper of the sprinkler over the filter. After being first brought into condition by means of sewage only, the filter was started on June 7, 1900. The filter is in better condition than when it was started.

The filtering-medium is coal, screened and graduated in size from about 1-inch cubes at the bottom to ¼-inch cubes at the top. The company, being well provided with steam, were prepared (under threat of legal proceedings from two sources) to pump the first filtrate on to a second filter for further purification, but this was not found necessary. The little suspended matter present after the first filtration is intercepted by shallow sand filters, and the effluent is clear, neutral, colorless, sweet, contains nitrates, and liberates albuminoid ammonia to the extent of about 0.1 part per 100,000. The diminution of dissolved oxygen after saturation, is less than 30 per cent. Similar installations are being made at the Fountains Free Brewery, Blackburn, and, in a modified form, at Messrs. Sumner's Brewery, Haigh, Wigan.

The difficulty with regard to free chlorine having been overcome in the case of bleach dye-works, Messrs. Wiggins, Teape & Co., of Chorley, Lancashire, decided in August, 1900, to try the effect of bacterial treatment on the waste from their paper-mill. The effluent from the mill was fairly clear, having been settled and filtered through continuous filters of animal charcoal. Complaints, however, were made by riparian owners on the River Lostock, some distance below the works, as considerable decomposition took place, with the usual offensive emanations. By this time the sterilizing effects of the chlorine had evidently been annulled. The most objectionable constituent of the crude liquors is the organic matter from the old rags used, and the starchy and fatty sizes from the new unbleached cloth or "parings." It was decided first to try the bacterial filter with sprinklers on the ordinary tank-effluent. Fairly satisfactory results were obtained by this means, but as the effluent was turbid, probably owing to the presence of finely divided particles of china-clay, sewage was added. The installation is practically identical with that at Messrs. Peel, Tootal & Co.'s works, and the Hook Norton brewery. The results are highly satisfactory—one of them, of no little importance, being the absence of the turbidity due to the coagulating effect of the sewage. In almost all mills where esparto grass is used, much difficulty is experienced in obtaining a clear effluent, even after filtration through very fine ashes. After admixture with sewage, however, and sprinkling, the final effluent contains much less suspended matter than that from brewery-waste.

In the discussion of the paper, Dr. Samuel Rideal stated that the author had confirmed the view which he himself held, that if the proper sequence of bacterial processes was adopted, practically all kinds of organic matter would break down and give satisfactory effluents. By proper sequence he meant, not the method adopted 5 or 6 years ago, following the work of the Massachusetts Board of Health, of attempting to effect the whole decomposition in a contact-bed, but the realization of the absolute necessity of bringing about a preliminary decomposition of an anaerobic character before passing the liquid into a filter-bed where it was under oxidizing influences. With regard to the starch-paste experiments, all chemists were well aware that complex carbohydrates were capable of being broken down into carbohydrates of simpler constitution by a process of hydrolysis which did not involve any oxidation at all. But that inversion or hydrolysis required time and suitable conditions, and one of those conditions was not the presence of oxygen. It was seen clearly from the experiments in the paper that the cellulose liquids which had caused a great deal of nuisance in many districts when allowed to stand by themselves with the proper ferment, produced by mixing them with some anaerobic sewage, underwent a considerable breaking down into these simpler carbohydrates, which were then easily oxidized in the final stage. Another point brought out clearly was that the effect of the decomposing-tank or preliminary anaerobic decomposition was sometimes to augment very considerably a figure by which both engineers and chemists in the past had set great store, namely, the albuminoid ammonia. Therefore, as he had contended on previous occasions, an arbitrary standard of albuminoid ammonia must not be set up, because here was a process going on in the direction of purification, but involving in every one of the experiments an increase in the albuminoid ammonia. Another point of interest was the possibility of dealing, by bacterial action, with liquids containing chlorine. He had studied some of the electrolytic processes, and had found that chlorine had a marked sterilizing effect only when the organic matter had been practically removed by some preliminary bacterial process; and then very good sterilization could be produced. Bacterial treatment was therefore consistent with the presence of chlorine in those cases in which this absorption of free chlorine by some of the organic matter first took place. Free chlorine was also removed in another way prior to bacterial decomposition—he thought it had been so removed in some of the author's experiments—namely, in the presence of ammonia. Free ammonia re-acted with chlorine very quickly, a neutralization was effected, and the germicidal properties of the free chlorine were in this way removed. Therefore a liquid containing free ammonia as well as free chlorine quickly reached a state in which it was amenable to bacterial change.

Engine Governing and Parallel Running of Alternators.

Some time ago the International Society of Electrical Engineers appointed a committee consisting of Messrs. Blondel, Rateau, Miet, Guilhert, van der Stegen, Picou, Vigreux, Brillié and Chevrier to investigate the whole question of the parallel running of alternators as affected by engine governors. Their report was given out late last spring, and the following abstract of its contents has been published by "Science Abstracts:"

The desirability is shown of defining by a special coefficient $K = (N_o - N_{max})/N_o$, (N_o and N_{max} = angular velocities at no load and full load respectively) the controlling power of the governor. This coefficient, or some other similar function of the speeds, has been called the coefficient of isochronism. Inasmuch, however, as isochronism is a most undesirable condition for parallel running, the term is inappropriate, and "governor coefficient" is proposed as a better name. The curve representing mean angular speeds as a function of the load is of great importance; this is really the mean between two nearly parallel curves, the difference of whose ordinates is called the stability; the actual mean speed for any load may oscillate between the two limits, this oscillation being due, amongst other things, to variations in friction and to play in bearings and gear-teeth. For a given load the "stability" of the governor ought, for reasons which are explained, to be greater than the difference between the maximum and minimum instantaneous speeds during one revolution. It is shown that, for the same stability, the loads taken by different sets (supposed of equal capacity) will tend towards equality as the curves referred to are more inclined towards the axis of load.

Various engine-makers and central station engineers were asked to obtain experimentally curves of mean engine speed as a function of load, some of which are reproduced. Pressure in the steam chests, in one typical case, was maintained constant by means of the throttle valve; the curve is nearly a straight line, slightly convex to the origin. The drop is about 5 per cent. between no load and full, the load being that between the alternator terminals. If indicated horse power is plotted as abscissa, the convexity is increased. It is desirable, but not absolutely necessary, that the drop in speed should be proportional to the load; the possible difference in the load taken by two identical sets in parallel is then constant for all loads. The form of curve giving a difference of load proportional to the load is that which is convex to the origin; curves with a point of inflexion and a tangent nearly horizontal are quite impossible for satisfactory parallel running.

The necessity for a considerable "governor coefficient" for parallel working necessitates a special compensation arrangement to maintain the frequency constant. Three such devices are described. One consists of a weight movable either by hand or from the switchboard by means of a small electromotor, which varies the effort which the governor must exert in order to come into action; or the effect of the weight may be altered without the necessity for displacing it, by means of the current in a solenoid. The second way is to act on the admission valve of the engine so as to vary the pressure at the steam ports as the load varies. The ...rd method is to use some automatic regulator, such as the Denis compensator, employed by some engine-builders in Paris. The two first methods, while giving the necessary variation of speed, are not always sufficient to maintain it constant; in such a case, a method devised by Picou has been used, by which a by-pass with an easily regulated valve is used to shunt the steam admitted to a cylinder.

What is the best type of governor? Theoretically any form of governor can give a required percentage drop, but practical considerations of dimensions may make one system preferable to another. Quick-acting governors, in which centrifugal force is counterbalanced by springs, are best for parallel running; the possibility of modifying the range, etc., when in place is also an important consideration; and spring governors or those which make use of an inclined plane lend themselves easily to this.

Governor oscillations. The period of these ought not to coincide with the period of oscillation of the flywheel, if dangerous hunting is to be avoided. With spring governors the period is generally very short, and can easily be calculated.

Method of damping oscillations. Short-period oscillations, such as, e.g., those depending solely on the governor, can be damped by a dashpot; the damping need not be considerable, as friction alone will do nearly all that is required. Long-period oscillations require very powerful damping; but here a curious effect comes in, that if the orifices in the dashpot piston are adjusted to give the best effect for oscillations of long period, the resulting damping for short-period oscillations will be exaggerated. A remedy for this is to have a dashpot provided with valves which relieve the pressure of the oil when this exceeds a certain limit.

Governors ought to he of short-period of oscillation, and, to avoid resonance, the various oscillation periods of the plant ought to be different.

The influence of multiple expansion on governor oscillations. When, as is generally the case, the governor controls the admission to the high-pressure cylinder only, its rapidity of action is diminished by multiple expansion—a condition prejudicial to good parallel working; and the tendency to oscillations is also increased. When the governor acts on the different cylinders, this tendency is less marked.

Oscillations of long period. These are given rise to by variation in the existing torque under certain states of load and by somewhat undefined conditions of the governor, particularly excessive damping. In the case of two alternators in parallel, they can be produced by a want of balance of power between the two machines owing to lack of simultaneity in the action of the governors. Long-period oscillations can be reduced (1) by increasing the "governor coefficient," (2) by reducing the distance between the two limiting curves which represent mean speed as a function of load, and (3) by increasing the power of the governor. If the alternator drives the engine, however, these oscillations may reappear.

The best way of governing several alternators running in parallel. Should each set have its own governor, as is the usual practice, or would it be better to regulate the speed of the whole system by a single governor (a) acting either on one only of the engines, the governors of the others only serving in case of accident, or (b) acting simultaneously on the admission of all the engines? The first method (each plant separately governed) demands that the governors should be very sensitive and should have practically the same percentage drop at full load; but in practice it is found possible even with different types of governors to obtain satisfactory results. The disadvantage of this method is that the load comes on or off all the machines simultaneously. Rateau proposes to use governors with large percentage drop in combination with Denis compensators; these would be adjusted for the different machines to speeds varying slightly the one from the other. Thus, in the case of four machines running at a speed of about 100, the compensators might be set at 102, 101, 100 and 99 revolutions respectively. Thus there would never under normal conditions be more than one machine running at reduced load; the others would be either fully loaded, or would be taking no load and would of course then be shut down. The second solution (one governor controlling the whole of the alternators running in parallel by regulating the admission of its own engine) may do well enough where the variation is small as on lightning circuits. Where, however, the variations might exceed the capacity of the controlling machine, serious dangers might be introduced. Against this there is the great advantage that all the other sets are acting under the best conditions economically. With asynchronous alternators this method would be the natural one to employ, if the control were effected by a synchronous alternator. The third method, while electrically leaving little to be desired, is mechanically very difficult to realize.

The Manchester Ship Canal Company had an unusually prosperous career during the first half of this year, according to the report to the stockholders by Chairman J. K. Bythell. The receipts showed an increase over the preceding half year's figures of $97,600, while the increase in the expenditures was but $8,100. The sea-borne imports and exports amount to 1,457,000 tons, an increase of 195,000 tons over the amount for the preceding six months. A number of new steamship lines running to Manchester have been established, although the season generally has been very dull in British shipping circles.

The Power Plant of the Highland Canal & Power Company, on which construction has just begun, is to have an original installation of 30,000 horse-power for use in Duluth and on the Masaba range. The water-shed is about 2,500 square miles with an average annual rainfall of 30 inches; the reservoir capacity will be one-fifth the annual precipitation. From the reservoir system a 2½-mile canal will run to a so-called forebay with an area of 1 square mile and an average depth of 20 feet. From this two lines of 72-inch riveted steel pipe will run to the power house 10,000 feet distant, on Duluth Harbor, where the effective head will be about 660 feet. Each of the six units will have two Pelton wheels direct-connected to a generator furnishing 5,000 electrical horse-power at 220 revolutions per minute. Three-phase current at 25 cycles and 6,600 volts will be furnished. An auxiliary receiver or equalizer has been connected with all the pipe lines and with each unit in the power house. This arrangement, coupled with relief valves, is expected by Mr. F. A. Cokefair, chief engineer, to insure safety against damage by water-ram, reduce the friction loss in pipes by keeping the velocity constant in all and allow the operation of any unit from the receiver in case of repairs to the pipe lines.

The Paradox of the Pantheon.

The Romans were the first people to realize the artistic value and develop the architectural possibilities of the groined vault and dome. By their means they obtained effects of unencumbered spaciousness impossible with columns and piers. Greek buildings remain to our day only as roofless ruins. The stupendous monuments of Egypt, rivalling those of Rome in magnitude, are chiefly open courts and colonnades with hypostyle halls, which, though roofed with stone, are encumbered by columns. In the Great Hall at Karnak, the broadest aisle is less than 20 feet wide in the clear and not over 80 feet high. In contrast with these dimensions are those of the Baths of Diocletian at Rome, which have an unencumbered floor space of 340x87 feet with a groined vault 90 feet high. The constructive methods by which the Romans accomplished the erection of these great buildings have been investigated by many architects and are the subject of several valuable books. A systematic study and examination of Roman vaulting has never been undertaken, however, and in the most perfectly preserved and frequently visited of all Roman monuments, the Pantheon, the extraordinary contradiction between the construction and decoration of the magnificent dome, though known for 150 years, has hardly been discussed. In 1894 Prof. A. D. F. Hamlin, of Columbia University, observed certain facts which suggested a surprising explanation of this paradox, and after waiting in vain for some years for a solution from some other source, has discussed the subject in a series of papers in the "School of Mines Quarterly," from which the following notes have been abridged with his permission. As a study in ancient Roman vault construction, apart from the Pantheon problem, the papers also merit the attention of all interested in the engineering and architectural methods of bygone days.

The true Roman system of construction is particularly interesting at the present time because it was based on the use of concrete. The architecture of the Egyptians and the Greeks was one of stone, and the construction of their great edifices was a tedious labor. When Rome, enriched by the spoils of world-wide conquests, began to build on a grand scale, the slow processes of stone construction were out of the question. She had enormous resources as respects rude labor, and the practical Roman builders accordingly devised a system of construction utilizing this unskilled labor to the utmost, employing the relatively limited artistic resources of the empire so as to make a minimum of original design serve for a maximum of buildings. Hence the greater part of the walls, piers and vaults were concrete, and brick and stone were used only for facings.

The builders were economical in many respects. To support the enormous weight of the heavy concrete vaulting while it was setting would have involved a massiveness of timber construction for centerings which was deemed extravagant, and two other methods were adopted to accomplish the same end. Sometimes, over a very light wooden frame covered with slats a couple of feet apart, there was built a thin vault of large flat tiles laid in strong cement. These were covered in turn with smaller tiles breaking joints with the layer below. This made a strong elastic shell, which, when loaded up to the haunches with concrete, was quite sufficient to carry the load of the concrete afterwards placed on the upper portion to complete the vault. The second method of construction, used in the larger vaults, was more complex. Cellular ribs of brick and tile were first built on light centers. Other centers were then fixed between the ribs and the intervening space was filled with concrete. As these fillings, starting from the spring and growing a foot or two daily, hardened, they formed monolithic lintels between the ribs, bracing them against lateral overturning and taking upon themselves a part of the weight of the next portion of the filling.

It is noteworthy that these admirable building methods eventually degenerated into matters of unthinking routine, and there are ribbed vaults where the ribs could have served no useful purpose. Even the Pantheon, dating from the early part of the second century, is full of solecisms. Lanciani declares that the beautifully executed discharging arches which are so noticeable in the upper part of the exterior brick facing are only one brick deep and serve no constructive purpose. In the dome of this building the constructive ingenuity of the Romans appears highly developed and yet associated with the most extraordinary disregard alike of that economy of means and labor which characterizes many phases of Roman building and of the logical connection which in most great architectural works exists between the structural framework and the decorative dress. In the dome of the Pantheon these are not merely independent but are absolutely contradictory.

The Pantheon was built by Hadrian between 117 and 138 on the site of an earlier temple constructed by Agrippa. The portico is a reconstruction by Septimius Severus and Caracalla with materials from an older structure. The building is a circular edifice 142 feet in diameter, internally covered by a hemispherical dome 140 feet high, springing from the circular wall. This wall is 20 feet thick, but its seeming massiveness is reduced one-half by seven niches, n, Figure 1, opening inwards and alternately rectangular and semi-circular in plan, an eighth opening forming the great doorway; and eight smaller semi-circular chambers, opening outward only through small windows. The eight large niches are capped by arches and half-domes. The wall appears to have been constructed in the usual way with facing of broad flat bricks and a filling of pozzolana concrete. The dome is sprung low enough to be inscribed within the square of 142 feet. The 28-foot oculus or eye at the summit not only lights the interior in the most beautiful manner imaginable, but relieves the dome of a great weight at its weakest point; while the carrying up of the exterior drum to one-third the height of the dome, and the series of external steps encircling the dome above it, provide for the loading of the haunches of the vault in the most satisfactory way.

Very effective, also, and admirably simple is the interior paneling of the dome with 140 plain rectangular coffers, each showing four sinkages except in the panels of the upper or fifth tier, which have but three. The lower rails in each panel are wider than the upper ones in order to render them visible to a spectator on the floor of the temple. The paradox of the Pantheon is to be found in this interior paneled face of the vault.

The use of panels as a ceiling decoration lent itself readily to Roman methods of vaulting with brick ribs, which could be arranged to form the vertical members of the framework of the panels, while the horizontal members or rails could likewise be built of brick, forming a rectangular network of bricks sufficiently rigid when set to carry of itself the concrete filling and backing of the vault. But as a matter of fact few large vaults remain which show this system of construction. The great vault of Diocletian's baths, now the church of S. Maria degli Angeli, is quite smooth and plain internally. Others, like the vaults of the side chambers of the Basilica of Maxentius and Constantine, are adorned with polygonal panels, large octagons and small squares or other like combinations, which contradict any practical system of structural ribs. The one complete and monumental example of this kind of vault decoration is the Pantheon, and here, if anywhere, it would seem to be the natural thing to allow the ribbing of the vault panels to dictate the design of the structural framework of the dome. The interior aspect of the dome would naturally suggest a system of vertical ribs converging to the oculus, and a series of horizontal arches between them, framing the panels and stiffening the whole skeleton. But this is not at all the way the dome was constructed, and unfortunately it is impossible at present to say clearly how it was built.

The discordance between the lines of the paneling and the structural skeleton of the dome was first observed during repairs executed between 1743 and 1756, when an architect named Piranesi was enabled to study the construction. His drawings, Figure 2, stated to be from measurements, show a framework of eight discharging arches over the eight niches or chapels, supporting eight massive ribs springing from their crowns and braced against disruption under this heavy load by a second tier of arches sprung from the haunches. This system of arches and ribs, harmonizing with the general plan of the wall below, was generally accepted by students of Roman art until recently. The fact that its lines cut across those of the panels and that an eight-fold system is fundamentally inharmonious with one of twenty-eight parts, was of course patent to the most careless observer. But this did not discredit Piranesi's presentation of the structural framework of the dome, because this, if inharmonious with the paneling, was perfectly consistent with the eight-part design of the whole interior, and the paneling was generally considered as a decorative appliqué of ribs in relief, presumably in concrete or stucco, on the inner surface of the completed vault, as shown in Piranesi's cross-sections.

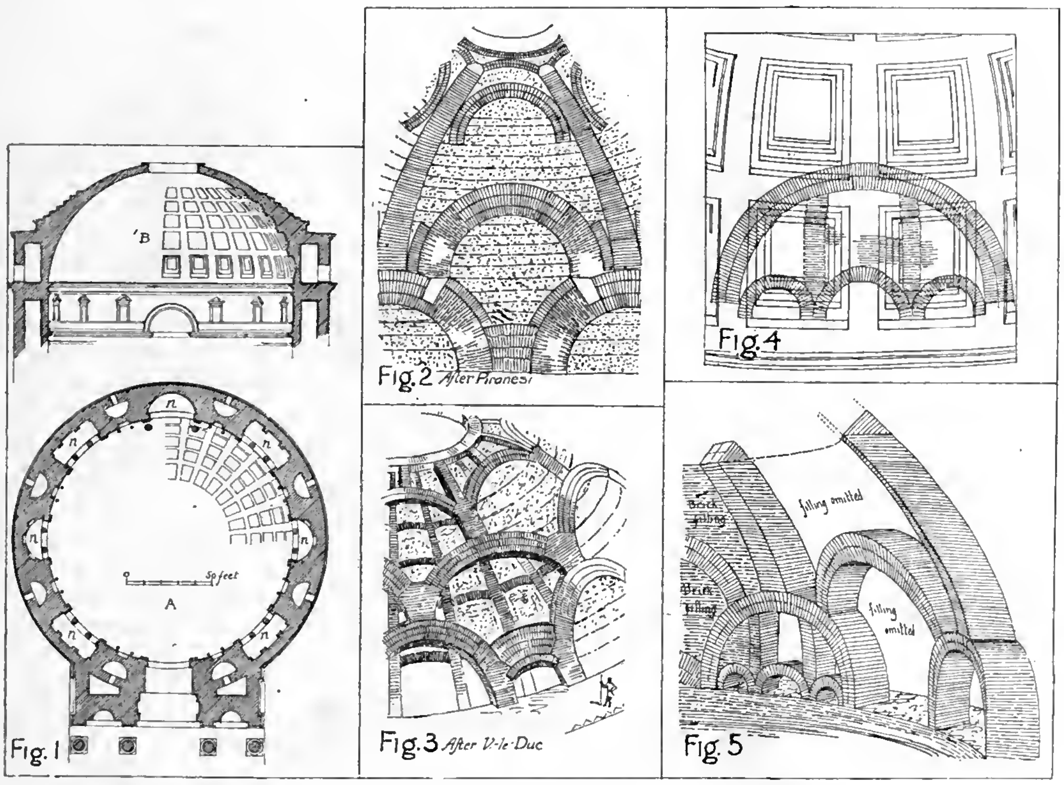
This explanation of the construction of the dome was questioned by Viollet-le-Duc in his famous "Dictionnaire." He suggested Figure 3, a preliminary skeleton of twenty-eight ribs and four series of horizontal arches, all of brick, light enough to be carried by trussed centerings; these formed the paneled design of the inner surface of the dome and served as a permanent centering for the construction of a more massive outer shell of arches and ribs after a modification of Piranesi's system. But this was merely a clever speculation of the French architect and has no basis in observed facts.

Professor Josef Durm, in his "Baukunst der Römer," discredits Piranesi's scheme by claiming that the latter could have discovered the ribs and arches only by cutting through the exterior cornice and steps around the base and haunches of the dome, and that, as there is no evidence of this, "one may be led to the conclusion that Piranesi was entertaining his readers with a figment of his own imagination." Durm accepts, however, the theory of two shells and two superposed frameworks, but he suggests that there are fourteen and not eight ribs, and that they are sprung directly from the wall and not from discharging arches. He seems to have overlooked the fact that in harmonizing the framing and paneling, he has thrown the framing and the walls supporting it out of accord. Moreover it hardly seems likely that Piranesi would entirely invent his system at a time when the evidences of his fraud would be so entirely patent to other observers.

From a study of these data and theories, which he gives more completely in his papers, Professor Hamlin reached the conclusion that Viollet-le-Duc's assumption of two shells was reasonable, although without insisting on the order in which they were built. It was possible that the outer or Piranesi shell was built first and the paneled framework laid up afterwards, on the removal of the great centerings for the outer shell, by means of movable centerings hung from the outer framework. Each zone of the paneling would be self-sustaining as soon as completed. If thus constructed as an afterthought, perhaps when Septimius Severus rebuilt the portion, its discordance with the divisions of the dome framework is easier to understand. It was with this theory in mind that Professor Hamlin examined the dome in 1894. Two years earlier, M. Chédanne had removed the stucco from three panels of the lower row in the dome and from several small areas near these. These bare spots were examined with an opera glass, as there was no scaffolding from which a close examination could be made at the time, and it was clearly seen that the whole structure was brick, ribs and filling alike. But the singular fact became apparent that it was not composed of structural ribs laid up as such according to the theories of Viollet-le-Duc and Durm, but the paneling was formed in the substance of the massive dome of brick, with discharging arches cutting at haphazard across the panels, as shown in Figure 4. The theory of a double shell, as well as that of paneling in concrete added as an afterthought, was thus disposed of. The dome was a single massive vault of solid brick, an unusual construction in Rome; the paneling was formed in the brickwork itself and this brickwork was laid up in a series of discharging arches, for a part of its height at least. These were plainly seen to have been planned with reference to the chapels or niches below, and so far, at least, Piranesi was proved to have been correct.

But these facts merely shifted the puzzle, they did not solve it. The inherent contradiction between the twenty-eight panel ribs and the eight-fold design of the rotunda was not explained, it was accentuated. The 140 panels were a part of the dome itself. The only explanation of the contradiction, to the satisfaction of Prof. Hamlin, is that the paneling was a decorative embellishment of the dome, which was originally intended to present a smooth internal surface, and that the panels were hewn in the solid brickwork after the completion of the vault. Prof. Hamlin acknowledges that such a procedure is contrary to the assumed method of Roman construction; but the alternative solution, that the panels were formed during the laying up of the various discharging arches, assumes the use of molds and of complicated special shapes of brick far exceeding the capabilities of Roman masons at the time this work was done. In Professor Hamlin's papers he explains in detail the intricacy of the mason work necessary in laying up the relieving arches and their filling over the huge forms for the panels.

If the dome is supposed to have been built first, with or without a skeleton of arches and structural ribs extending through its whole thickness, and without regard to interior decoration, it becomes clear that this could be done with relatively light and simple trussed centerings. Chédanne has shown from his examination of the brickwork that the eight discharging arches are built like vertical arches, although with the inner faces shaped to the curve of the dome. If this is also true of a second row of arches, as in the Piranesi theory, all the lower part of the dome could have been built up nearly to half its height without centering. As a matter of fact, Piranesi's sections show all the masonry of the dome up to the level of the fourth row of panels laid up in horizontal courses, and with this Chédanne's observations agree. From that level, it was possible to erect the eight massive ribs and the oculus at the top on skeleton centerings, spanning the opening with trusses either resting on the completed zone or supported from the floor of the rotunda. In Figure 5 Professor Hamlin sketches a part of the dome carried up in this manner; he does not claim that this was done, but merely suggests that such a procedure was possible and comparatively simple if the builders did not concern themselves about the interior paneling. The dome being completed and the centerings removed, wholly or in part, the hewing of the panels subsequently would be a simple matter without endangering the stability of the vault. The work would be simple, within the ability of laborers of little or no skill, and remarkable only for its quantity and not its difficulty. That the panels were formed in this manner is the more credible because it allows the supposition that the interior decoration was designed quite independently of the construction.



PROFESSOR HAMLIN'S SKETCHES OF THE DOME OF THE PANTHEON.

But two objections have been advanced against the validity of this theory. Chédanne has reported that the surface of the bricks does not indicate cutting. But Professor Hamlin finds it easier to believe Chédanne mistaken in his observations on this point than to suppose the arches could have been built into the molds without cutting or breaking the bricks; in most cases, he states, it would have been an absolute impossibility. On the other hand, the rough hewing of the panels, to be finished afterwards in stucco, might in many places have exposed such a serrated surface as Chédanne appears to have noticed, where the ends of brick came close to the hewing line.

The other argument is the fact that in the center of each panel there is a bronze anchor set in the brickwork to hold a bronze rosette or other ornament. It is not impossible that these were set in the brickwork after its completion, as such an operation is common enough in modern work. But even were this not so, it would simply prove that the paneling had been conceived and provided for when the dome was first built, without at all proving that the panels were actually shaped in the extremely difficult manner suggested by M. Chédanne.

Evidence of the most valuable nature as to the merits of these various explanations of the paradox of the Pantheon could be drawn from the appearance of other buildings of like character, but the present state of knowledge of the details of the vaults from the time of Hadrian to that of Constantine is inconclusive. Only by a critical examination of these structures can the true history and chronology of paneled vault decoration be worked out. Professor Hamlin gives illustrations of a few examples of such paneled vaulting in which the work is considered to support his theories. The summary of his investigations and studies he states in the following words.

"To sum up the conclusions which appear most rational, taking into account the present unsatisfactory character of the evidence at hand, or at least its lack of final conclusiveness, it would seem probable that the dome of the Pantheon as constructed in the time of Hadrian was internally a smooth vault, as its upper part always remained, and as many great vaults often were, *e. g.*, the great vault of the Tepidarium of Diocletian's Baths, now the nave of S. Maria degli Angeli. At some date subsequent to its completion, and very probably in the time of Septimius Severus, who rebuilt the great portico of the temple, or of Caracalla, it would appear that the emperor, desiring to embellish the dome and to replace its faded or ineffective stucco decoration with something more permanent and dignified, caused the existing panels to be hewn as a part of his work of general restoration and improvement. Owing to the difficulty and danger of working from overhead in the nearly flat central field of the dome, this work was confined to the lower three-quarters of its surface. It was a work easily executed when once the scaffolding was erected. No indications of the internal structure, discharging-arches or ribs appeared upon the stuccoed surface of the dome. The designer concerned himself, therefore, with only two problems—to secure an adequate scale in his work and to arrange so that the panels should center over the four axial niches of the building. The resultant of these two considerations was the adoption of a scale or spacing giving six panels intermediate between those centered on the axes of the building. The panels were marked out on the plastered surface and the cutting begun, the hewing away of portions of the discharging-arches of the dome being a relatively unimportant incident of the work. The beveling of the lower reveal of each sinkage of the panels was a very simple detail of the cutting, although it would have caused infinite labor and trouble to execute upon a mould as suggested by M. Chédanne. When the hewing was thus completed the whole was once more stuccoed, mouldings were run in the stucco of the edges of the 140 panels, the central rosettes and adornments of gilded bronze were added and the work was completed.

"The final proof or disproof of this theory must rest upon further and more minute investigation than has yet been possible, both of the Pantheon itself—to the unraveling of whose complicated history M. Chédanne has made so important a contribution—and of other vaulted structures of the Roman Imperial epoch. The Piranesi system must be finally vindicated or disproved by a more complete examination of the dome than has so far been undertaken. The brickwork of this and other monuments must be examined for technical evidence as to its having been hewn or laid up to a mold. It is to be hoped that the labors of the Italian government, whose Direzione Generale delle Antichità watches with such zealous and intelligent guardianship over its priceless archæological possessions, and the investigations of archæologists and students, both Italian and foreign, to whom the government shows such considerate hospitality, may at no distant date finally and authoritatively elucidate the paradox of the Pantheon."

Ventilating and Heating No. 23 School, Rochester, N. Y.

An interesting example of schoolhouse planning and schoolhouse heating and ventilation is afforded in a recently completed school building in Rochester, N. Y., No. 23, on Bowen Street in the eastern part of that city. These structures in Rochester, have for some time been designed by Mr. J. Foster Warner, of Rochester, and the present instance may be presented as typical of Rochester schoolhouse practice. No. 23 school is a two-story building comprising 16 grade rooms, all approximately of the same size, 24x30 feet, a kindergarten, one recitation room, a library, teachers' and a principal room and a large assembly room, besides the various utility rooms and some spaces in the basement. The fan system of heating has been installed for ventilation with direct steam radiation in the rooms for warming. The building complete, enclosing in the two stories 345,000 cubic feet of space, cost, including the heating and ventilating apparatus, $58,000.

An idea of the general arrangement of the rooms and the scheme for heating and ventilation can be obtained from the accompanying plans, which comprise a basement plan, half plans of the first and attic stories and various details. The building has extreme dimensions of 103x185 feet. It stands 100 feet back from Bowen Street on a lot extending through to another street and large enough for the exterior to appear to advantage. Its main entrance is in the center of the front facade and there are two pupils' entrances, one at each end of the building. Each school room is provided with its corresponding wardrobe, as shown, and is reached either directly from the corridor or from the wardrobe. Toilet rooms are provided on both the first and second floors, in ready access to the rooms served. The assembly room is located in the rear central part of the building at a lower level than the first floor, with two exits at the rear at ground level. It is about 58x58 feet in plan and separated with drop sliding doors from the main corridor of the first floor, which can thus be utilized as a gallery. In this connection mention may be made of foot warmers which are provided in the corridors. These are two in number and are not of the indirect type but consist of a direct radiating steam coil, set in a tin-lined recess in the first floor, the recess covered with a plain japanned iron lattice-pattern register. The register is about 10 feet long and a seat has been built alongside it its full length.

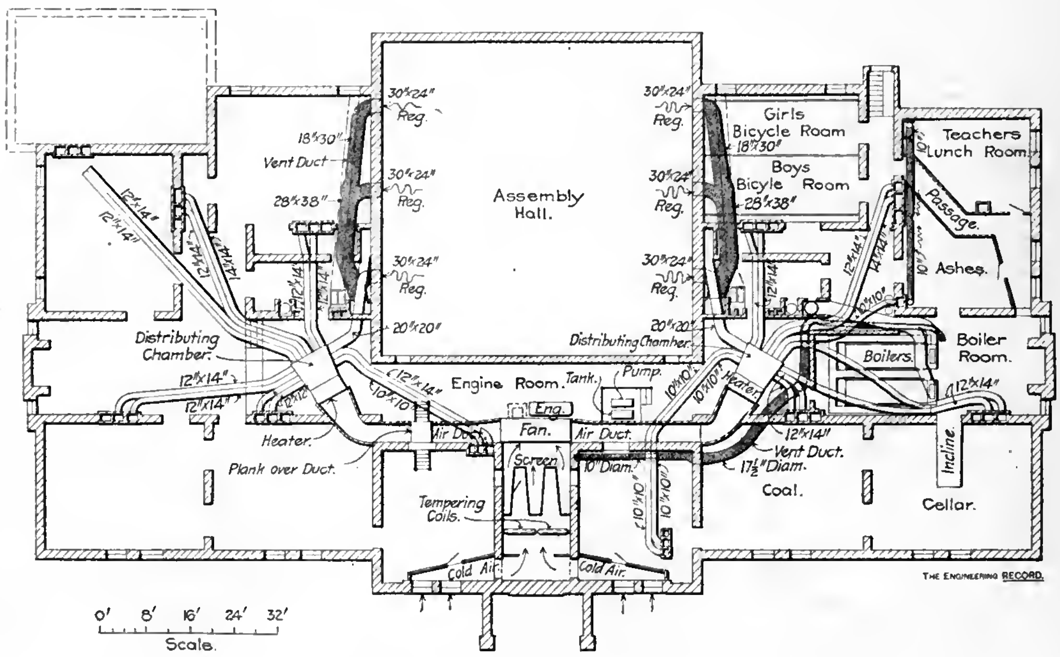
The second story is similar in arrangement to the first story, except, of course, that the assembly room does not continue through it. A recitation room, 18.5x24.5 feet is located in this story, serving the higher grade classes. In order to insulate it so far as possible against sound transfers into adjoining rooms, its walls enclose airspaces. These inside walls of the room are supported on 2x4 inch timbers staggered to leave about 5 inches air space between the inner wall surfaces, which consist of Neponset red rope paper tacked to wood cleats attached to the 2x4-inch timbers. The basement contains only general cellar and the heating apparatus, two bicycle rooms and a teachers' lunch room.

The ventilating apparatus is symmetrically arranged about the center line of the building and consists of an engine-driven double discharge blower which forces tempered air to two distributing points where heaters are installed and the individual supplies to the various rooms are taken. The air is received during school sessions through basement windows in the front of the building, passes through the tempering coil and thence to the fan through a cheese cloth screen for removing dust. The inner walls of the cold-air chambers, it will be noticed, are fitted with sashes of window glass to afford light to the spaces behind them. The tempering coil consists of four 5-foot sections of Sturtevant pipe coil heaters, two sections with four rows of 1-inch pipe and the other with two rows, and all 29 rows long standing 9 feet high. Altogether there are 2,550 feet of pipe, or 850 square feet of surface. These coils are provided with a bypass damper controlled by a Johnson thermostat in the tempered air chamber.

The blower is a 9x4.5-foot three-quarter housing Sturtevant fan driven by a directly-connected 15x10-inch center-crank horizontal Sturtevant engine. The engine is designed to drive the fan at a maximum speed of 150 revolutions per minute at 25 pounds maximum steam pressure and the system is calculated to deliver to each of 19 school and one recitation room, including two rooms of a future addition, 1,200 cubic feet of air per minute, to the assembly hall 8,000 cubic feet of air per minute, and suitable amounts to the principal's room, the library and the teachers' room, all at the same time. This amounts to something over 32,000 cubic feet of air per minute and gives a velocity of flow through the passages from the cold-air inlet to the fan of about 250 feet per minute and through the cheese cloth filter, which presents about 450 square feet of surface of 70 feet per minute.

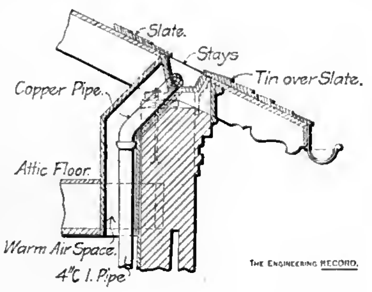
The air is discharged in opposite directions from the fan to two distributing chambers, at the entrance of each of which the main heater for each half of the building is placed. These are of the same type as the tempering coils, each containing about 3,763 lineal feet of 1-inch pipe, or 1,254 square feet of surface. Each heater comprises four sections, 6 feet 4 inches long, with four rows of pipes, each with 35 pipes 8 feet high. The heaters are also provided with by-passes underneath and at the distributing chamber, where, as stated, the individual room supplies are taken, butterfly mixing dampers, under the control of Johnson thermostats placed in the rooms corresponding, regulate the mixture of tempered and heated air to suit the local room conditions.

The air is delivered to the rooms at the usual height of about 8 feet through bronze screens made of flat crimped iron of plain



Foundation Plan, Showing Ventilating System.

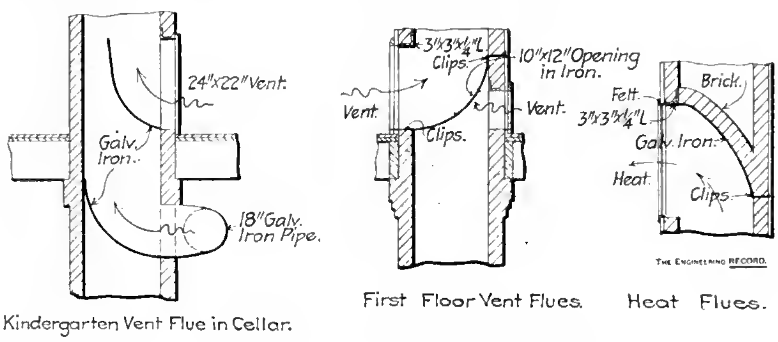
lattice pattern, set in an angle-iron frame. As already stated, the ventilating system is based on the supply of 1,200 cubic feet of air per minute to the average room, which on the basis of 30 cubic feet of air per capita per minute, allows for 40 pupils per room. The rooms being 24x30 feet in size, the gross amount of floor space per pupil is thus 18 square feet. The air supply to each room is carried from the distributing chamber in a 12x14-inch horizontal galvanized-iron duct and in a brick flue 20x24 inches in cross-section. The velocity of the air in the former case is accordingly 1,000 feet per minute and in the



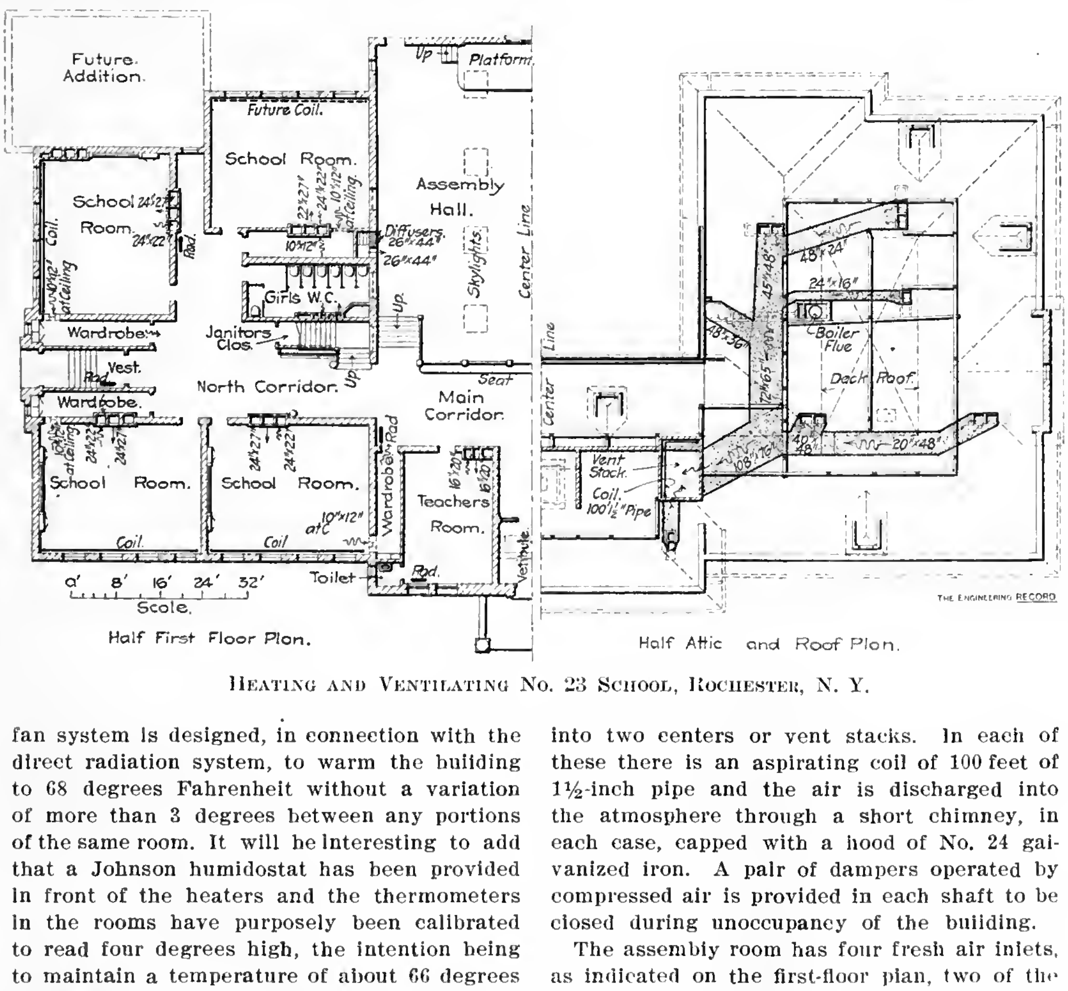
Section of Box Gutter and Cornice of Conductor.

latter 360 feet per minute. The register areas are 24x27 inches, so that the register is about 1 1/3 times the size of the flue. Allowing for lattice work, the velocity through the registers is about 350 feet per minute.

The flues are unlined, the brick work being rubbed smooth, but at bottom and top galvanized-iron is used to break the right angle turn and avoid eddying of the air. The construction at the top of the heat flues is shown in an accompanying detail drawing. The brickwork is arched over behind the galvanized-iron work. The inside of all flues visible through the registers are colored with red water paint. The



DETAILS OF FLUE CONSTRUCTION.



HEATING AND VENTILATING NO. 23 SCHOOL, ROCHESTER, N. Y.

fan system is designed, in connection with the direct radiation system, to warm the building to 68 degrees Fahrenheit without a variation of more than 3 degrees between any portions of the same room. It will be interesting to add that a Johnson humidostat has been provided in front of the heaters and the thermometers in the rooms have purposely been calibrated to read four degrees high, the intention being to maintain a temperature of about 66 degrees and a humidity of 50 per cent., without alarming the teacher by a thermometer reading below 70 degrees.

The outflow of air from the rooms is accomplished in general through two passages, through a vent register at the floor opening into a flue adjoining the hot-air flue and through a vent register at the ceiling over the door to the wardrobe, the area of these two registers aggregating that of the fresh air register. This latter arrangement provides for the ventilation of the wardrobes, which are fitted with hooks fastened to a cleat which extends six inches from the side walls, and with a small cupboard which has a galvanized wire panel affording a circulation of air. The air from the wardrobes passes into the vent flue that serves the school room, except in a number of cases where the location of the wardrobe did not allow of this arrangement, the latter instance having, for example, in the first story, floor registers admitting the air to a system of vent ducts in the basement. This system, as shown in the basement plan, is connected with the space surrounding the smoke stack, and the air in that way is given the accelerating force of the heat from the boiler flue. An accompanying cross-section shows the base of the vent flue and the opening to allow the passage of air from the wardrobe. At the attic, as shown, the exhaust air is collected by ducts into two centers or vent stacks. In each of these there is an aspirating coil of 100 feet of 1½-inch pipe and the air is discharged into the atmosphere through a short chimney, in each case, capped with a hood of No. 24 galvanized iron. A pair of dampers operated by compressed air is provided in each shaft to be closed during unoccupancy of the building.

The assembly room has four fresh air inlets, as indicated on the first-floor plan, two of the openings allowing the air to issue toward the center of the room and the others fitted with deflectors to direct the air toward the outer end of the room, where it was not so convenient to locate fresh air passages. In each case the supply duct for this room has a blast gate near the distributing chamber. The air is exhausted at the floor line with three side registers alongside each side wall, the aggregate area of the six vent registers being about 1.9 times that of the fresh air registers. Ducts in the basement carry the air to two large vent shafts, which lead to the attic, where the air is collected and discharged, as described.

The toilet rooms are ventilated independently of the rest of the building. Each is warmed by indirect radiation with stacks in the basement through which is conducted fresh air from independent air inlets in the rear basement wall. The stacks are located high enough to drain directly into the boilers by gravity, so that they can be operated at any time without regard to boiler pressure. Each stack has about 60 square feet of surface. The vitiated air from the toilet rooms is carried upward and discharged through separate flues into the atmosphere.

Steam for the plant is generated in horizontal tubular boilers, installed in duplicate. They were built by Atlas Engine Works, to stand 100 pounds pressure, but the maximum working pressure is intended not to exceed 25 pounds. Each boiler has a 54-inch shell with 46 tubes 3½ inches in diameter and 14 feet long. The main steam supply is 6 inches in diameter subdivided into a 3-inch line to the fan engine and a 2-inch pipe to each separate section of each heater. The radiation throughout the building is arranged for low pressure with separate supply and returns, and reducing valves are accordingly used in connection with the live steam supply. The water of condensation has thus to be pumped to the boilers, and a 6x4x6 inch Snider-Hughes Co. duplex steam pump and receiver has been installed for the purpose. The exhaust from both engine and pump is utilized as far as possible, being passed first through a Kieley oil eliminator and conveyed to the tempering coils and also to one section of each of the main heaters, these sections being in addition piped to receive live steam when necessary. In this connection the usual outboard exhaust pipe with back-pressure valve is furnished. Direct radiation has been provided for the corridors as well as for the vestibules.

The contractors for the heating and ventilating apparatus, which cost $8,500.00, were Messrs. Barr & Creelman, of Rochester.

The Simplon Tunnel excavation was carried on during July at the rate of 16.8 feet per day in the north heading and 23.4 feet at the south, according to "Engineering," which gives the total advance at the end of the month as 24,-849 feet at the north and 16,420 feet at the south. The rock temperature in the north heading is 127 degrees Fahrenheit. The flow of water in the north tunnel is 1.88 gallons per second, but in the south tunnel it is 243.1 gallons, and has caused much trouble.

The Durability of Steel in Concrete.

It has generally been assumed that steel embedded in concrete does not suffer any injurious changes, although an occasional instance is mentioned to show that the metal will be corroded under some circumstances. In order to obtain definite information on the subject, M. Breuillié undertook at La Chainette a series of experiments which are described by him in a recent issue of the "Annales des Ponts et Chaussées."

Four slabs of concrete-steel were first made in which the proportions of the Portland cement concrete were as follows:

No.	1	2	3	4
Cement, lbs.	1,323	1,323	1,764	2,204
Sand, cu. ft.	12.6	12.6	12.6	12.6
Gravel, cu. ft.	31.8	31.8	31.8	31.8

All slabs had an area of 36x39 inches and a thickness of 11.8 inches. The steel rods embedded in them were 3/16 inch in diameter and were arranged in the following order: About ¾ inch from the upper face there was placed a rectangular network of rods parallel to the sides and about 1½ inches apart, the outside rods being ¾ inch from the edge. One and one-half inches below the first a second layer was laid; a third 1½ inches below the second; a fourth 4 inches below the third; a fifth 1½ inches below the fourth; a sixth the same as the fifth. On the first layer of bars a netting of 3/32-inch wire was laid, and the mortar was pressed on it so as to form a tight coating. Six manometer tubes penetrated in each layer.

The first slab was subjected to a pressure of 12 meters (39.4 feet) of water in the morning of one day, which was taken off in the evening. For six days this operation was continued. The manometer tubes show that the water had penetrated into the block, impregnating it completely, and had reached the embedded steel. After these few days the plate was left in the open air exposed to the action of the weather. From time to time pieces of the concrete were taken from the block, and the metal was always found in perfect condition.

Two facts are to be noted: The surface of the metal was bright before it came into contact with the cement and dull after the metal was exposed by removing the cement. The mortar adhered to the steel at the edges in the parts protected by bitumen, but it did not adhere in the parts where the water had circulated. By additional experiments the author verified the above fact, that if steel bars, having a bright surface, were immersed in cement mortar during several days, the surface became dull after removal of the adhering mortar. It appeared that the mortar had attacked the surface of the steel. This action of mortar on steel explains the reduction of rust on steel bars in cement. The latter is a fact frequently stated and which can easily be verified by letting some bars take a slight layer of rust and then embedding them in cement mortar. The first bars which were removed from the mortar after three to five days showed still some rust stains. The last bars which were removed after 15 to 20 days were perfectly free from rust, which appeared to have given up its oxygen to the cement.

The water which passed through the concrete slabs was sampled before and after passing, and an analysis of the salts contained in it was made by the laboratory of the Ecole des Ponts et Chaussées. These salts came from the water as well as from the concrete block. Specimens collected after the pressure was stopped gave the results next tabulated. The table shows that water just before passing into the blocks after removal of pressure contains more mortar salts than the water which passed through the slab.

When sampied	Before passing.	After passing.
No. samples	3	4
	Grams.	Grams.
Silica	2.46	1.42
Aluminum and iron	3.60	2.32
Lime	17.70	15.60
Magnesia	Traces	Traces
Sulphuric acid	1.22	0.90
Chlorine	1.22	0.90
Loss on ignition	28.46	25.85

The three remaining slabs were subjected to the action of water under a pressure of about 50 feet. In spite of the rich proportion of cement, the use of a metal netting and the smoothening of the mortar, all three specimens, though more tight at the beginning than the best granite, were penetrated by the water after having been subjected to intermittent pressures. The water which passed through the plates as well as the water which came back from the upstream end was analyzed. The following table gives the results obtained:

Samples taken	Up-stream.	Down-stream.
No. samples	5	8
	Grams.	Grams.
Silica	3.20	1.52
Aluminum and iron	6.12	2.40
Lime	20.50	17.50
Magnesia	0.50	Traces
Sulphuric acid	1.59	1.13
Loss on ignition	26.98	28.27

The silica, aluminum and iron, magnesia and sulphuric acid come from the slabs only.

Comparing these proportions with those shown by an analysis of the cement, it was found that the proportion of iron and aluminum collected is much higher than that generally found in cement, 19 and 13 per cent. instead of 10.5.

When slabs 2, 3 and 4 were broken, the bars, which were bright when embedded, had become dull, and the metal did not adhere to the cement at the portions through which the water passed. Just as in slab 1, it appeared that the bars did not rust when they were surrounded by mortar, even when the water passed through the mortar.

The preceding seems to indicate that, first, a salt is formed by the action of cement on iron, and, secondly, this salt is dissolved by the water which penetrates into the concrete-steel.

If the cement attacks the steel and a chemical combination is formed, the weight of the steel must be more or less than before, according as the newly-formed body adheres to the steel or not. To verify this conclusion ten 2x2-inch plates were taken. Each little plate thus had 8 square inches surface. These were weighed and then embedded in Portland cement mortar; after 24 days they were taken out, carefully cleaned of all mortar, weighed and again put in the mortar. The same process was repeated after 14 days, and, finally, after 76 days, an increase in weight was noticed in every case, the amounts of milligrams being as follows:

Plate.	After 24 days.	After 14 days.	After 76 days.	Total.
1	4 mg.	2 mg.	4 mg.	10 mg.
2	1	5	5	11
3	6	4	5	15
4	4	3	7	14
5	3	3	5	11
6	4	3	6	13
7	6	3	5	14
8	5	2	5	12
9	4	4	5	13
10	6	2	4	12
Avge.	4.3 mg.	3.1 mg.	5.1 mg.	12.5 mg.

The increase in weight was very definite, and it increased with the length of time the metal was left in the mortar. An analysis of these plates, made at the laboratory of the Ecole des Ponts et Chaussées, only gave general indications that the increase in weight appears to be due to the formation of a silicate of iron.

To find the rate of increase in weight, fifty 2x2-inch steel plates were numbered from 1 to 50, weighed and embedded in cement mortar. Every five days a series of five plates was taken out and carefully cleaned by a thorough rubbing. The results obtained are tabulated below:

Increase after	Minimum.	Average.	Maximum.
5th day	—1	—3/5	0
10th "	0	1	2
15th "	3	4.2	6
20th "	3	4.6	7
25th "	5	5.8	7
30th "	5	6.4	7
35th "	5	6.0	7
40th "	5	6.6	8
45th "	7	7.4	9
50th "	8	9.4	11

The increase in weight, as can be seen, was quite regular, except between the thirtieth and fortieth day, during which period cold weather prevailed.

If a soluble salt had formed, the plates taken out from the mortar should lose weight under the action of water. Nos. 46 to 50 were twice put in constantly renewed water, and they lost part of their weight. After six hours the loss of weight was on an average 2 milligrammes, after a second immersion of seven hours the loss was 2.2 milligrammes. The tabulated results are as follows:

Plate.	Increase in weight.	Decrease after 1st immersion.	Decrease after 2d immersion.	Total.
46	8 mg.	3 mg.	1 mg.	4 mg.
47	11	2	3	5
48	8	1	2	3
49	10	2	3	5
50	10	2	2	4
Avge.	9.4 mg.	2 mg.	2.2 mg.	4.2 mg.

The salt which is formed at the contact surface of steel to cement seems to have a determining effect on the adhesion of the two bodies, and, as this salt forms slowly, the author decided to find out whether the adhesion takes place on the setting of the cement or whether it increases with age, the same as the salts do. Thirty plates, 1⅝x2¾ inches, were placed on a horizontal surface of a concrete block made in the proportion of 31.2 pounds of cement to 1 cubic foot of sand. The whole was left in a room, and the mortar hardened under ordinary conditions. The plates were torn off vertically in series, the first series after two days, the rest after every five days. The tests were such that only the adhesive resistance was shown and no friction between the two materials could take place. The average results of each series were as follows:

Contact period.	Average adhesion.
2 days	4 lbs. per sq. in.
7 "	9.5 " "
12 "	13.5 " "
17 "	16.2 " "
23 "	18.5 " "
27 "	18.8 " "

It may be stated that the adhesion increased uniformly and reached after 30 days a greatest value of 22 pounds per square inch, or about half of the adhesion which is generally assumed.

The results obtained do not give at the end of each period the least amount of adhesion which can positively be expected, and it is evident that it is not advisable to use higher values, though higher results can be obtained under special conditions. The author attempted to find the effect on the adhesion of leaving the plates in open air or keeping them in a hot room, but in no case were the results noticeably below the above, and in some instances they were much higher. In a special case, by mixing the cement after warming it in the sun, an adhesion of 34 pounds per square inch was obtained in five days, but it should be added that the plates did not then show any regularity in their adhesion to the mortar. The experiments convince the author that, (a) the cement attacked the iron, (b) water dissolved the composition which formed at the contact of the two materials, (c) the adhesion of the steel to the cement disappeared when water passed through the concrete-steel for a certain time, (d) the weight of the iron salts which adhere to the steel and the normal adhesion between the steel and concrete increased with the time.

Trade Publications.

The Westinghouse Electric & Mfg. Co., Pittsburg, has issued a revised edition of its circular concerning lightning protection. It explains injuries to electrical apparatus by lightning, outlines the functions of different classes of protective devices against such injuries and describes in detail, with many illustrations, the construction and installation of arresters, choke coils and static interrupters.

The Roebling Construction Co., 121 Liberty street, New York, has prepared a 102-page album of views of business buildings, industrial plants, residences and churches which have been supplied with its system of fire-proof floors and partitions. These buildings include many of the most notable architectural works of the last two years.

In The Engineering Record of August 2, there was printed a report by Dean & Main on several trials of a 300-horse-power De Laval turbine, operating under different conditions. This report has just been issued in pamphlet form by the De Laval Steam Turbine Co., 74 Cortlandt street, New York.

The inventor of the continuous sewage filter described in The Engineering Record of August 23, Mr. F. Wallis Stoddart, of Bristol, England, has issued a well-illustrated 40-page pamphlet describing its principles, construction and capabilities.

Mr. W. L. Dickinson, of Springfield, Mass., president of the Connecticut Valley Highway Association, has made an investigation of the results of the use of Warren's bituminous macadam pavement, and the report, which can be obtained from him, has been published with letters from city officials familiar with the work.

A 224-page book is needed to describe the twist drills, reamers, taps, dies, mills and cutters made by the Standard Tool Co., Cleveland, and to furnish the many valuable tables the company has prepared. These give the decimal equivalents for millimeter and drill gauges and fractions, full particulars of screw threads used in this country and abroad, standard pipe dimensions, and wire and screw gauges.

The Harrison Safety Boiler Works, Philadelphia, have issued two pamphlets concerning feed-water heaters, one referring to the advantages of the Cochrane open heater for collieries and other places where the boiler feed is liable to be poor, and one explaining the Sorge-Cochrane open heater and purifier for treating hard water chemically as well as by heat. In the latter the amount of chemical required can be determined from time to time by a simple color test and the supply regulated by a valve.

McIntosh, Seymour & Company, Auburn, N. Y., have issued a book containing a full description of the design of the various varieties of engines they build, ranging from the 20-horse-power high-speed type to the large vertical and horizontal units of several thousand horse-power employed in mills and power stations. Many elaborate tables of capacities and dimensions are furnished and the illustrations give views in numerous engine rooms of interest to steam plant designers.

The new edition of the heating catalogue of the J. L. Mott Iron Works, New York, is a well-illustrated book of 96 pages. It describes many types of hot-water heaters with capacities of 100 to 10,000 feet of radiation, steam boilers with a range of 300 to 8,000 feet, and radiators of many styles and forms.

The Magee Furnace Co., Boston, Mass., has issued a second edition of its "manual," a leather-bound book of 72 pages. The construction and dimensions of the steam and water heaters of various types made by the company are fully explained, but the greater part of the book is a collection of tables, standard drawings and suggestions valuable to the architect and fitter.

The new bulletins of the Bullock Electric Mfg. Co., Cincinnati, include the following: No. 1,002, direct-current multipolar "N"-type motors of ½ to 60 horse-power; No. 1,003, marine lighting and power sets; No. 1,012, direct-current multipolar "H"-type motors of 4 to 200 horse-power; No. 1,013, direct-current multipolar "H" and "HI"-type belt-driven generators of 3 to 500 kilowatts. The special features of design and construction are explained and the tables of dimensions are unusually complete.

The Hyatt Roller Bearing Co., Harrison, N. J., has issued a well-illustrated bulletin on the use of its well-known bearings for heavy duty at slow speed. Trucks, hoists, conveyors, transfer tables, cranes, cars and other apparatus are operated much more easily when fitted with these bearings, according to numerous testimonials in the pamphlet, which contains tables to assist in selecting bearings for given loads and shafts.

A handsomely illustrated description of its various types of cable railways for handling coal and merchandise has been prepared by the C. W. Hunt Co., Allen street, West New Brighton, N. Y. It is particularly interesting for the numerous illustrations of installations for important power plants and coal storage yards.

Personal and Obituary Notes.

Mr. Rolla W. Roberts has been elected city engineer of Saginaw, Mich.

Mr. J. H. McRee, city engineer of Wilmington, N. C., died suddenly in that city on September 9.

Capt. Francis R. Shunk, Corps of Engineers, U. S. A., has been ordered to St. Augustine, Fla., to relieve Capt. Herbert Deakyne.

Thomas E. Chandler, of the Chandler & Taylor Co., steam engine builders, of Indianapolis, died September 10 at the age of 70 years. He had been confined to his bed but ten days.

Mr. Eduardo J. Chibas, M. Am. Soc. C. E., of Santiago de Cuba, has been retained by the authorities of Guantanamo to plan a system of sewerage and sewage disposal works and to report on the improvement of the streets of that city.

In Asphalt Paving in New York the contractors use in most cases a fine, well-graded sand. Mr. W. H. Broadhurst, chemist of the Highway Department, states that the use of such sand together with a large amount of fine mineral dust permits of the use of a large percentage of bitumen containing a larger percentage of flux than is possible with a coarse sand. The effect of such improvement in formula tends largely to increase the life of the pavement. It should be noted in this connection that on Broadway, and on many downtown streets subjected to heavy traffic, Portland cement has been used for the fine mineral dust in place of powdered carbonate of lime. As Portland cement contains a larger amount of impalpable powder than does powdered carbonate of lime, the use of same with a fine, well-graded sand, and proper amount and quality of asphaltic cement, produces a very dense pavement mixture with a minimum percentage of voids. The result has been for the reasons above noted an asphalt pavement of the highest grade. In fact, it may be said that the feasibility of laying asphalt pavements on streets which sustain such heavy traffic as Broadway is due to these improvements in the asphalt mixture.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Philadelphia, Pa.—Local press reports state that the following bids were opened Sept. 12 by Director of Pub. Wks. for constructing the pumping station to be erected at Delaware Ave. and Race St. in connection with the new high-pressure fire service: *a*, amount; *b*, time in days; *c*, price per cu. yd. for removal of old buildings; *d*, price per pile for pile driving: Geo. C. Dietrich, *a* $74,400, *b* 140, *c* $9, *d* $6.90; Ryan & Kelly, *a* $81,000, *b* 140, *c* $12, *d* $12; Henderson & Co., *a* $56,533, *b* 180, *c* $10.75, *d* $9.80.

The following bids are stated to have been opened Sept. 17 for a pumping station at Lardners Point (bids were on same specifications on which bids were made Aug. 12); the figures following the bids are, 1st, the number of working days to complete the foundations and superstructure for the engines; 2d, the number of working days to complete the entire work: Geo. C. Dietrich, $532,000, 145, 240; Millard & McGraw, $533,000, 150, 250; Henderson & Co., $637,000, 7 and 5 mos.; D. J. McNichol, $722,000, 310 days.

Sodus, N. Y.—Local press reports state that this town proposes to let a franchise for the construction of water works. Lewis H. Clark is said to be interested.

Cincinnatus, N. Y.—Engr. F. W. Moxley estimates the probable cost of a system of water works at $11,000, not including reservoir site, cost of springs and right of way.

New York, N. Y.—Bids were opened Sept. 18 by Robt. G. Monroe, Comr. of Water Supply, Gas & Electricity, for building an engine, coal and boiler house for high service works at Jerome Park Reservoir, Jerome Ave. between Van Cortlandt Ave. and Mosholu Parkway, as follows: Luke A. Burke, $123,000; Kelley & Kelly, $113,900; N. W. Ryan, $97,750; Chas. Scheidecker, $132,379; John R. Sheehan & Co., Inc., $111,700.

Homestead, Pa.—The Boro. Council has awarded the contract for the new addition to the water plant to J. Monroe & Son, of Pittsburg, for $4,500.

Newport, N. Y.—The proposition to issue $15,000 water works bonds is reported to have carried.

Paterson, N. J.—The following bids were opened Sept. 10 by the Jersey City Water Supply Co., for constructing the Parsippany Dike: A, Metropolitan Constn. Co., Jersey City; B, Hillpot & McCabe, Jersey City; C, Beckwith & Quackenbush, Mohawk, N. Y.; D, Higginson & Shannon, Jersey City.

Items and Quantities.	A	B	C	D
Clearing 8 acres	$50.00	$123.50	$50.00	$60.00
Stripp'g, 12,000 cu. yds.	.30	.33	.25	.27
Excav, 4,000 c.y.	1.00	1.03	1.25	1.52
Emb'k., 130,000 cu. yds.	.40	.52	.34½	.63
Loam, 7,200 c. y.	.50	.52	.29	.56
Seeding 5 acres.	50.00	58.00	25.00	52.00
Paving, 15,000 sq. yds.	.75	.58	1.25	.75
Concrete mas., 12,000 c. y.*..	3.60	2.40	4.00	3.40
24-in. drain, 60 lin. ft.	3.00	3.00	1.00	2.75
Gravel, 800 c. y.	1.25	1.70	1.00	1.05
Totals	$119,480	$119,742	$123,073	$149,047

*Does not include cement.

South Deerfield, Mass.—Bids will be received by the Water Comrs. until Sept. 24 for constructing masonry dam and cleaning reservoir site on Roaring Brook near this village. J. B. Bridges, Chmn.

Ithaca, N. Y.—The Ithaca Light & Water Co. has awarded the contract for the construction of the dam on its property in Six Mile Creek to Tucker & Vinton, of New York City, for $34,225.

Nassau, N. Y.—Bids will be received by the Village Bd. of Trus. until Oct. 1 for furnishing material and constructing a system of water works. Bids will be received separately for building reservoir, dam, laying pipe, with hydrants, valves, special castings, etc. Henry N. Smith, Pres.; E. W. Moxley, Engr.

Aiken, S. C.—F. W. Wessels, Chmn. Water Wks. Com., writes that the contract for drilling an artesian well 10-in. in diameter, minimum depth 55 ft., maximum depth 1,000 ft., was awarded Sept. 12 to Perry Andrews & Bro., of Atlanta, Ga.

Richmond, Va.—A correspondent writes that the City Council has received a proposition from a company (of which John C. Robertson, Times Bldg., Richmond, is said to be able to give information) to furnish the city with water from a clean stream.

Baltimore, Md.—The Water Com. has reported favorably on the resolution to appoint a commission to consider the feasibility of establishing a filtration plant.

Portsmouth, Va.—Press reports state that Gen. Mgr. of the Portsmouth, Berkley & Suffolk Water Co., has been directed to proceed at once with contemplated improvements. Judge L. R. Watts, Pres.

Salem, Va.—Paul S. Nugart, professor of civil engineering in Syracuse University, Syracuse, N. Y., is said to have been appointed by the town to make improvements in the water supply.

Richmond, Va.—Mayor Taylor has approved a resolution instructing the Committees on Finance and Water to report a scheme for raising $350,000, to be used for clear water.

Atlanta, Ga.—Mayor Mims in a communication to the Council urges the issue of $400,000 for the purpose of perfecting the water works system.

New York, N. Y.—Norton & Dalton have been awarded a contract for laying water mains in a number of streets, bids opened Sept. 4, as follows. The work includes the setting of 3 20-in. stop cocks, 42 12-in. stop cocks, 59 6-in. stop cocks, and 121 hydrants.

Items and Quantities.	Norton & Dalton.	F. Thellmann, Jr.	John Cornwell, Jr.	Henry Lipps, Jr.	F. V. Smith Contg. Co.	Cunningham & Kearns.
Cast iron pipe, 1,235 tons	$31.00	$33.00	$35.00	$31.75	$33.00	$32.00
Specials, 80 tons	57.00	65.00	60.00	57.00	59.00	58.00
Rock, without blasting, 10 cu. yds.	5.00	5.00	5.00	8.00	6.00	5.00
Rock excavation, 1,400 cu. yds.	3.00	3.50	3.00	.32	2.50	3.00
Earth excavation, 20,000 cu. yds.	.25	.30	.37	.32	.30	.30
Filling, 20,500 cu. yds.	.25	.30	.16	.32	.25	.25
20-in. pipe, to lay, 2,600 lin. ft.	.50	.70	.70	.66	.50	.50
12-in. pipe, to lay, 15,000 lin. ft.	.25	.50	.40	.37	.35	.30
6-in. pipe, to lay, 18,000 lin. ft.	.19	.35	.27	.21	.20	.17
Brick work, 150 cu. yds.	10.00	12.50	15.00	12.00	10.00	10.00
Concrete, 10 cu. yds.	5.00	5.50	6.00	5.00	3.50	4.00
Asphalt, 1,500 sq. yds.	4.00	4.00	4.00	6.00	4.00	4.00
Granite block pavement, 2,800 sq. yds.	1.50	2.00	1.50	3.00	1.60	1.25
Macadam, 700 sq. yds.	.50	.75	.60	.50	.60	.25
Flagging, 4,000 sq. yds.	.25	1.00	.50	.50	.40	.15
Curb, 1,100 lin. ft.	.10	.20	.10	.01	.10	.05
Totals	$93,243	$112,140	$107,389	$104,635	$98,510	$96,950

Bidders all of New York City except Henry Lipps., Jr., his address being Ellicott Ave., Williamsbridge.

Westbrook, Minn.—Bids will be received by the Village Council until Sept. 29 for $7,000 bonds, the proceeds to be used to construct a system of water works, for both public and private use. John E. Villa, Village Recorder.

Kewanee, Ill.—Bids will be received by the Bd. of Local Improv. until Sept. 24 for laying 4,050 ft. of 6-in. (33 lbs. per ft.) and 72 ft. of 4-in. (22 lbs. per ft.) cast-iron pipe, 5 Ludlow fire hydrants, five 6-in. gate valves and boxes, and 2,500 lbs. of special castings. F. F. Whiffen, Pres.

Galion, O.—City Clk. J. O. Ross writes that on Sept. 15 it was voted to issue $50,000 bonds for the construction of water works.

Eureka, Ill.—This city is said to be considering the erection of a water tower and tank at a cost of $4,000.

Kiester, Minn.—Press reports state that this town voted for water works, and work is to be started without delay.

Roanoke, Ill.—The matter of establishing water works for fire protection is said to be under consideration.

Rantoul, Ill.—The Village Bd. is inspecting various water works' systems. A 75,000-gal. tank is favored and 6-in. mains.

Chicago, Ill.—Bids are wanted Sept. 24 for furnishing material and constructing the intake, foundation and pump wells for the 39th St. Pumping Station, etc. F. W. Blocki, Comr. of Pub. Wks.

Albia, Ia.—W. A. Seevers, of Oskaloosa, Ia., is said to have made a proposition to furnish $100,000 if a similar sum is raised here, to install a complete electric light and water system with an interurban line to Hilton and other points.

Webster Grove, O.—Bids will be received at the office of the City Clk. of Webster Grove, until Oct. 6 for furnishing approximately the following quantities of cast-iron pipe and special castings; all net tons: 105 tons of 12-in., weighing 80 lbs. per ft.; 75 tons of 10-in., 60 lbs. per ft.; 150 tons of 8-in., 45 lbs. per ft.; 260 tons of 6-in., 33 lbs. per ft.; 350 tons of 4-in., 21 lbs. per ft.; 12½ tons of special castings. Edw. S. Hart, Chmn. Com. on Water Supply, Clayton, Mo.; Wm. H. Bryan, Consulting Engr., Lincoln Trust Bldg., St. Louis, Mo.

Cass Lake, Minn.—The Cass Water, Light & Power Co. will in about 2 weeks award the contract for laying about 4,000 ft. of 8 and 6-in. water mains. For all information address the above company.

New Bremen, O.—It is stated that bids are wanted Sept. 23 for water works to cost about $30,000. G. A. Kunning, Clk.

Mt. Clemens, Mich.—The Bd. of Pub. Wks. recommends that a new engine and a 3,000,000-gal. pump be purchased for the water works.

Grinnell, Ia.—The Grinnell Water Co. has contracted with Colcon & Daily, of Mt. Pleasant, for the construction of a dam for $5,000.

Hamilton, O.—At a recent citizens' meeting the special committee appointed on July 9 to investigate the needs of Hamilton's water works system recommended a new pumping station to cost $83,600.

Youngstown, O.—The Bd. of Water Wks. Trus. has bought 8 acres of land as a site for a filtration plant. Plans and estimates for a plant to filter Mahoning River water will be made at once, according to local press reports.

Minneapolis, Minn.—The sum of $200,000 has been set aside by the Water Works Com. for the construction of 2 large distributing mains for the city water system, and about $25,000 will be expended for smaller mains.

Zeeland, Mich.—The Village Bd. has let to Arbuckle-Ryan Co., of Toledo, O., a contract to install a complete water and lighting system within 60 days.

Westerville, O.—Bids will be received by the Water Wks. Trus. until Sept. 26 for furnishing material and erecting the following items for water works: a frame building for pumping station with slate roof, a brick receiving reservoir, 2 steel pressure tanks, with valves and connections erected. All bids are to be made separately for labor and material. J. P. Force, Consulting Engr.

Abingdon, Ill.—Bids are wanted Sept. 23 for erecting a power house for water works station, 1 deep well pump, and necessary attachments, for water tower and foundations. Geo. Cadogan Morgan, Engr., 808 Royal Insurance Bldg., Chicago.

Dallas, Tex.—The City Council has adopted the report of the Water Comrs. and Com. on Pub. Improvements, recommending that Chester B. Davis, of New York City, be employed to make surveys, with plans and specifications and estimates of cost for a pipe line to Bachman reservoir.

Minden, La.—It is proposed to construct water works. W. H. Webb, Engr. in Charge.

Perry, Okla. Ter.—The Council is said to be considing the matter of sinking an artesian well.

Huntsville, Tenn.—Press reports state that this city is about to purchase several tons of water pipe for extensions in E. and W. Huntsville.

Miami, Ind. Ter.—Press reports state that the Miami Artesian Water & Electric Light Co., which has a capital of $50,000, proposes to put in a plant. Jas. K. Moore, Secy.

Jackson, Miss.—A special committee has been appointed to secure a pure water supply from artesian wells; $40,000 has been appropriated.

Tuscumbia, Ala.—Col. D. A. Tompkins has a franchise for water works and electric lights for this city, and it is stated that the plant, which will be located at Sheffield, will cost $150,000, Tuscumbia to receive a supply of water and lights from that city, Tennessee River water being utilized. The extension to Tuscumbia is estimated to cost $50,000, with an additional $25,000 to be expended in filtering the water. C. H. Campbell, of Charlotte, N. C., is said to represent Col. D. A. Tompkins.

Dyersburg, Tenn.—It is stated that bids are wanted Sept. 29 for constructing water works and an electric light plant, to cost about $40,000. W. A. Fowlkes, Jr., Mayor.

Tonopah, Nev.—J. H. Ralston, of Carson City, Nev., writes that the probable cost of the 60 miles of wood water-pipe line which it is proposed to construct to Tonopah will be $1,000,000.

Walla Walla, Wash.—Press reports state that steps are being taken to develop and extend the water system; the plan provides for several miles of new pipe.

Tacoma, Wash.—The matter of extending the water mains to outlying districts is under consideration.

Mt. Vernon, Wash.—Press reports state that the Skagit Improvement Co. has been incorporated, with a capital stock of $100,000, and will put in a water works system for Sedro-Woolley and Mt. Vernon. The incorporators are W. R. Morgan, W. E. Guerin and H. F. Guerin.

Tacoma, Wash.—City Comptroller Lister estimates the total cost of operating the city department for the coming year at $719,408; of this amount $75,000 is for a new water supply plant to be built at South Tacoma, and $25,000 for a new service to furnish increased pressure in the more elevated portions of the city.

The Council has passed a resolution for the extension of water mains on certain streets in the Sixth and South Side additions.

Del Norte, Colo.—The Continental Land & Irrigation Co. has been incorporated, with a capital of $200,000, to operate in Rio Grande, Costilla, Saguache, Conejos, Archuleta, Mineral and Hinsdale counties. Principal office in Del Norte. Directors: Theo. J. Lakenan, Wm. H. Cochran, Wilber E. Shaw and A. J. Weiss.

Marysville, Cal.—The State Bd. of Examiners has approved plans and specifications for the first of the proposed Yuba River barriers, which is to cost $35,000. Total appropriation, $800,000.

Salt Lake City, Utah.—City Engr. Kelsey has filed a notice to the effect that the city has located and appropriated a tract of land in Parley's Canyon for a reservoir and dam site.

Nampa, Idaho.—Local press reports state that plans and estimates are being prepared for water works.

Lincoln, Neb.—The City Council has ordered the City Water Comr. to lay 28 blocks of water mains, 4, 6 and 8-in. pipe to be used.

Lidgerwood, N. D.—Bids are wanted Sept. 29 for constructing a water works distribution system, according to plans prepared by Prof. J. J. Flather, of Minneapolis. John Nuding, City Aud.

Winnipeg, Man.—The time for receiving bids for cocks, pipe, hydrants, meters, etc., is Sept. 29, as advertised in The Engineering Record.

Armstrong, B. C.—It is stated that bids are wanted Sept. 30 for water works to include 3 miles of mains. Jos. McDonald, Recorder.

SEWERAGE AND SEWAGE DISPOSAL.

Scranton, Pa.—Jos. P. Phillips, Ch. Engr., Dept. of Pub. Wks., writes that bids will be received until Sept. 29 for constructing the 19th Dist. Sewer. The work will contain about 60,000 ft. of various sized pipe and brick sewer, and is estimated to cost about $180,000.

Boston, Mass.—Bids are wanted Sept. 24 for sewerage works in Rosemont St.; also until Sept. 25 for sewerage works in Blandford and Cummington Sts. Jas. Donovan, Supt. of Streets.

Bayonne, N. J.—The Council has instructed the City Engr. to prepare plans and specifications for sewers in E. 16th, W. 17th and W. 43d Sts.

New Brunswick, N. J.—Bids are wanted Sept. 25 for laying a vitrified pipe sewer in Ray St. Wm. F. Harkins, Street Comr.

Amherst, Mass.—The Selectmen are considering the question of sewage disposal.

Westfield, Mass.—Town Engr. Oren E. Parks writes that the following bids were opened Sept. 13 in response to a readvertisement for the completion of Section 1 of the storm water sewer system: A, Seymour & Newell, Springfield, $34,765 (awarded); B, Robert D. Maynard, Springfield, $35,344; C, Long & Little, Leominster, $37,077; D, D. W. Mellen, Springfield, $37,566; E, G. M. Atkins & Co., Palmer, $38,536; F, Bruno, Salomone & Petitti, E. Boston, $41,568. For detail bids see accompanying table:

Items and Quantities.	A	B	C	D	E	F
Earth excav.:						
54-in. sewer, 4,610 ft.	$1.25	$1.50	$1.50	$1.65	$2.00	$2.05
36-in. sewer, 98 ft.	1.25	1.00	1.00	1.65	1.50	2.00
Siphon	$100	$100	$140	$195	$150	$125
8-in. sewer, 670 ft.	.30	.25	.40	.50	.35	.40
Br. mas., 1,890 cu. yds	12.00	12.15	13.00	12.25	12.00	13.35
Con. mas., 695 cu. yds.	7.25	6.00	5.75	7.00	7.00	7.50
Lumber, 15 M. ft.	20.00	30.00	30.00	30.00	40.00	35.00
Rock excav., 160 cu. yds.	3.50	3.00	4.00	5.00	4.00	3.50

Mortar for brickwork, Portland cement, 1:2½; concrete masonry, Portland cement, 1:3:6; earth excavation, average cut 9.7 ft.

Schenectady, N. Y.—The Common Council has authorized the construction of a number of new sewer mains.

Harrisburg, Pa.—A. C. Stamm, Secy. Bd. of Pub. Wks., writes that the detail bid of S. M. Neff, 120 Liberty St., New York City (successful bidder), for the construction of the intercepting sewer, was as follows (bids opened Sept. 3): Parabolic concrete and expanded metal sewers complete, 5-ft. at $9.80 per lin. ft., 4-ft. at $8.95; 5-ft. rectangular concrete sewer with steel beams and concrete top, concrete walls and bottom, complete at $15 per lin. ft.; outfall sewer complete, including the manhole at bank of Susquehanna River, the 36-in. vit. sewer pipe, the 36-in. c. i. pipe excavation of river bottom, etc., $6,000 lump sum; silt basin and regulating chamber at Schuylkill St., including regulating valve, float, float chamber, manholes, screen bars, inlet pipes, etc., complete, $800 lump sum; for each manhole complete on intercepting sewer, $65; for each silt basin on inverted siphon and on connections with intercepting sewer where no inverted siphon is used, complete, $250; for each manhole containing a flap gate, to be built on existing sewers, complete, $225; for each manhole at discharging ends of inverted siphons, complete, $60; cast iron pipe, 5-in. and 8-in., with leaded joints, in inverted siphons, at $3 and $4 respectively, per lin. ft.; 10-in. and 12-in. in connections with intercepting sewer at $6 and $7 respectively, per lin. ft.; yellow pine timber in foundations, including excavations for placing same, etc., $45 per M. ft. B. M.; spruce timber in foundations, $45 per M. ft. B. M.; sheeting, shoring, bracing and sheet piling, $35 per M. ft. B. M.; vitrified sewer pipe, with cemented joints, 8-in., 10-in. and 12-in., at $2.50, $2.75 and $3 respectively, per lin. ft.; extra concrete, mixed 1 part cement, 3 parts sand and 6 parts broken stone, $7.50 per cu. yd.; extra gravel or broken stone filling, $1.75 per cu. yd. The total amount of contract is about $167,227.

McKeesport, Pa.—The Common Council has passed ordinances as follows: for sewers in Pope Alley, Butler St., "A" Alley and Douglass St., for a sewer in Packer St., a sewer in Sinclair and Jerome Sts. and for a $75,000 bond issue for Crooked Run sewer.

Erie, Pa.—The City Engr. has reported the cost of the city's portion of a sewer from the lake to the intersection of East and McCarter Ave., as $18,823; also of East Ave. sewer, McCarter Ave. to 26th St., as $20,087.

Geneva, N. Y.—Bids will be received until Sept. 24 by Chas. S. Boyd, State Supt. of Pub. Wks., Albany, for constructing sewers to conduct the waters of Washington and Cemetery Creeks from a point beyound the terminal of said creeks, through the towing path extended, of the Cayuga and Seneca Canal, in said city; also for repairing and protecting the extended towing-path of the Cayuga and Seneca Canal across the harbor at Geneva.

Solvay, N. Y.—Village Clk. A. E. Waterfield writes on Sept. 15 the Bd. of Trustees was authorized to obtain a temporary loan of $8,400 to pay for building a sewer in the Draper tract, and to complete the pumping and lighting plant, which is now being operated by steam.

East Washington, Pa.—Boro. Engr. McAdam has reported to the Boro. Council that 5,000 ft. of sewer will be necessary to complete the system, and he has been instructed to prepare plans for same.

North Braddock, Pa.—Press reports state that several thousand dollars are to be expended by this Boro. for sewering and paving the 1st Ward.

East Greensburg, Pa.—The Boro. Council has passed an ordinance authorizing the construction of a public sewer, and a branch sewer, 10, 8 and 6-in. pipe to be used. H. F. Seanor, Ch. Burgess.

Brooklyn, N. Y.—The following bids were opened Sept. 17 by J. Edw. Swanstrom, Boro. Pres., for constructing sewers in 60th St. from 14th Ave. to 19th Ave., etc., only the largest items being given: A, John J. Creem; B, James Malloy & Co.; C, Jas. H. Holmes & Co.; D, John McNamee:

	A	B	C	D
Brick sewer:				
162-in., 15 ft.	$65.50	$55.00	$31.00	$65.00
156-in., 4,015 ft.	61.50	55.00	31.75	53.00
144-in., 660 ft.	43.00	49.00	27.00	45.00
78-in., 60 ft.	20.00	21.00	15.00	20.00
30-in., 100 ft.	5.00	4.00	5.00	4.50
Vit. pipe:				
24-in., 100 ft.	5.00	3.50	3.75	4.00
18-in., 100 ft.	4.00	3.00	3.00	3.00
6 manholes "A"	400.00	900.00	150.00	500.00
7 manholes "B"	50.00	60.00	125.00	75.00
8 manholes "C"	35.00	65.00	75.00	35.00
Receiving basins, 16	100.00	100.00	87.00	95.00
Planking, 680 M. ft.	20.00	20.00	17.00	20.00
Sheeting, 2,300 M. ft.	.01	20.00	17.00	20.00

Lancaster, N. Y.—Surveys are being conducted for the purpose of establishing a road and sidewalk grade line and also preparatory to the building of a sewer and drainage system.

Atlanta, Ga.—Mayor Mims in a recent communication to the Council, recommends the issue of $400,000 bonds for the improvement of the sewer system by extending the various trunk sewers to the city limits.

Council Bluffs, Ia.—The Council has adopted resolutions for an 8-in. sewer in E. Pierce St., and for the construction of a sewer in Williams St.

Edgerton, Wis.—Edw. Ruger, of Janesville, Wis., is said to be making a survey for a sewerage system.

Columbus, O.—Local press reports state that City Engr. Julian Griggs has now completed plans for the West and South Side sewer sections of the main trunk system, and also of the central relief section covered by the $265,000 bond issue recently accepted by the sinking fund trustees.

Wapakoneta, O.—It is stated that bids are wanted Sept. 29 for constructing sewers in certain streets. C. E. Fisher, City Clk.

Cincinnati, O.—The Bd. of Pub. Service has decided to construct a sewer in Observatory road from Edwards road to Crawfish creek trunk sewer.

Venice, Ill.—Press reports state that the City Council has under consideration the question of issuing $50,000 bonds for the construction of a sewerage system.

Clay Center, Kan.—Citizens are considering the construction of a municipal system of sewers.

Indianapolis, Ind.—The Bd. of Pub. Wks. has adopted a resolution for a main sewer in the northeast part of the city, to be known as the Valley Ave. sewer; said sewer, which will be 1¾ miles in length, will begin with 12-in. pipe and will connect with 14th St. sewer at a diameter of 4½ ft., 3-ring brick. Total estimated cost, $30,000.

Newton, Ia.—The City Council has been petitioned for the construction of 2 sewers.

Fairfield, Wis.—J. B. Ashley, of Baraboo; Mr. Palmer, of Fairfield, and A. J. Turner, of Portage, have been appointed by Judge Siebecker as a Comn. to examine and report upon the practicability of draining the marsh bordering on Leach Creek, in Fairfield, Sauk Co., and a tract in Caledonia, Columbia Co.; the district embraces some 6,500 acres.

Kaukauna, Wis.—Local press reports state that this city is soon to build an addition to its sewer system in the 2d Ward, which is likely to cost $15,000.

Sebring, O.—The County Comrs., Youngstown, have decided to make a survey for a large drain or open sewer for this village.

Lansing, Mich.—City Engr. H. A. Collar writes that the construction of a sewer 12,255 ft. long is proposed; the size to vary from pipe 15-in. in diameter to oval form, of brick 48x62 ins.; said sewer will absorb a creek that flows through the northwestern part of the city. Probable cost, $51,500.

Marshalltown, Ia.—The City Council has ordered the construction of a sewer in the First Ward.

Green Bay, Wis.—Sewer bonds to the amount of $50,000 were recently sold by the City Council.

Portland, Mich.—Village Clk. D. F. Goss writes that pipe sewers are to be laid. W. F. Sellick, Chmn. of Street Com.

Ironton, O.—Bids are wanted Oct. 2 for constructing several sewers in Dist. No. 4. Geo. H. Davies, City Clk.

Glenville, O.—Bids will be received by B. F. Davies, Jr., Village Clk., until Oct. 4 for constructing main storm water sewers in portions of several streets.

Akron, O.—Bids are wanted Sept. 27 for constructing local sewers in several streets; also until Oct. 11 for constructing a main trunk sewer in and through districts Nos. 3 and 10, including catch basins, manholes, ventilators, etc. Chas. H. Isbell, Clk. Bd. City Comrs.

Jeffers, Minn.—Bids will be received by the Village Council until Sept. 25 for constructing a sewer in this village. M. N. Rivers, Village Recorder.

Massillon, O.—Bids will be received by the Sewer Comrs. until Sept. 27 for furnishing material and constructing sanitary sewers in Duncan and Walnut Sts. Orlando C. Volkmor, Clk.

Bucyrus, O.—Bids are wanted Sept. 25 for constructing sewers in portions of East Warren and West Warren Sts. C. P. Bryant, City Engr.

Youngstown, O.—Columbiana and Mahoning Counties have under consideration plans for the construction of a drainage canal about 5 miles long. Estimated cost, $100,000. J. A. Brooks, of East Liverpool, is one of the Comrs. for Columbiana Co., and J. W. Van Auken, of Youngstown, is one of the Comrs. for Mahoning Co.

St. Louis, Mo.—The following bids were opened Sept. 16 by the Bd. of Pub. Improv., R. P. Garrett, Engr., for constructing joint district sewers in Rock Spring Joint Sewer Dist.:

Items and Quantities.	Hill-O'Meara Con. Co.	Heman Con. Co.
Earth excav., 40,000 cu. yds.	$.68	$.65
Loose rock excav., 600 cu. yds.	2.50	3.00
Solid rock excav., 200 cu. yds.	4.00	4.00
Quicksand excav., 10 cu. yds.	5.00	10.00
Extra earth furnished, 10 cu. yds.	.60	.50
Class "A" concrete, 10 cu. yds.	8.00	7.00
Class "B" concrete, 270 cu. yds.	7.00	6.00
Class "C" concrete, 600 cu. yds.	6.00	6.00
Rubble stone mas., 10 cu. yds.	6.00	6.00
Br. masonry, 6,800 cu. yds.	9.75	10.00
Vit. br. masonry, 530 cu. yds.	12.00	13.00
6-in. pipe sewers, 50 lin. ft.	.25	.20
9-in. pipe sewers, 10 lin. ft.	.40	.30
12-in. pipe sewers, 10 lin. ft.	.45	.40
15-in. pipe sewers, 10 lin. ft.	.50	.50
18-in. pipe sewers, 10 lin. ft.	.75	.70
21-in. pipe sewers, 10 lin. ft.	.95	1.00
24-in. pipe sewers, 10 lin. ft.	1.50	1.00
Junction in br. sewers, 230 pieces	.80	1.00
Cast iron, 7,500 lbs.	.03½	.03
Wrought iron, 2,000 lbs.	.04½	.04
Lumber in trench, 100 M. ft. B. M.	27.00	30.00
Timber found., 1 M. ft. B. M.	37.00	40.00
Drain pipes, 1,000 lin. ft.	.30	.50
Totals	$111,477	$113,069

Burlington, Ia.—City Engr. E. Steece writes that the City Council has ordered South and West Hill sewer system, 10¼ miles, tile and brick; North Oak system, 2 miles; Central Ave. and Arch St. sewer, 2,000 ft.

Monmouth, Ill.—Bartlett & Kling, of Galesburg, Ill., on Sept. 13 were awarded the contract for sewage disposal plant, including septic tank (bids opened Aug. 30.).

Girard, O.—City Clk. E. L. Hauser writes that the Council is asking for plans and specifications for a sewerage system and disposal plant.

Decatur, Ind.—Bids are wanted Oct. 1 for constructing tile sewers in several streets. D. M. Hower, City Clk.

Nashville, Tenn.—A bill is before the City Council to appropriate $73,000 to extend the Edgefield branch sewer.

Honey Grove, Tex.—The question of establishing a $6,000 sewer system is said to be under consideration.

Toronto Junction, Ont.—The Town Council is said to be considering plans prepared by R. E. Speakman for sewage disposal.

Toronto, Ont.—The City Engr. is said to recommend the installation of a separate sewerage system for the East End Dist. Estimated cost, $40,000.

BRIDGES.

Harmony, Pa.—Press reports state that the Engineering Dept. of the B. & O. R. R. will shortly begin the building of 3 highway bridges in this city, on the Plattsburg Div. J. M. Graham, Ch. Engr., Baltimore, Md.

Springfield, Mass.—John A. Bennett, of Boston; Geo. H. Mellen, of Newton, and Geo. W. Bishop, of Athol, have been appointed as a R. R. Commission to act in the matter of alteration to bridges over the Boston & Maine tracks at Plainfield St. and the Berkshire St. bridge across Boston & Albany tracks.

West Hartford, Conn.—Town Clk. Henry C. Whitman writes that on Sept. 10 it was voted to construct a bridge across Trout Brook on Fern St.; cost of bridge and approaches, $4,090.

Reading, Pa.—The Viewers have reported to the Court recommending the building of a steel bridge across Schuylkill River at 6th St., to have a 20-ft. roadway, 5-ft. walks, with plank flooring, and consist of 2 spans, one 190 ft. long, the other 130 ft. long; estimated cost, $75,000.

Erie, Pa.—The City officials have received an offer from the Pittsburg & Eastern R. R. Co. to contribute $20,000 toward the construction of a bridge, provided the structure is placed at the Buffalo road crossing.

New Orleans, La.—Geo. G. Earl, Gen. Supt. Sewerage and Water Bd., writes that all bids opened Aug. 12 for sewers were rejected Sept. 3. A summary of the bids follows and the detailed bid of Contract B is given in the accompanying table:

	Estimated value.	Thos. F. Moore & Co., Syracuse, N. Y.	John Dowdle, New Orleans.	The U. S. Const. Co., Milwaukee, Wis.
Contract A	$490,710	$608,878.40	$700,428.50	....
Contract B	556,262	715,521.80	714,549.25	$813,325.05
Contract C	594,397	882,141.45	886,891.75	863,706.85

Items and Quantities.	John Dowdle, New Orleans.	Thos. F. Moore & Co., Syracuse, N. Y.	The U. S. Const. Co., Milwaukee, Wis.
Circular brick sewers:			
5-ft. 6-in., 17.3 to 20.3 ft. deep, 2,660 ft.	$27.50	$29.22	$30.50
5-ft. 3-in., 17.0 to 18.0 ft. deep, 250 ft.	24.60	26.90	27.65
5-ft. 0-in., 16.0 to 17.0 ft. deep, 750 ft.	23.00	14.05	26.45
4-ft. 9-in., 13.7 to 16.3 ft. deep, 1,710 ft.	17.00	19.85	23.75
4-ft. 6-in., 12.0 to 13.5 ft. deep, 1,280 ft.	14.90	18.44	18.20
4-ft. 3-in., 11.5 to 12.5 ft. deep, 1,050 ft.	14.65	17.06	17.15
4-ft. 0-in., 19.0 to 20.0 ft. deep, 690 ft.	18.40	21.20	21.60
3-ft. 9-in., 18.0 to 19.5 ft. deep, 1,520 ft.	16.50	17.66	20.85
3-ft. 6-in., 17.0 to 18.0 ft. deep, 1,140 ft.	14.20	15.10	17.60
3-ft. 3-in., 16.0 to 17.5 ft. deep, 1,560 ft.	13.70	14.44	21.48
36-in., 14.0 to 16.5 ft. deep, 1,380 ft.	12.25	12.25	16.20
27-in., 17.0 to 19.0 ft. deep, 600 ft.	11.80	13.96	13.70
27-in., 11.0 to 13.5 ft. deep, 1,385 ft.	9.70	9.77	10.60
Pipe sewers:			
36-in. double strength, 14.0 to 16.0 ft. deep, 1,380 ft.	12.60	10.00	14.20
27-in., 10.0 to 12.0 ft. deep, 600 ft.	8.60	5.27	9.87
27-in., 12.0 to 14.0 ft. deep, 1,000 ft.	9.60	6.55	10.98
27-in. double strength, 14.0 to 16.0 ft. deep, 100 ft.	9.95	7.25	11.00
27-in. double strength, 16.0 to 18.0 ft. deep, 350 ft.	10.60	8.32	12.60
27-in. double strength, 18.0 to 20.0 ft. deep, 300 ft.	11.90	9.11	13.20
24-in., 6.0 to 8.0 ft. deep, 950 ft.	5.15	3.61	6.90
24-in., 8.0 to 10.0 ft. deep, 700 ft.	5.15	3.89	6.80
24-in., 10.0 to 12.0 ft. deep, 800 ft.	6.35	4.84	7.45
24-in., 12.0 to 14.0 ft. deep, 100 ft.	7.65	5.16	8.27
24-in. double strength, 14.0 to 16.0 ft. deep, 1,100 ft.	7.80	5.79	8.40
24-in. double strength, 16.0 to 18.0 ft. deep, 350 ft.	9.50	6.16	10.37
21-in., 10.0 to 12.0 ft. deep, 3,250 ft.	6.95	3.56	7.64
21-in., 12.0 to 14.0 ft. deep, 950 ft.	7.20	4.00	7.90
21-in. double strength, 14.0 to 16.0 ft. deep, 100 ft.	6.85	4.69	7.65
18-in., 8.0 to 10.0 ft. deep, 100 ft.	4.00	2.44	4.54
18-in., 10.0 to 12.0 ft. deep, 750 ft.	4.70	2.94	5.15
18-in., 12.0 to 14.0 ft. deep, 3,200 ft.	6.00	3.31	6.75
18-in. double strength, 14.0 to 16.0 ft. deep, 100 ft.	7.15	4.69	7.92
15-in., 8.0 to 10.0 ft. deep, 1,700 ft.	3.60	1.89	3.70
15-in., 10.0 to 12.0 ft. deep, 2,750 ft.	4.20	2.37	4.10
15-in., 12.0 to 14.0 ft. deep, 100 ft.	5.40	2.87	4.80
12-in., 6.0 to 8.0 ft. deep, 100 ft.	2.90	1.46	2.86
12-in., 8.0 to 10.0 ft. deep, 2,400 ft.	3.26	1.78	3.52
12-in., 10.0 to 12.0 ft. deep, 1,400 ft.	3.80	2.46	3.40
10-in., 6.0 to 8.0 ft. deep, 100 ft.	2.85	1.64	2.61
10-in., 8.0 to 10.0 ft. deep, 1,450 ft.	2.15	2.01	1.90
10-in., 10.0 to 12.0 ft. deep, 650 ft.	3.62	2.45	3.60
8-in., 0.0 to 6.0 ft. deep, 28,300 ft.	1.00	1.18	1.07
8-in., 6.0 to 8.0 ft. deep, 75,100 ft.	1.25	1.61	1.32
8-in., 8.0 to 10.0 ft. deep, 20,800 ft.	1.40	2.13	1.46
8-in., 10.0 to 12.0 ft. deep, 1,000 ft.	3.05	2.62	2.80
6-in. stand pipe, 4,000 ft.	.10	.10	.10
Manholes under 8 ft. in depth, 200	63.00	56.00	67.00
Over 8 ft. and under 10 ft., 60	74.00	62.25	81.00
Over 10 ft. and under 12 ft., 20	93.00	74.75	102.50
Over 12 ft., 20	110.00	81.00	117.00
Manholes on main sewers, 60	130.00	50.00	139.75
Flush tanks, 130	75.00	98.75	82.65
Extra concrete, Grade A, 450 cu. yds.	8.90	8.10	8.70
Grade B, 50 cu. yds.	7.00	7.79	6.90
Grade C, 1,200 cu. yds.	6.50	5.23	6.44
Extra brickwork, Port. cement mortar, 275 cu. yds.	12.00	12.50	12.80
Extra excavation over 16 ft. deep, 100 cu. yds.	1.30	.94	1.57
Under 16 ft. deep, 100 cu. yds.	1.15	.75	1.38
Excavation for pumping stations, 2,000 cu. yds.	1.00	1.25	1.05
Pavements relaid: Asphalt, 650 sq. yds.	4.00	3.75	4.50
Belgian block, 390 sq. yds.	.85	1.25	1.30
Cobble stone, 970 sq. yds.	.95	.63	1.10
Gravel, 10,000 sq. yds.	1.00	.63	1.25
Shell, 300 sq. yds.	1.25	1.25	1.20
Plank pavement, 900 lin. ft.	.35	1.56	.60
Banquette pavements: Schillinger, 1,250 sq. yds.	1.85	2.50	1.75
Brick, 2,350 sq. yds.	.90	.75	1.20
Flagging, 65 sq. yds.	1.25	.75	1.15
Round piling, 7,000 lin. ft.	.55	.94	.57
Decking, per thousand ft. B. M., 27,000 ft. B. M.	30.00	50.00	46.00
Lumber under brick sewers, 250,000 ft. B. M.	30.00	50.00	38.50
Lumber under pipe sewers, 80,000 ft. B. M.	15.00	15.00	15.00
Sheeting and bracing, 75,000 ft. B. M.	10.00	10.00	10.00
Sheeting and bracing at pumping station, 60,000 ft. B. M.	38.00	50.00	40.00
Cinders under sewers, 600 cu. yds.	2.25	1.88	2.20
Oyster shells under sewers, 600 cu. yds.	2.35	1.75	2.30
Sand under sewers, 600 cu. yds.	2.25	1.75	2.45
Gravel under sewers, 100 cu. yds.	2.25	1.75	2.45
Steel, 2 tons	120.00	150.00	110.00
Castings, 1 ton	100.00	250.00	102.00
Cast iron pipe, 8 tons	67.50	50.00	86.00
Duct in crown brick sewer, 40,000 ft.	.45	.32	.48
Duct in trench with pipe sewer, 8,000 ft.	.75	.75	.78
Curb reset, 200 lin. ft.	.50	.33	.63
Dirt buckets, 130	5.00	2.50	3.00
5-in. flushing siphons, 130	24.00	40.00	26.00
Back fill at pumping stations, 150 cu. yds.	.50	.63	.65
Crossing Drainage Canal	4,000.00	1,500.00	4,750.00
Totals	$714,549.25	$715,521.80	$813,325.05

Center Rutland, Vt.—The Selectmen have decided to call a town meeting Sept. 22 to decide the matter of contributing 40 per cent. of the cost (estimated at $4,500) of constructing a combination bridge for highway and track purposes in this city. The Rutland St. Ry. Co. has offered to pay the remaining 60 per cent. W. W. Wilkins, Chmn. Selectmen; David Fox, Mgr., Rutland St. Ry. Co., Rutland.

Albany, N. Y.—Deputy Supt. of Pub. Wks. Winslow M. Mead writes that the contract for constructing a bridge over Allegany River, on Allegany Indian Reservation, in the town of South Valley, has been awarded to Wm. H. Schmidt, of Buffalo, N. Y., for $25,311.

Harrison, N. J.—See "Railroads."

Boston, Mass.—The abutments of the Wellington bridge are about completed and it is stated that the Metropolitan Park Comrs. will be ready in a short time to receive bids for constructing the bridge and the draw.

Baltimore, Md.—Road Engr. W. W. Crosby recommends the building of a steel bridge across Georges Run, on Beckleysville Road, which will replace present wooden structure.

Hartford, Ind.—The Co. Comrs. of Blackford and Grant Cos. have agreed to build a joint county bridge across Walnut Creek, east of Hartford.

Washington, Ind.—The Co. Council has appropriated $3,500 to aid in the building of an iron bridge across White River, west of this city; $10,000 has been voted for this bridge, and $1,500 raised by subscription. The cost of the construction (contract for which is to be awarded in the near future) is not to exceed $15,000.

Three Rivers, Mich.—Jackson Bros., of this city, are reported to have secured the contract to construct a bridge across St. Joseph River for $14,900, the city to do all the filling. The bridge is to consist of 5 concrete arches, 3 40-ft. and 2 20-ft. long.

Hinckley, Minn.—A petition is in circulation to vote bonds for a bridge across Kettle River.

Huron, O.—It is stated that the officials of the Lake Shore Electric Ry. have submitted to the War Dept. at Washington, plans and specifications for a swing bridge to be built across Huron River, in this city, at a cost of $25,000. B. Mahler, Pres., Cleveland, O.

East Grand Forks, Minn.—Bids will be received by the City Council until Oct. 7 for constructing 2 approaches for the proposed bridge across Red Lake River, between Washington and Michigan Aves. Henry Harm, City Recorder.

Frankfort, Ind.—Bids will be received by the Bd. of Co. Comrs. until Oct. 6 for constructing several bridges, including a steel truss bridge, a stone brick arch, and a stone arch bridge. Address Co. Aud.

Watertown, Wis.—C. T. Loweth, Engr. & Supt. Bridges & Bldgs., Chicago, Milwaukee & St. Paul Ry., Chicago, Ill., writes that said company proposes to build at Watertown, across Rock River, an arch of cut stone backed with concrete; work to be done by the Ry. Co. A. G. Bennett, of Watertown, Engr. in Charge.

Halo, O.—It is stated that a petition is being circulated for the extension of the Boulevard from Halo to Akron city limits. Should this be done it would necessitate the building of a viaduct across the canal in this city.

St. Bernard, O.—The Bd. of Control has granted the Miami & Erie Canal Transportation Co. permission to raise and lengthen the bridges over the canal from St. Bernard to Butler Co. line.

Gas City, Ind.—Press reports state that the construction of a bridge is being considered. Probable cost, $12,000.

Kansas City, Mo.—The construction of an $85,000 viaduct at Guinotte and Lydia Aves. by the Missouri Pacific and Alton railroads, the Metropolitan St. Ry. Co. and the city, is being considered.

Marion, Ia.—The Co. Bd. of Superv. has been petitioned to construct a bridge across Cedar River, at what is known as Upper Palisades.

Peoria, Ill.—It is stated that the City authorities may employ an expert to estimate the cost of constructing a wagon bridge in this city.

Mason City, Ia.—The building of a stone bridge across Willow Creek at State St. is being considered.

Jonesboro, Ind.—The Co. Council has appropriated $14,000 for a bridge across Mississinewa River above Jonesboro, in Mill Township.

Huntington, Ind.—The Co. Comrs. have surveyed the Wabash River bridge on Warren Road, with a view to the building of a structure which will accommodate both wagon traffic and traction cars.

Canton, O.—Bids will be received by the Co. Comrs. until Oct. 11 for constructing a bridge at Linden Ave., having a 50-ft. span and 50 ft. wide.

Indianapolis, Ind.—It is stated that bids are wanted Oct. 8 for constructing a bridge across Eagle Creek. Harry B. Smith, Co. Aud.

Chillicothe, O.—The Co. Comrs. have decided to build a bridge across Haynes Ford, in Paint Creek, to have a 140-ft. span.

Stephenson, Mich.—The Co. Road Comrs. are reported to be considering the building of an iron bridge in this town.

Nevada, Ia.—Local press reports state that an agreement has been reached between the city and the officials of the Des Moines, Iowa Falls & Northern Ry. whereby a steel bridge is to be built where said railroad crosses the highway at Indian Creek.

Lawton, Okla. Ter.—Press reports state that the Secy. of the Interior, at Washington, D. C., has approved the building of 10 bridges in Comanche County.

Hillsboro, Tex.—See "Paving and Roadmaking."

Everett, Wash.—City Engr. Boyle recommends that a $50,000 steel bridge replace the condemned Everett Ave. structure. Maj. Mills, Corps Engrs., U. S. A., recommends that it be constructed 175 ft. further up stream.

Cottage Grove, Ore.—The Co. Comrs. have ordered the building of a wagon bridge at Cottage Grove.

Caldwell, Idaho.—City Clk. Edgar Meek writes that the contract for building a 352-ft. bridge across Fayette River has been awarded to Pueblo Bridge Co., Pueblo, Colo., for $39,980.

PAVING AND ROADMAKING.

Ebensburg, Pa.—Bonds to the amount of $11,000 for street improvements, are reported to have been voted at a recent election.

Freehold, N. J.—The Monmouth Co. Bd. of Chosen Freeholders has adopted a resolution authorizing the Com. on Freehold and Eatontown road to have a plan, maps and survey made, with estimates of cost for building a macadam road. Engr. Forman of said Bd. has placed the estimated cost of building the Manalapan and Freehold road of macadam (total length 6.30 miles) at $47,495; maps, etc., for this road have been referred to the State Road Comr. for his approval.

Morristown, N. J.—The County and Town Road Committees have decided to macadamize a portion of James St.; the county to pay for the 12 ft. strip in the center of the road.

Jersey Shore, Pa.—The proposition to issue $28,000 street improvement bonds is reported to have carried.

Brooklyn, N. Y.—Bids are wanted Oct. 1 for regulating and repaving with asphalt on portions of 3 streets, in all 12,971 sq. yds.; also for regulating, regrading and repaving with granite (12,690 sq. yds.) on a sand foundation the roadway of Varick Ave.; also for regulating, grading, curbing and laying cement sidewalks, in all about 48,120 sq. ft. of cement sidewalk. J. Edw. Swanstrom, Boro. Pres.

Ilion, N. Y.—City Engr. J. D. Ringwood writes that the contract for brick paving (bids opened Sept. 10) has been awarded to W. T. O'Connor, of Syracuse, at $2.30 per sq. yd. for Mack brick; total, $7,246.

West Hartford, Conn.—Town Clk. Henry C. Whitman writes that it was voted on Sept. 10 to provide for macadamizing a portion of Fairview St.

Troy, N. Y.—City Engr. E. R. Cary writes that on Sept. 9 the contract for improving 2d Ave. was awarded to P. H. Dumary & Co., Albany, N. Y., at the following prices: 34,750 sq. yds. of brick pavement on 6-in. concrete, at $2.17, $75,207; 24,500 sq. yds. of brick pavement on 8-in. concrete, at $2.23, $54,635; 26,250 ft. of curb, at 87½ cts.; 1,000 ft. old curb reset, at 35 cts.; 1,250 ft. old bridging relaid, at 45 cts.; 32 catch basins, at $95; 30 truck basins, at $14.50; 22 old catch basins repaired, at $40; total, $158,308.

Brooklyn, N. Y.—Bids will be received until Sept. 24 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and constructing cement concrete sidewalks, requiring in all about 76,457 sq. ft.; also for furnishing material and flagging sidewalks in various parts of the Borough, requiring in all about 61,670 sq. ft. of bluestone flagging.

Pittsburg, Pa.—Bids will be received by W. E. Thompson, Co. Compt., until Oct. 4 for the permanent improvement of certain county roads.

Pittsburg, Pa.—Bids are wanted Oct. 1 for grading and curbing on several streets; for paving with asphalt on portions of numerous streets; for grading, paving and curbing with block stone on portions of numerous streets. Total estimated cost about $425,000. J. Guy McCandless, Dir. Dept. Pub. Wks.

New York, N. Y.—The contract for work on the Grand Boulevard and Concourse, from E. 161st St. to Mosholu Parkway, Boro. of Bronx, was awarded Sept. 4 to the Uvalde Asphalt Co., 1 Bway., their bid submitted Aug. 20 being as follows: Earth excavation, 298,000 cu. yds., 27.5 cts.; rock excavation, 402,000 cu. yds., $1.08; filling, 603,000 cu. yds., .5 cts.; select filling, 14,600 cu. yds., 30 cts.; 18-in. pipe, 1,000 lin. ft. $1.25; 12-in. pipe, 4,000 lin. ft., $1; dry rubble, 12,000 cu. yds., $1.25; masonry in arch, 3,950 cu. yds., $10; ringstones, 2,500 cu. ft., $2; brick work, 2,155 cu. yds., $14; parapet walls, 4,525 cu. ft., $1; coping and corbels, 5,060 cu. ft., $2; coping on parapet, 2,030 cu. ft., $3; pedestals, 1,150 cu. ft., $3; Random range ashlar, 14,100 cu. ft., $6; rubble, 1,860 cu. yds., $4; concrete, 2,100 cu. yds., $4; waterproofing 1,900 sq. yds., 70 cts.; piles, 26,500 lin. ft., 20 cts.; new curb, 39,500 lin. ft., 65.5 cts.; old curb, 3,650 lin. ft., 10 cts.; new flag, 308,800 sq. ft., 22 cts.; old flag, 14,000 sq. ft., 3 cts.; new bridgestone, 24,100 sq. ft., 61 cts.; old bridgestone, 3,550 sq. ft., 10 cts.; macadam, 128,000 sq. yds., 60 cts.; bicycle path, 42,000 sq. yds., 40 cts.; gutters, 33,300 sq. yds., $1.31; lumber, 65,000 ft., B. M., $10; 42-in. circular sewer, 170 lin. ft., $1,520; catch basins, 60, $60 each; guard rail, 4,800 lin. ft., 90 cts.; guard rail 2,900 lin. ft., $1.75; total, $1,011,323.

Buffalo, N. Y.—Bids are wanted Sept. 30 for paving a portion of Sobieski St. Francis G. Ward, Comr. of Pub. Wks.

New York, N. Y.—Bids were opened Sept. 18 by Thos. W. Hynes, Comr. of Dept. of Correction, for building a sidewalk at the City Prison Tombs as follows: John R. Sheehan & Co., $14,500; and P. J. Carlin & Co., $12,000.

Windsor Locks, Conn.—Bids will be received by the Bd. of Selectmen until Sept. 24 for constructing a macadam and telford road in this town. Leslie C. Seymour, 1st Selectman.

Atlantic City, N. J.—It is stated that bids are wanted by the City Clk. until Sept. 25 for repairing sidewalks; work in part consists of 20,000 sq. ft. of cement sidewalks to be laid, 5,000 sq. ft. of old paving brick or block to be relaid, 20,000 sq. ft. of bluestone flagging, 500 cu. yds. of filling, 500 cu. yds. of excavation, etc. J. W. Hackney, City Engr.

Nutley, N. J.—Bids are wanted Sept. 24 for constructing telford and macadam road pavement on portions of several streets. Jas. Gilmore, Chmn. Town Council; Frank T. Shepard, Town Engr.

Swissvale, Pa.—Bids will be received until Sept. 25 by C. B. Judd, Boro. Engr., 1211 Park Bldg., Pittsburg, for grading, curbing and paving portions of several streets in this Borough.

Charlottesville, Va.—The City Council has voted to submit to the people at the election to be held Nov. 4, the proposition to issue $80,000 street improvement bonds.

Boston, Mass.—Bids will be received by the Schoolhouse Comn. until Sept. 25 for grading and paving the grounds around the South Boston High School, Thomas Park, South Boston. R. Clipston Sturgis, Chmn.

North Braddock, Pa.—See "Sewerage and Sewage Disposal."

Harrisburg, Pa.—The Common Council has passed the ordinance providing for the paving of numerous streets.

Towson, Md.—Bids will be received by the Baltimore Co. Comrs. until Oct. 1 for building about 5 miles of road, known as Park Heights Ave., 3d Dist. Engr.'s estimate: 17,000 cu. yds. of excavation, including all grubbing and clearing; 10 cu. yds. of masonry, laid dry; 80 cu. yds. of cement masonry, 540 lin. ft. of 12 to 24-in. vitrified clay pipe, etc. W. W. Crosby, Co. Roads Engr.

Indianapolis, Ind.—Local press reports state that the following bids were received Sept. 10 for resurfacing with asphalt a portion of Massachusetts Ave: Western Construction Co. at $5.36 per lin. ft., total $23,187; Barber Asphalt Paving Co., $5.94, total $25,716; Marion County Const. Co., $4.24, total $18,342.

Toledo, O.—Local press reports state that the County Comrs. have rejected bids on the Holland and Brown stone roads; the work, which it is said involves an expenditure of about $100,000, will be indefinitely postponed.

St. Paul, Minn.—The Bd. of Pub. Wks. has agreed upon a favorable report on the macadamizing of Concord St. for a distance of 7 blocks. Estimated cost, $10,093 if granite is used or $9,725 if paved with limestone.

Columbus, Ind.—Bids will be received by the Bd. of Co. Comrs. until Oct. 6 for constructing about 3½ miles of free gravel road in Wayne Township. Sam. W. Fitch, Co. Aud.

Iowa City, Ia.—The Council is reported to have adopted a resolution to issue $14,274 College St. paving bonds.

Alton, Ill.—The City Council has passed an ordinance for the paving of Bluff St. with brick.

Massillon, O.—City Clk. T. H. Seaman writes that the following bids were opened Sept. 10 for about 17,000 sq. yds. of paving: *a*, paving, per sq. yd.; *b*, labor; c, new curb, per lin. ft.; *d*, old curb (4,900 lin. ft.) reset: Ohio Bituminous Macadam Co., Cleveland, O., *a* $1 for bit. macadam, *b* $1.10, *c* 40 cts., *d* 25 cts.; Weible, Schatt & Vogt, Massillon, O., *a* $1.68 for asphalt blocks, labor $1, or 73½ cts. for brick, labor 75 cts.; *c* 20 cts., *d* 15 cts.; Dine & Corl, Canton, O., *a* 70 cts. for brick, *b* 55 cts., *c* 25 cts., *d* 20 cts.; Geo. S. Hering & Son, Mansfield, O., *a* $1.56 for asphalt block, labor 73 cts., or 63 cts. for brick, labor 76 cts.; John B. Snyder, Massillon, O. (awarded), *a* 78 cts. for brick, *b* 36 cts., c 40 cts., *d* 20 cts.

Chicago, Ill.—Bids are wanted Sept. 24 for constructing sundry public improvements, including drains, sewers, paving, cement walks, etc. John H. May, Secy.

Boone, Ia.—City Engr. Chas. E. Russell writes that sundry streets have been ordered paved, approximately 10,000 sq. yds. brick paving with concrete curb. Bids will be received late this year and the work done early next year.

Cincinnati, O.—Bids are wanted Oct. 20 for $200,000 bonds, the proceeds of said bonds to be used to resurface, repair or improve existing streets or highways in the city. Edwin Henderson, City Clk.

Newark, O.—Bids will be received by F. T. Maurath, City Clk., until Oct. 13 for furnishing material and excavating, preparing foundation, and paving with brick on a portion of Elm St.

Leavenworth, Kan.—City Clk. M. A. Przybylowicz writes that the contract for improving 4th St. (bids opened Sept. 3) was awarded Sept. 12 to Chapin & Greeve, of Leavenworth, at 30 cts. per cu. yd. for regrading, 48.9 cts. per lin. ft. for curbing and $1.469 per sq. yd. for 19,063 sq. yds. of paving.

Moline, Ill.—City Engr. H. G. Paddock writes that the contract for 7,412 sq. yds. of asphalt paving, with 4,577 ft. of curbing, on 5th and 7th Sts. (bids opened Sept. 12) has been awarded to the Barber Asphalt Paving Co., of Chicago, Ill., for $18,985; also the contract for paving a portion of 11th St. for $2,868.

Marshalltown, Ia.—City Engr. Wm. Bremner writes that the following bids were opened Sept. 8 for 9,950 sq. yds. of asphalt paving. Bidders: A, Barber Asphalt Paving Co. (awarded); B, Western Paving & Supply Co., Indianapolis, Ind.:

Items.	A	B
Paving on old macadam	$1.80	$1.88
Paving on concrete	1.97	2.25
Curbing	.42	.43
Combined curb and gutter	.65	.43
Totals	$18,640	$19,600

Chippewa Falls, Wis.—The City Council is said to have received specifications for paving Bridges St. with brick at $50,634.

Kenosha, Wis.—City Clk. Gus. Jacob writes that the contract for paving on Main and N. Main St. (bids opened Sept. 13), has been awarded to A. E. Rutledge & Co., Rockford, Ill., at their bid of $1.48 per sq. yd. for paving with Purington Galesburg brick, and 46 cts. per lin. ft. for sandstone curb; total, $9,752.

Milwaukee, Wis.—Bids will be received by the Bd. of Pub. Wks. until Sept. 23 for grading and macadamizing portions of several streets; also for cement curbing on portions of several other streets. Chas. J. Poetsch, Chmn.

Bedford, Ind.—It is stated that bids are wanted Sept. 27 for constructing about 14 miles of roads in Shawswick Township. John M. Gainey, Co. Aud.

Pontiac, Mich.—Bids will be received by the Common Council until Sept. 29 for 4,850 sq. yds. of paving on East Pike and West Pike Sts. Wm. J. Fisher, City Engr.

Green Bay, Wis.—Bids are wanted Sept. 25 for 2,485 sq. yds. of macadam pavement and 13,600 lin. ft. of combined cement curb and gutter. Address Frank E. Murphy.

Decatur, Ind.—Bids are wanted Oct. 1 for macadamizing 2 streets and for paving with brick on 1 street. D. M. Hower, City Clk.

Des Moines, Ia.—Bids are wanted Oct. 6 for paving with asphalt on several streets, in all about 49,672 sq. yds. J. E. Stout, Chmn. Bd. Pub. Wks.

Nevada, Mo.—Bids are wanted Sept. 30 for paving with brick on a portion of East Cherry St. Geo. L. Stump, City Clk.

Bluffton, Ind.—The City Council has rejected all bids for the paving of Cherry St., and new bids will be asked.

St. Paul, Minn.—The City Engr. has been directed to provide plats for the proposed boulevard along the Mississippi River bank for a distance of 5 miles. Probable cost about $8,000 per mile.

Burlington, Ia.—City Engr. E. Steece writes that the City Council has ordered 12,000 sq. yds. of brick paving.

Ft. Worth, Tex.—Steps are being taken by the City Council to pave Houston St. with asphalt or vitrified brick. John B. Hawley, City Engr.

Baton Rouge, La.—The Police Jury is said to have appropriated $5,000 for a road working outfit.

Nashville, Tenn.—The City Council has passed on second reading the bill appropriating $2,200 for the purchase of a portable stone crusher.

A bill before the Council provides for the appropriation of $5,000 for the paving of a portion of Market St.

Louisville, Ky.—Local press reports state that the Bd. of Pub. Wks. has awarded contracts amounting to about $15,000 for asphalt paving in Transit Ave., Elwood and Woodbine Sts., to the R. B. Parks Co., of Louisville, at an average of $1.52 per sq. yd.

Hillsboro, Tex.—The proposition to issue $40,000 bonds for paving and bridge work in this county is reported to have carried at the recent election.

New Orleans, La.—The City Council has adopted ordinances providing for the paving of portions of St. Charles St., Howard Ave., Bourbon and Toulouse Sts. with asphalt; also for the repaving of a portion of Canal St.

Memphis, Tenn.—Local press reports state that contracts for paving 13 streets with asphalt have been awarded, the Memphis Asphalt & Paving Co. receiving two-thirds of the work and the Southern Paving & Const. Co. the remainder. For bids received see The Engineering Record of Sept. 13.

Great Falls, Mont.—City Engr. C. W. Swearingen writes that it is proposed to grade and boulevard 8th Ave. N., approximate cost $6,500; also 2d Ave., approximate cost $5,000.

Omaha, Neb.—The contract for paving E. Pierce St. is stated to have been awarded to Jas. Wickham at $1.89 per sq. yd. for Galesburg block on concrete base; curbing to Nelson & Okon at 29 cts. cash or 31 cts. certificates.

Spokane, Wash.—The contract for paving a portion of Main Ave. with asphalt is stated to have been awarded to the Barber Asphalt Paving Co., as follows: Concrete, $7.85 per cu. yd.; wearing surface, 98 cts. per sq. yd.; asphalt binder, 40 cts. per sq. yd.; brick gutters, $3.10 per sq. yd.; granite curbs, 45 cts. per lin. ft.; general excavation, 60 cts. per cu. yd.; sewer excavation, 80 cts. per cu. yd.; cement mortar, $19.40 per cu. yd.; catch basins, $27.50 each; surface inlets, $15 each; curb inlets, $17.50 each; 8-in. pipe, 60 cts. per ft.; 10-in. pipe, 80 cts. per ft.; sewer pipe bends, 10-in., $1 each. Total, $67,333; maintenance for a period of 10 years, $6,700.

San Diego, Cal.—City Engr. de Hemecourt has made surveys for a system of boulevards over 26 miles in length; he estimates the total cost at about $51,800.

Denver, Colo.—The contract for grading, curbing and macadamizing S. 14th St. has been awarded to the Western Realty & Paving Co. for $20,904.

Montclair, Colo.—Bids are wanted Sept. 25 for grading and paving with macadam on a portion of Colfax Ave. Arthur B. Stark, Town Clk.

Toronto, Ont.—Among the improvements recommended by City Engr. Rust are asphalt paving on Bathurst St. to cost $38,555 and on Elm Ave. to cost $4,455.

POWER PLANTS, GAS AND ELECTRICITY.

Enfield, Conn.—The Enfield Electric Light & Power Co. is reported to be preparing to enlarge its plant on Central St. It is probable that an additional 250-H.-P. engine and boilers will be put in.

New York, N. Y.—Bids are wanted Sept. 24 for furnishing material and extending and improving the fire alarm telegraph system; security, $7,500. Thos. Sturgis, Fire Comr.

Huntington, N. Y.—The Huntington Light & Power Co. has been incorporated to furnish gas and electricity for light, heat and power purposes in Huntington and vicinity; capital, $75,000. Directors: Willard N. Bayles and W. Wilton Wood, of Huntington; Robt. W. de Forest, of N. Y. City, and others.

Seneca Falls, N. Y.—It is stated that the Geneva, Waterloo & Seneca Falls Heat, Light & Power Co., through Attorney W. S. MacDonald, of Seneca Falls, has asked for a 50-year franchise to operate its plant in this place.

Fulton, N. Y.—The Fulton Fuel & Light Co., of Fulton, has been incorporated; capital, $125,000. Directors—H. W. Noble and W. E. Moss, Detroit, and J. A. Fost, Fulton.

Lancaster, Pa.—The Lancaster Valley Electric Light Co. is reported incorporated, to supply electric light to Manheim, Ephrata, Mt. Joy and a large section of farming country from a central plant.

Solvay, N. Y.—See "Sewerage and Sewage Disposal."

Hawley, Pa.—Engr. in Charge C. J. Young, 3718 N. Carlisle St., Philadelphia, writes that the United Water Power Improvement Co., of Philadelphia, proposes to build a $1,000,000 power plant and dam near Hawley; detail plans are now being prepared.

Palo Alto, Pa.—Geo. M. Roads, of Pottstown, representing the Schuylkill Valley Gas Co., is stated to have petitioned the Town Council for a right of way to lay its mains through Palo Alto.

Nantucket, Mass.—Press reports state that John W. Cawley, of Boston, who recently purchased the plant of the Nantucket Electric Co., has also secured the plant of the local gas light company and will install a new electric plant throughout.

Fayetteville, N. C.—The Richmond Engineering Co., of Richmond, Va., is stated to have secured the contract for an electric light plant for $11,306.

North Amherst, O.—City Clk. T. E. Kaser writes that on Oct. 6 a vote will be taken on the proposition to construct a $10,000 electric light plant.

Xenia, O.—John H. Brown and Geo. Mayer, of Chicago, Ill., are reported to have procured the controlling interest in the plant of the New People's Gas & Electric Light Co., of Xenia, formed by the consolidation of two old companies. It is reported that both plants will be greatly improved and the gas plant rebuilt.

Loudonville, O.—T. O. Levering and P. A. Berry are stated to have petitioned the Council for a franchise to lay pipes in this city for a natural gas supply.

Baraboo, Wis.—The City Council is stated to have granted two lighting franchises, one to B. H. Strong, Mgr. of the present plant, for 25 years, and another to L. E. Hoyt for 20 years.

Ferndale, Minn.—Bids will be received by the village until Sept. 25 for constructing an electric light plant, according to plans prepared by O. Claussen, of St. Paul. H. Lyons, Village Recorder.

Glen, Minn.—Bids are wanted Sept. 25 for constructing an electric light plant. C. Paulson, Recorder.

Muncie, Ind.—The Wabash Oil & Gas Co. is stated to have petitioned the City Council for a franchise to pipe the streets of the city to supply the people with gas. Chas. A. Meeker is Vice-Pres.

Albia, Ia.—See "Water."

Fonda, Ia.—M. G. Coleman, of Fonda, writes that he, L. S. Straight and others propose to let a contract for the construction of an $8,000 gas plant, as soon as franchise is obtained from the town.

Alton, Ill.—The Peterson Electric Co., of Chicago, is stated to have petitioned the Council for a franchise for an electric light plant.

Lena, Ill.—City Clk. J. M. Schermerhorn writes that an effort is being made by F. C. Blair, of Chicago, to organize a stock company for the construction of an electric light plant, at a probable cost of $12,000.

Sparta, Ill.—The Sparta Gas & Electric Co. has been incorporated, with a capital of $50,000, to furnish light, heat and power. Incorporators: L. J. Sexton and L. W. Barker.

Zeeland, Mich.—See "Water."

Enid, Okla. Ter.—The Enid Light, Heat & Power Co., of Enid, has been incorporated, with a capital of $200,000. Incorporators: W. G. Williams, of Sparta, Wis.; Harry Newton, of Fleming, and others.

Dyersburg, Tenn.—See "Water."

Tuscumbia, Ala.—See "Water."

Pierre, S. D.—The Burt Electric, Heating & Lighting Co. is reported incorporated at Pierre, with a capital of $20,000, by Geo. Gilbert, Peter Sheckman and J. E. Evans.

Santa Fe, N. M.—The City Council is stated to have granted a franchise to the Capital Light & Power Co.

Sacramento, Cal.—The Bd. of Superv. are stated to have granted the Sacramento Natural Gas Co. a franchise for a pipe line on Riverside Road.

Redding, Cal.—A press report states that the Northern California Power Co. (H. H. Noble, Pres.) will establish a plant on the Pitt River.

Burns, Ore.—The Electric Light & Power Co., of Burns, has been incorporated to operate a plant to furnish electric light and power; capital, $10,000. Incorporators: C. Cummins, F. O. Jackson, and others.

Oakland, Cal.—The Midland Electric Power Co. has been incorporated, with a capital of $200,000, by J. H. Lawrence and Cary Howard, of Oakland, and F. H. Bates, of San Francisco. The company owns power rights on the San Joaquin River and intends to develop the power and transmit it to Alamedo County and eventually to Oakland.

San Bernardino, Cal.—The Etiwanda Power Co. has been incorporated, with a capital of $250,000, by Geo. Chaffey, N. W. Stowell, and others, all of Los Angeles.

ELECTRIC RAILWAYS.

Falmouth, Mass.—The Cape Cod St. Ry. Co. has been incorporated by Wm. M. Butler, F. Apthorp Foster, G. E. Dean and others, with a capital of $100,000, to construct a line 20 miles in length, all in Falmouth, running from a point on the North Shore road at the Bourne boundary line to the Waquoit Post Office.

Holbrook, Mass.—The Selectmen are stated to have granted the Holbrook, Weymouth & Nantasket St. Railway Co. a franchise from the Randolph line along Union, Plymouth and Weymouth St. to the Weymouth town line.

Watertown, N. Y.—It is stated that surveys are now being made under the supervision of M. P. McGraph, Gen. Mgr. of the Redwood-Alexandria Bay Electric Ry., for the Watertown-Carthage Electric road, and the contract is soon to be let for the construction. The proposed road will be 19 miles long and will pass through Black River, Felts Mills and Great Bend. John Carlisle, Pres., Watertown.

Springville, N. Y.—Chas. E. Botsford, of Springville, is reported to be engaged on a railroad survey to run from this village to the Stony Point steel plant, by way of New Oregon and Hamburg. The work is being done for the Goodyears, of Buffalo.

Alden, N. Y.—The Buffalo & Depew Ry. Co. is stated to have petitioned the Highway Comrs. for a franchise.

Ballston Spa, N. Y.—A press report states that the Ballston Terminal R. R. Co. has in contemplation the reconstruction of the old mill dam in Kayaderosses Creek at Factoryville, near its steam power house. F. H. Norris, Supt. Ballston Spa.

Brooklyn, N. Y.—The Bd. of Estimate is stated to have adopted a resolution authorizing the placing underground in Brooklyn of trolley feed-wires and all others except those now securely attached to elevated structures on several of the most traveled thoroughfares.

Westmoreland, N. Y.—The Highway Comrs. are stated to have granted the Oneida Ry. Co. a franchise through the town; the proposed line will be about 5 miles in length. H. J. Clark, Ch. Engr., Syracuse.

Altoona, Pa.—The Altoona Belt Line Co. is stated to have secured permission from the Superv. of Logan township to construct its lines in that territory.

Sharon, Pa.—The East End St. Ry. Co. is stated to have awarded the contract for building the road from West Middlesex to Sharon to H. G. Hamilton, of Youngstown, and William McIntyre, of Sharon. The same company will build a road to Greenville and Mercer.

Plymouth, Mass.—The Bristol & Plainville Tramway Co. is stated to have petitioned the Selectmen for a franchise.

South Amboy, N. J.—The Jersey Central Traction Co. is stated to have petitioned the Council for a franchise to enter the Borough at Bway. J. B. Snow, Ch. Engr., Keyport.

Hamburg, N. Y.—The Buffalo, Springville & Cattaraugus Ry. Co. is stated to have petitioned the State R. R. Comrs. for permission to extend its line from Hamburg to Cattaraugus, a distance of about 28 miles.

Kirkland, N. Y.—The Oneida Ry. Co. is stated to have petitioned the Highway Comrs. for a franchise. H. J. Clark, Ch. Engr., Syracuse.

Auburn, N. Y.—The Auburn City Ry. Co. is stated to have secured a franchise to extend its State St. line through Aurelius Ave. to the city limits. R. A. Dyer, Jr., Supt., Auburn.

Hopewell, N. J.—The Delaware Valley Traction Co. is stated to have secured a right of way through Hopewell Township.

Jamestown, N. Y.—The Warren & Jamestown St. Ry. Co. is stated to have petitioned the Council for a franchise from the southern to the central part of the city.

Chesapeake City, Md.—The Town Comrs. are stated to have granted a franchise to the Cecil & Kent Electric Ry. Co.

Norfolk, Va.—A press report states that the Directors of the Bay Shore Electric Ry. Co. have voted to double track the entire line now in operation, to extend the system, and to make improvements to its power plant. In all between $300,000 and $350,000 will be expended. H. L. Page, Pres., Norfolk.

Bellefontaine, O.—The Council is stated to have granted a franchise to the Findlay, Kenton & Bellefontaine Electric Ry. Co. David Joy, of Findlay, is one of the incorporators.

Scottsburg, Ind.—Jos. H. Shea and Mark Storen are stated to have petitioned the Scott Co. Comrs. for a franchise for an electric railway through the county to be connected with the Jeffersonville, New Albany & Sellersburg Rapid Transit Line.

Portland, Ind.—The Co. Comrs. are stated to have granted a franchise to the Muncie & Portland Traction Co.

Richmond, Ind.—It is stated that the Cincinnati, Hamilton & Indiana Traction Co. is to extend its line to Liberty and Richmond.

Columbus, Ind.—The Co. Comrs. are stated to have granted Morton Hall, Wm. Daugherty and Albert Morris a franchise for an interurban electric line from Columbus across Bartholomew County to Seymour, Brownstown, Saline, West Baden, French Lick, Scottsburg and Jeffersonville.

South Bend, Ind.—A new electric railway known as the Elkhart, So. Bend & Chicago Ry. is asking for a franchise in this city; line to run from Elkhart to South Bend. W. Osgood Orton and Geo. W. Bryson, of South Bend, are interested.

Macomb, Ill.—The Macomb & Western Illinois Electric Co. has been incorporated; capital, $300,000. Incorporators: D. P. Pennywitt, Henry C. Agnew and E. I. Hampton.

Baraboo, Wis.—The City Council is stated to have granted the Sauk County Power & Traction Co. an extension of its franchise for one year to complete an electric road between Devil's Lake and the dells at Kilbourn.

Grand Rapids, Mich.—The Dirs. of the Grand Rapids, Grand Haven & Muskegon Electric Ry. Co. are stated to have decided to make improvements and enlarge the system. It is proposed to extend the line from Mona Lake to Lake Harbor, a distance of 4 miles. Jos. Kirwin, Secy., Grand Rapids.

Eveleth, Minn.—The Mesaba Electric Ry. Co. has been incorporated, with a capital of $50,000, to construct an electric railway between Eveleth and Virginia, a distance of 4½ miles. Incorporators: G. G. Hartley, O. D. Kinney and others, of Duluth.

Chicago, Ill.—The Chicago, Milwaukee Ave. & Inland Lakes Traction Co. is stated to have petitioned the Co. Comrs. for a franchise to construct and operate a street railroad in Milwaukee Ave. from the present city limits in Jefferson to the north line of Cook County. Geo. Leininger, Pres. G. F. Lanaghen, Secy.

Minneapolis, Minn.—John Wunder is stated to have secured the contract for erecting the superstructure of the power house for the Twin City Rapid Transit Co. The building will cost about $350,000. It will be 2 stories high, 155x155 ft. Total cost of plant, including machinery, will be about $1,000,000.

South Bend, Ind.—The Elkhart, South Bend & Chicago Ry. Co. is stated to have petitioned the Bd. of Pub. Wks. for a franchise.

St. Louis, Mo.—Chas. V. Weston, of Weston Bros., of Chicago, Ill., experts in elevated railroads, is reported to be preparing plans and specifications for an intramural railway to be constructed within the Fair grounds. It is reported that it will take about 8 miles of track and cost about $750,000. It has not been decided whether the construction of the road will be given to contractors or whether a concession will be granted for its construction.

Hamilton, O.—The Butler Co. Comrs. are stated to have granted a franchise to the Cincinnati, Hamilton & Indiana Traction Co. to construct its line from this city to College Corner, O., through Darrtown and Oxford.

Lebanon, Ky.—Hill Spalding, an attorney of Stanford, Ky., is reported to be investigating the cost of constructing an electric railway from Lebanon via Bradfordsville and Hustonville to Moreland.

Nashville, Tenn.—Local press reports state that at a meeting of the incorporators of the Nashville & Gallatin and the Nashville & Columbia Electric Railways in the Wilcox Bldg. Sept. 11 it was decided to consolidate. It is also reported that contracts will be let soon for the rails, power plants and all necessary equipment for construction. W. J. Whitthorne, of Columbia; Douglas Wilkie, of Franklin, and E. A. Christian, of Gallatin, are among the incorporators.

Blossom, Tex.—J. C. Mason, of Deport, and W. F. Bryant, of Blossom, are reported interested in the construction of an electric railway between Blossom and Deport.

Santa Fe, N. M.—The City Council has granted J. E. Lacome a franchise for the construction of a street railway.

Provo, Utah.—The City Council is stated to have granted Reed Smoot, Jesse Knight and others a franchise for an electric railway.

Forest Grove, Ore.—E. W. Haines, who furnishes this place with power, is reported to be considering the construction of an electric railway from the depot to this place, a distance of about 1¼ miles.

Los Angeles, Cal.—The City Council is stated to have granted a franchise to Campbell & Johnson, for an electric railway from Pasadena to Los Angeles.

San Jose, Cal.—F. F. Granger is stated to have petitioned the City Council for a franchise to construct a line from the western limits of the city and Stevens Creek Road over San Carlos and Market Sts. to W. Santa Clara St.

Oakland, Cal.—The Mayor is stated to have signed the ordinance granting the Oakland Transit Co. a franchise for the extension of its lines to connect with the proposed new Emeryville ferry system between this side and San Francisco.

Santa Cruz, Cal.—The Bd. of Superv. are stated to have granted a franchise to W. J. Rodgers, of San Jose, for an electric railroad to extend 5 miles from Watsonville to Camp Goodall.

South Pasadena, Cal.—The City Trus. are stated to have granted a franchise to the Pacific Electric Ry. Co.

Yosemite, Cal.—Mr. Ray, of Coulterville, is reported to be surveying for an electric railway commencing at Barnard Place and extending to Merced Falls, a distance of about 80 miles. It is reported to be the intention of the company to construct 2 dams in the Merced River, to supply power for an electric plant and electric railway, the dams alone to cost about $800,000.

RAILROADS.

Harrison, N. J.—A press report states that the Town Council and the Lackawanna R. R. Co. have reached an agreement with regard to the elevation of the company's tracks. The town will pay for the lowering of gas and water pipes. The R. R. Co. agrees to do all the other work, including the erection of a bridge at 5th St. 36 ft. wide and 12 ft. high, a stone archway at 3d St. 8 ft. wide and 8 ft. high, and the depression of several others streets. W. K. McFarlin, Ch. Engr., Hoboken.

Chase City, Va.—Geo. A. Endly, of Chase City; Freeman Epes, of Blackstone, and others, are reported interested in the construction of a railroad from Chase City to Blackstone, a distance of about 35 miles.

Morgantown, W. Va.—It is reported that it is proposed to construct a branch of the Morgantown & Kingwood R. R. from Reedsville to Belington.

Walhalla, S. C.—Application has been made for a charter for the Tennessee, Georgia & South Carolina R. R. Co., which is to build a line from Walhalla, S. C., to Charleston, Tenn.

Wadley, Ga.—A charter has been granted to the Wadley & Mt. Vernon Extension R. R. Co., with a capital of $50,000, for a railroad to connect with the Wadley & Mt. Vernon Road. It is proposed to build 40 miles of road running through Coffee and Clinch Counties. Incorporators: John M. Lott, Sr., D. D. Pouch, and others.

Chicago, Ill.—The Chicago Northern Ry. Co. has been incorporated, with a capital of $10,000, to construct a line from a point on the Chicago & Northwestern Ry., near Mayfair, Cook Co., to Lake Bluff, Lake Co. Principal office to be at Chicago. Incorporators: Marvin Hughitt and J. B. Redfield, of Chicago; J. F. Cleveland, of Oak Park, and others.

Lebanon, Mo.—The North and South Central R. R. Co., of Hahatonka, has been incorporated, with a capital of $250,000, to construct a standard gauge line from Lebanon, on the line of the St. Louis & San Francisco R. R., to Linn Creek in Camden Co., a distance of 25 miles. Directors: R. D. Kellogg, Lebanon; R. G. Scott, Hahatonka; S. W. Wheeler, Deeaturville, and others.

Providence, Ky.—A press report states that the Louisville & Nashville R. R. Co. will extend the Providence, Ky., branch of the system through to Shawneetown, Ill., a distance of about 40 miles. R. Montfort, Ch. Engr., Louisville.

Fulton, Ky.—A press report states that the Illinois Central R. R. will double track the main line from Fulton to Memphis, Tenn. W. J. Harahan, Ch. Engr., Chicago.

Ft. Smith, Ark.—A charter has been granted to the Oklahoma Central R. R. Co., with a capital of $5,000,000, to build a line from Ft. Smith, Ark., to Vernon, Tex., a distance of 350 miles. L. W. Van Horne, of Salt Lake City, Utah, is one of the incorporators.

Stillwater, Okla. Ter.—A charter has been granted to the Kansas, Oklahoma Central & Southwestern R. R. Co., with a capital of $11,500,000, to construct a line from Cedarville, Kan., through Stillwater, Guthrie and El Reno, Okla., to Kirkland, Tex. It will have two branch lines, one from Stillwater to Ft. Smith, Ark., and the other n. w. to Woodward, Okla., on the Tex. border; total distance, 640 miles. Principal office to be at Stillwater.

Ft. Worth, Tex.—A press report states that preparations are being made by the Chicago, Rock Island & Pacific Ry. Co. for building its extension from Ft. Worth, Tex., to the Gulf of Mexico, a distance of about 300 miles. The Gulf Construction Co. has been organized in Chicago to do the work, the first part of which will be between Ft. Worth and Dallas. H. A. Parker, of Chicago, Ill., 1st Vice-Pres. of the Rock Island, is Pres. of the Construction Co. W. E. Dauchy, Ch. Engr., Chicago, Ill.

PUBLIC BUILDINGS.

Norwich, Conn.—It is stated that a central fire fire station is to be erected at a cost of $25,000.

Buffalo, N. Y.—Local press reports state that Mosier & Somers, of Buffalo, have secured the contract for erecting the 65th Regt. Armory for $491,970. It will be of brick, with a facing of white Medina sandstone. John T. Sadler & Co., of Elmira, is stated to have secured the contract for heating same for $28,000.

New York, N. Y.—Bids are wanted Sept. 24 for furnishing material and making alterations and repairs to quarters of Engine Co. No. 22, located at 159 E. 85th St. Thos. Sturgis, Fire Comr.

Newark, N. J.—The following bids are reported to have been received by the Court House Comn. Sept. 15 for erecting the new court house: Hedden & Sons, 431 Ogden St., Newark, $1,121,994; Norcross Bros., 160 5th Ave., New York, N. Y., $1,251,600; Chas. T. Wills, 156 5th Ave., New York, N. Y., $1,236,275.
Bids will be received at the Fire Dept. Headquarters, Halsey and Academy Sts., Newark, until Sept. 23 for building an extension to house of Engine Co. No. 7, and making alterations and repairs to the main building. Theo. C. E. Blanchard, Pres. Bd. Fire Comrs.

Glen Gardner, N. J.—The Comn. appointed to select a site for the proposed State Hospital for Consumptives, are stated to have purchased property at Glen Gardner. Dr. Chas. J. Kipp, of Newark, is Ch. of Comn.

Rahway, N. J.—Bids will be received until Sept. 24 by the N. J. State Reformatory Comn., at Rahway, for furnishing 600,000 common brick to be delivered on the siding at the Reformatory. Address Thos. M. Gopsill, Secy.

Meyersdale, Pa.—Chas. W. Bolton & Co., Witherspoon Bldg., Philadelphia, are stated to be preparing plans for the First M. E. Church; a Sunday school and parsonage will also be erected; total cost, $30,000.

Harrisburg, Pa.—The Capitol Comn. is stated to have awarded to G. F. Payne & Co., of Philadelphia, the contract for erecting the Capitol for $3,600,000, with $110,000 more for a granite dome.

Farnhurst, Del.—Rogers & Totten, of Philadelphia, Pa., have prepared plans for an annex to the State Insane Asylum at Farnhurst, to cost $10,000, for the Trus. of the Poor, of New Castle Co.

Brooklyn, N. Y.—A permit has been issued for a 3-story convent and laundries to cost $80,000, to be erected on Maujer St. and Bushwick Ave. for the R. C. Church of the Most Holy Trinity, of Montrose and Graham Aves. Architect, F. J. Berlenbach, 260 Graham Ave

New York, N. Y.—The following bids were received Sept. 12 by Thos. Sturgis, Comr. of Fire Dept., for a building to be erected at 105 and 107 W. 102d St. for an engine house: Thos. D. Connors, 1123 Bway., $73,373; Thos. B. Leahy, 9 E. 42d St., $69,793; Fanning & Reilly, 150 5th Ave., $66,000 (awarded); N. W. Ryan, 106 E. 23d St., $66,985.

Yonkers, N. Y.—Lynch & Larkin, of Yonkers, are stated to have secured the contract for erecting the Carnegie Library for $48,500.

Canastota, N. Y.—Bids are wanted Sept. 30 for erecting a public library. Mrs. Jennie S. Stafford, Chmn. Bldg. Com.

Schenectady, N. Y.—Bids will be received by the Bd. of Superv. until Sept. 25 for erecting a laundry, stable, bakery and an ice house on the Almshouse site. C. A. Beckwith, Chmn. Com. on Lands & Bldgs.

Cambridge, Md.—A press report states that plans are being prepared for a charity hospital to be erected here at a cost of $40,000.

Springfield, O.—Bids will be received by the Bd. of Hospital Trus. until Oct. 14 for furnishing material and performing all labor for the excavation, grading and stone masonry for the City Hospital; estimated cost of building, $50,000. R. N. Lantz, City Clk.
Bids will be received by the Bd. of Co. Comrs. until Oct. 10 (readvertisement) for erecting a building for county offices on the site of the present West Co. Bldg. A. K. Hahn, Co. Aud.

Bryan, O.—Bids will be received by the Co. Comrs. until Oct. 3 for furnishing material and constructing a hot water heating plant for the Court House. Howard Friend, Co. Aud.

Cleveland, O.—Local press reports state that on Sept. 13 the contract with Lehman & Schmidt, Hickox Bldg., for preparing plans and overseeing the construction of the proposed court house was approved and signed.

Milwaukee, Wis.—Press reports state that plans are wanted Oct. 10 for 2 branch police stations. P. Pawluski, Compt.

Mt. Clemens, Mich.—T. Van Damme, of Mt. Clemens, is reported to be preparing plans for a Carnegie Library for Mt. Clemens, to cost $15,000.

St. Louis, Mo.—The Murch Bros. Construction Co. is stated to have secured the contract for erecting the Maple Ave. M. E. Church, for about $50,000.

St. Louis, Mo.—Local press reports state that the following bids for the erection of the Mines and Metallurgy Bldg. for the World's Fair were opened Sept. 16: Hill-O'Meara Const. Co., $533,635; Strehlow & Phelps, $559,997; W. O. & C. G. Burton, $563,772; J. J. Dunnavant & Co., $566,663; Kellerman Contracting Co., $568,900; Smith & Eastman, $586,978; Nicholas Polligreen, $610,000; R. W. Morrison & Co., $643,627.

Connersville, Ind.—Bids will be received by the Co. Aud. until Sept. 27 for remodeling and reconstructing the heating plant in the Court House.

St. Francisville, La.—The plans of Andrew J. Bryan & Co., of Jackson, Miss., are stated to have been accepted for a $30,000 court house.

Anadarko, Okla. Ter.—Chas. H. Jones, Co. Surveyor, writes that H. J. Vandenberg, of Guthrie, has secured the contract for erecting the court house for $30,000.

El Paso, Tex.—Mauran, Russell & Garden, Chemical Bldg., St. Louis, Mo., are stated to have prepared plans for the Carnegie Library, and the contracts for its erection will be let about Oct. 1.

Ruston, La.—Mr. Lewman, of Jackson, Miss., is stated to have secured the contract for erecting the Lincoln Co. Court House for $34,000.

Riverside, Cal.—The Bd. of Superv. are stated to have adopted the plans of Burnham & Bleisner for a court house, to cost about $150,000.

Santa Rosa, Cal.—The plans of Ernest M. Hoen, of Sacramento, are stated to have been accepted for the Carnegie Library, to cost about $20,000.

BUSINESS BUILDINGS.

Worcester, Mass.—Barker & Nourse, of Worcester, have prepared plans for a $40,000 addition to the Odd Fellows' Home of the Grand Lodge of Mass., at Worcester.

Dunkirk, N. Y.—Olympia Lodge, No. 602, I. O. O. F., is stated to have decided to erect a temple on Central Ave. at a cost of about $25,000.

Warsaw, N. Y.—Leon H. Lempart, of Rochester, is reported to have prepared plans for a $37,000 theater for Warsaw.

Niagara Falls, N. Y.—Geo. B. Long, Prudential Bldg., Buffalo; C. N. Everett, and C. W. Morris, forming one firm, are stated to have secured the contract for erecting a factory here for the Carter-Crume Co., Ltd., for $110,000.

Philadelphia, Pa.—E. P. Brink & Son, Stephen Girard Bldg., are stated to have prepared plans for a hotel to be erected on 33d and Chestnut Sts. for the Belmont Hotel Co., to cost about $250,000. Wm. M. Ayres, Pres.

Warwick, N. Y.—The Crane Giles Co., of Middletown, is stated to have secured the contract for erecting the Red Swan Inn for $29,989.

Lansdowne, Pa.—Bunting & Shrigley, Crozer Bldg., Philadelphia, are stated to be preparing plans for a 1-story brick and stone bank 30x50 ft. for the Lansdowne & Darby Savings Fund Society.

Cape May, N. J.—Henry D. Dagit, 435 Chestnut St., Philadelphia, Pa., is stated to be preparing plans for a power house for the Cape May Electric Co. Contracts for the machinery are reported awarded.

Paterson, N. J.—Geo. Hardy Payne, Stained Glass Mfgr., is reported to be having plans prepared by Fred. W. Wenthworth, Paterson Natl. Bank Bldg., for a new building which he will erect on Park Ave. for offices and workshops.

Baltimore, Md.—Parker & Thomas are stated to be preparing plans for a 6-story warehouse to be erected on Paca St. near Lombard for Dr. B. Tilghman. The building will be 53x130 ft. and cost about $35,000. It will be occupied by Rosenfeld & Co. as a shirt factory.

Elyria, O.—Fred Wolf, of Elyria, is stated to have secured the contract for constructing a steel plant for the Columbian Steel Co., for $51,000.

Cleveland, O.—Local press reports state that the General Cartage & Storage Co. will erect a 9-story building at 17 to 31 Merwin St., at a cost of about $250,000.

Indianapolis, Ind.—The Indianapolis St. Ry. Co. is to erect a 1-story brick car barn, 300 ft. sq., on W. Washington St., to cost about $75,000

Hammond, Ind.—C. G. Hellick, of Chicago, is the architect for a 2-story and basement brick business building; hot water heating plant. Approximate cost $15,000.

Chicago, Ill.—C. G. Hellick, Telephone Bldg., is the architect for a 2-story and basement brick building with stone trimmings, steam heating plant and electric light, to be located at 35th and Vernon Aves. Approximate cost, $30,000.

Bay City, Mich.—A correspondent writes that the Opera House at this place, which was destroyed by fire, at a loss of about $100,000, is to be rebuilt.

Topeka, Kan.—The plans of E. L. Hopkins are stated to have been selected for a building for the R. R. Y. M. C. A., to cost about $30,000.

Durand, Mich.—The Ann Arbor & Grand Trunk Ry. freight sheds are reported to have been destroyed by fire Sept. 6. W. F. Bradley, Supt., Durand.

Marquette, Mich.—Charlton & Gilbert, of Marquette, are stated to have prepared plans for a 2-story brick office building for the Lake Superior Iron Co. It will cost $15,000.

Terrell, Tex.—The Elks Assoc. is stated to have decided to erect a $15,000 building.

Houston, Tex.—A correspondent writes that bids recently received for the Houston "Post" building have been rejected and that new bids will be asked.

Louisville, Ky.—The Directors of the Louisville Trust Co. are stated to have voted to build a 7-story stone front building on 5th and Market Sts. to cost $16,500. Architects have been ordered to prepare plans.

Fargo, N. D.—Bowers Bros. are stated to have secured the contract for erecting the J. I. Case warehouse, for about $40,000.

DWELLINGS.

Brooklyn, N. Y.—Plans have been filed with the Tenement House Dept. in the Temple Bar Bldg. for the building of an apartment house on President St. and Prospect Park West. Carl J. Zimmermann, 681 Willoughby Ave., is the owner. Schwartz & Gross, 160 5th Ave., New York, are the architects. The building will cost $200,000.

Denver, Colo.—The Denver Chicago Construction Co. has been formed, with a capital of $50,000, to erect an apartment house on Colfax Ave. and Williams St. F. E. Edbrooke, Opera House Blk., is reported to be preparing the plans.

SCHOOLS.

Springfield, Mass.—The E. M. Porter Htg. & Plumbing Co. is stated to have secured the contract for installing a heating plant for the Tapley School addition for $3,398.

New York, N. Y.—The following bids were opened Sept. 15 by C. B. J. Snyder, Supt. of School Bldgs., Bd. of Educ., for installing electric elevators in Wadleigh High School, Boro. of Manhattan: Otis Elevator Co., $9,955; Marine Engine & Machine Co., 125 White St., $9,648 (awarded).

Bids opened at the same time for the general construction of school 65, Boro. of Bronx, were as follows: Patrick Sullivan, $193,600; Luke A. Burke, 401 W. 59th St., $185,000 (awarded); Thomas B. Leahy, $194,639.

The only bid received at the same time for the general construction of school 110, Boro. of Manhattan, was from Patrick Sullivan, at $227,860, and was rejected.

New York, N. Y.—Plans have been filed for an addition to the Harvard Club House, to be erected at the rear of the existing structure, which stands at 27 W. 44th St. It will contain an assembly hall, will be 3 stories high and cost $100,000. Architects, McKim, Mead & White, 160 5th Ave.

Plans have also been filed for a 5-story brick school to be erected on Central Park West and 63d St., for the Society for Ethical Culture of New York; cost of building is placed at $500,000. Architects, Carrere & Hastings 28 E. 41st St.

Bridgeton, N. J.—Jos. Steelman, of Bridgeton, is stated to have secured the contract for erecting a school here for $25,000.

Hawthorne, N. J.—Bids will be received until Sept. 25 by the Bldg. Com. of the Boro. Bd. of Educ. for furnishing material and doing the masonry, carpentry, ventilating, heating, etc., in the erection of a 6-room brick and stone school, adjoining School No. 2, on Godwinville Road. John G. Whittaker, Chmn.

Scranton, Pa.—It is proposed to erect a $55,000 annex to the high school. Archt., G. N. Edson.

Springfield, N. J.—Bids will be received by the Bd. of Educ. until Sept. 23 for furnishing material and installing a direct-indirect steam heating plant in an 8-room school; also for furnishing material and installing plumbing, including closets, etc., and for the electric lighting. Theo. D. Sickley, Secy.

Thurmond, W. Va.—It is stated that bids are wanted Sept. 29 for erecting 2 schools at Thayer. John Brash, Pres. Bd. Educ. of Quinnimont Dist.

Norfolk, Va.—Bids will be received until Oct. 2 by the Local Bd. of Improv. of the 7th Ward, for erecting a brick school, according to plans prepared by Vance Hebard, 76 Charlotte St. W. F. Crall, Chmn.

Chicago, Ill.—The plans of Turnock & Ohrenstein are stated to have been accepted for the Talmud Torah School, to be erected on N. Wood and Blucher Sts., to cost about $18,000.

Stevens Point, Wis.—The Bd. of Educ. is stated to have authorized the erection of a school in the 6th Ward, at a cost of about $14,000.

Ottawa, Kan.—A press report states that the main building of the Ottawa Univ. was burned Sept. 10; it had recently been completed at a cost of $50,000.

San Luis Obispo, Cal.—The Bd. of Trus. of the S. Californai Polytechnic School is reported to have instructed Dir. Leroy Andreson to proceed with the immediate establishment of said school. The plans of W. H. Weeks, of Watsonville, Cal., for 2 of the buildings have been accepted, and work on them will commence at once. Total cost of entire institution about $120,000.

Pasadena, Cal.—School bonds amounting to $100,000 are stated to have been sold.

STREET CLEANING AND GARBAGE DISPOSAL.

North Adams, Mass.—Local press reports state that C. G. Bartlett & Co., to whom the contract for collecting the city's garbage for 5 years was awarded, have withdrawn their bid, and the Bd. of Health has called for new bids to be opened Sept. 24.

Jersey City, N. J.—The Newark Sanitary Reduction Co. has been incorporated, with a capital of $100,000; registered office, Jersey City. The company is to dispose of garbage and house refuse. Incorporators: H. O. Coughlan, A. D. Meekins and Paul Tisson.

New York, N. Y.—The contract for the final disposal of garbage in the Boro. of Bronx has been awarded to the Decarie Mfg. Co., of Minneapolis, at $16,000 per year.

Champaign, Ill.—A plan is under consideration for the construction of a garbage crematory.

Houston, Tex.—The City Council has rejected the proposition of Haralson & Co. agreeing to do the street sweeping for a period of 5 years for $27,000 per annum, garbage collection being extra made a total of about $40,000. A resolution under consideration provides for a call for bids for the repair and operation of the crematory.

Spokane, Wash.—The estimated cost of constructing a crematory exclusive of site, is $18,000.

Montreal, Que.—Bids will probably soon be asked for the removal of snow from the streets of this city.

GOVERNMENT WORK.

Boston, Mass.—The contract for repairs and alterations to the heating apparatus at the U. S. Marine Hospital has been recommended for award to Huey Bros., of Boston.

Tompkinsville, N. Y.—The following bids were opened Sept. 8 at the office of the U. S. Engr. of the 3d Lighthouse Dist., for furnishing 9,000 tons of riprap and erecting breakwater at Orient Point Light Station, Long Island: Estate of John Beatty, Leete's Island, Conn., $2.43 per ton; Daniel McAvoy, 21 State St., N. Y. City, $1.50 per ton; E. S. Belden & Sons, Hartford, Conn., $1.93 per ton.

New Brunswick, N. J.—There were 9 bids opened Sept. 11 at the Treasury Dept., Washington, D. C., for furnishing the heating apparatus for the U. S. Post Office at New Brunswick. The lowest 3 were from Hugh McKeag & Son, New Brunswick, at $1,971; Frank Dobson, New York City, at $2,178, and E. Rutzler, of New York City, at $2,341.

There were 7 bids opened at the same time for conduits and wiring for above building, the lowest 3 being as follows: Keller, Pike & Co., Philadelphia, $1,130; J. F. Buchanan, Philadelphia, $922; Western Electric Co., New York City, $724.

Philadelphia, Pa.—The following bids were opened Sept. 15 by Lieut.-Col. C. W. Raymond, Corps of Engrs., U. S. A., for furnishing and depositing riprap stone for protecting timber bulkhead in Delaware River, near Reedy Island: *a*, 45,000 tons riprap stone; *b*, 30,000 tons buttress stone; *c*, total: Hughes Bros. & Bangs, Syracuse, N. Y., *a* $1.20, *b* $1.20, *c* $90,000; Richardson & Ross Quarry Co., Philadelphia, Pa., *a* $1.13, *b* $1.45, *c* $106,050.

Buffalo, N. Y.—Maj. T. W. Symons, Corps of Engrs., U. S. A., writes that the contract for excavating at Ogdensburg Harbor has been awarded to Daly & Hannan Dredging Co., of Ogdensburg, for $20,784. Award not yet confirmed by the Ch. of Engrs., U. S. A.

Boston, Mass.—Bids are wanted at the U. S. Engr Office until Oct. 30 for dredging in Boston Harbor, as advertised in The Engineering Record.

West Point, N. Y.—Bids are wanted Nov. 1 for completing the Cadet Mess Hall, as advertised in The Engineering Record.

New York, N. Y.—Bids are wanted Oct. 20 for rock removal at Larchmont, Echo Bay and Saugerties Harbors, N. Y., as advertised in The Engineering Record.

Annapolis, Md.—The following bids were opened Sept. 10 at the office of the U. S. Quartermaster for officers' quarters at Marine Barracks, Naval Academy: Arthur Cowsill, of Washington, $31,689; Chas. McCaul, Philadelphia, $31,750.

Ft. Getty, S. C.—Bids are wanted Oct. 13 for heating by hot air system several buildings at this post, as advertised in The Engineering Record.

Ft. Myer, Va.—Bids are wanted Oct. 18 for constructing officers' quarters, as advertised in The Engineering Record.

Norfolk, Va.—The following bids were opened Sept. 13 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing concrete and granite dry dock exclusive of pumping plant and caisson, at the Navy Yard, Norfolk: *a*, price for dry dock and accessory structures complete in accordance with plans and specifications; *b*, amount to be deducted if all keel blocks, docking keel blocks, bilge blocks and bilge-block slides, with metal fittings for same, etc., are omitted; *c*, amount to be deducted for omitting construction of certain approaches; *d*, amount to be deducted if capstans and foundations for same above an elevation of 6 ft. below the coping level are omitted: Norcross Bros., Worcester, Mass., *a* $1,214,677, *b* $39,622, *c* $73,567, *d* $16,879; New York Continental Jewell-Filtration Co., New York City, *a* $1,217,610, *b* $33,554, *c* $76,000, *d* $23,500; McLean Construction Co., Jersey City, N. J., *a* $1,282,000, *b* $40,500, *c* $53,500, *d* $16,000; P. J. Carlin & Co., New York City, *a* $1,320,000, *b* $90,300, *c* $80,000, *d* $18,000; J. C. Rodgers, New York City, *a* $1,270,000, *b* $35,600, *c* $65,100, *d* $15,900; John Peirce, New York City, *a* $1,281,000, *b* $33,404, *c* $60,837, *d* $16,586. The Hoffman Engineering & Construction Co. also bid on above work, but their prices are not now available.

Columbia, S. C.—The following bid was opened Sept. 3, by Capt. J. C. Sanford, Corps of Engrs., U. S. A., at Charleston, S. C., for constructing the Chanoine dam across the Congaree River: The Evansville Contract Co., Evansville, Ind., oak, 30 M. ft., at $125; pine, 30 M. ft., at $25; excav., 4,000 cu. yds., at $1; rock excav., 2,200 cu. yds., at $4; bolt holes, 1,500 lin. ft., at 75 cts.; stone filling, 600 cu. yds., at $2; concrete, 3,000 cu. yds., at $8; cast iron, 94,000 lbs., at 10 cts.; wrought iron, 43,000 lbs., at 15 cts.; steel, 50,500 lbs., at 10 cts.; bolts, etc., 13,500 lbs., at 10 cts.; total, $65,875.

Cleveland, O.—Bids are wanted Sept. 25 for the removal of the wrecked tow barge "L. L. Lamb," which lies ¾ of a mile from the ends of the piers at Fairmount Harbor, O. Maj. Dan. C. Kingman, Corps Engrs., U. S. A.

Ft. Snelling, Minn.—Bids are wanted Oct. 11 for remodeling 4 double barracks at this post, including steam heating, plumbing and electric wiring in the same. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Muskegon, Mich.—Bids are wanted at the U. S. Engr. Office, Grand Rapids, Mich., until Oct. 15 for construction of revetment and repair of pier at Muskegon, as advertised in The Engineering Record.

San Antonio, Tex.—Bids are wanted Oct. 15 for sinking an artesian well at Ft. Ringgold, Tex. J. L. Clem, Ch. Q. M., San Antonio.

Denver, Colo.—Bids are wanted Oct. 6 for constructing 5 buildings, officers' quarters, barracks, stable and gun shed, at Ft. D. A. Russell, Wyo. Lieut.-Col. J. W. Pope, C. Q. M., Denver.

Portland, Ore.—Bids are wanted Oct. 8 for placing cut stone, concrete and rubble masonry and doing necessary grading in connection with improving Columbia River, at Cascades, Ore. Bids will also be received at the same time for mattress, rock and pile work in connection with extension of jetty at mouth of Coquille River, Ore. Capt. W. C. Langfitt, Corps Engrs., U. S. A.

Rapid City, S. D.—H. & F. Roettiger, of Mountain City, are reported to have received the contract for building the Indian school at this place for $34,000.

Ft. Totten, N. D.—Bids are wanted Oct. 9 for furnishing material and constructing steam heating, electric lighting and sewer systems at the Ft. Totten Indian School, N. D. For further information apply to Chas. L. Davis, Supt. Indian School, Ft. Totten; A. C. Tonner, Acting Comr. Indian Affairs, Dept. of the Interior, Washington, D. C.

Ft. Lincoln, N. D.—Bids are wanted Oct. 11 for constructing a double set of Lieutenants' quarters, a double set of Captains' quarters, a barrack, a guard house, a bakery, and set of Hospital Stewards' quarters, at Ft. Lincoln, N. D. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

MISCELLANEOUS.

Brooklyn, N. Y.—Bids are wanted Sept. 25 for furnishing material and erecting wrought iron picket fence on Shore Road. Bids will also be received at the same time for furnishing material and delivering 7,000 cu. yds. coarse bank gravel on Ocean Parkway, between Ave. U and Coney Island Concourse. Wm. R. Willcox, Chmn. Comrs. of Parks, N. Y. City.

New York, N. Y.—Bids were opened Sept. 18 by Thos. W. Hynes, Comr. of Dept. of Correction, for building a stone wall and gates around the prison buildings on Leonard, Elm and Franklin Sts., as follows: John R. Sheehan & Co., $122,500; and P. J. Carlin & Co., $118,000.

Elmira, N. Y.—Bids will be received by Chas. S. Boyd, State Supt. of Pub. Wks., Albany, until Sept. 24 (readvertisement) for repairing the dykes and banks of the Chemung River in this city.

Jersey City, N. J.—Local press reports state that J. Swenson is preparing to build a $50,000 dry dock at the foot of Warren St.

Buffalo, N. Y.—A. J. Rockwood, Engr. Western Div. N. Y. State, has prepared plans for dredging Erie Basin at Buffalo, and the contract for doing the work is about to be let. Appropriation, $50,000.

Ottawa, Ont.—It is stated that bids are wanted by the Bd. of Pub. Wks. until Sept. 25 for extending Point-aux-Pelee Island wharf. Fred. Gelinas, Secy.; H. A. Gray, Res. Engr., Confederation Life Bldg., Toronto, Ont.

Montreal, Que.—It is stated that bids are wanted Oct. 2 for rebuilding portions and extending Locks 1 and 2 at the entrance of Lachine Canal. L. K. Jones, Secy., Dept. Rys. & Canals, Ottawa, Ont.

The contract for constructing the shore wharf between King Edward and Alexandra piers is reported to have been awarded by the Harbor Comrs. to F. J. Weber for $95,400.

NEW INDUSTRIAL PLANTS.

The American Ochre Co., Cartersville, Ga., is erecting a 40x120-ft. mill, which will have a daily capacity of 20 tons.

The Thomas Mfg. Co., Springfield, O., maker of agricultural implements, expects to erect a new foundry.

The Vigor-o Health Food Co., Ltd., Owosso, Mich., has been incorporated, with a capital of $500,000, and will erect a 3-story and basement, 60x120-ft. factory and a power house 40 ft. square.

The Goodhue, Minn., Milling Co. will erect a 3-story and basement, 32x60-ft mill and a 30x32-ft. engine house, installing a 90-H.-P. Corliss engine and a 100-H.-P. boiler.

The Valley Iron Co., Birmingham, Ala., contemplates the opening of coal and ore mines, the building of coke ovens and the erection of a blast furnace plant near Sulphur Springs and Valley Head. The details have not yet been worked out.

The Globe Iron Works Co., Minneapolis, Minn., contemplates erecting a 45x60-ft. foundry with a 3-ton cupola, and installing a brass foundry.

The Southern Cross-Tie Co. will, about Jan. 1, erect a plant requiring a power plant of about 400 H.-P. Gordon Bryan Mgr., Liverpool & London & Globe Bldg., New Orleans, La.

J. C. Montgomery & Son, Verona, Tenn., will erect a 2-story, 30x50-ft. flour mill. The capacity of the power plant will be 50 H.-P.

The Wellsville, Pa., Mfg. Co. is erecting a 3-story, 100x40-ft. factory to be lighted electrically. The power will be supplied by a 16-H.-P. gasoline engine.

The Duluth, Minn., Brewing & Malt Co. is erecting a stock house, wash house and racking room, the estimated cost of which, with refrigeration, will be about $50,000.

The Vermont Farm Machine Co., Bellows Falls, Vt., has let a contract for a 2-story, 60x170-ft. machine shop with a 17x113-ft. basement.

Wagener Bros., Penn Yan, N. Y., contemplate erecting a 3-story shoe factory, to be about 125x35 ft., and equipped with a power plant of 30 to 50 H.-P.

L. H. Moore, Gentry, Ark., is endeavoring to secure the erection of a cold-storage and ice plant in that place.

Mill No. 1, including the card, spinning and slasher rooms of the Stonewall, Miss., Cotton Mills, was damaged by fire to the amount of about $75,000.

A large Portland cement plant will soon be built near Cumberland, Md., by a company in which Ernest R. and Marion Ackerman, of Plainfield, N. J., are interested.

BUSINESS NOTES.

The Girard, O., Boiler & Mfg. Co. has received a contract from the West St. Louis Construction Co., St. Louis, Mo., for the erection at Kirkwood, Mo., of a steel standpipe of 24 ft diameter and 110 ft. high.

The new plant of the Millers Falls, Mass., Paper Co. will be electrically driven throughout. The contract for the entire equipment, including generators, motors, arc and incandescent lights, etc., has been placed with Sargent, Conant & Co., Boston.

Among contracts recently received by the Otis Elevator Co., for installations in New York, are the following: Hotel Imperial Annex, seven hydraulic and two electric elevators; Blair Building, six hydraulic elevators; Metropolitan Life Insurance Co., 23 high-pressure passenger elevators, four hydraulic freight elevators and two electric passenger elevators for additions to their buildings, and converting 13 passenger elevators so as to be operated at increased pressure. The plant, when complete, will consist of 40 hydraulic elevators operated from one pumping station.

The Chicago office of the Stilwell-Bierce & Smith-Vaile Co. reports the sale of Smith-Vaile triplex pumps for water works and electric light plants at Caldwell, Idaho; Holland and Crystal Falls, Mich.; Little Falls, Minn., and Marseilles, Ill. Also compound steam pumps for Zeeland, Mich.

The Allis-Chalmers Co., Chicago, reports the following among its engine sales for August, the engines being 1890 Reynolds Corliss unless otherwise stated: Armour Institute of Technology, 9 and 18x24-in. cross-compound; Bamberger De Lamar Gold Mines Co., Utah, 22 and 44x48-in. cross-compound and a 28x12-in. Reynolds jet condenser and air pump; Carnegie Steel Co., Pittsburg, repairs for 42 and 60x60-in. blowing engine; Pawling & Harnischfeger, Milwaukee, 18x36-in.; Boyne City, Mich., Lumber Co., 24x48-in.; Kirby Lumber Co., Houston, Tex., 36x60-in.; Interurban Construction Co., Ottumwa, Ia., 18x42-in.; Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., three vertical standard long crosshead 44 and 84x60-in. blowing engines; Calumet & Arizona Mining Co., Douglas, Ariz., 14 and 28x36-in. tandem compound, and a left hand low pressure side 40 and 44x48-in. Reynolds Corliss condensing blowing engine; National Lead Co., New York, 18 and 32x36 tandem compound; Miner Hillard Milling Co., Wilkesbarre, Pa., 20x42-in. girder frame; Larson & Orwell, Clarkfield, Minn., 10x30-in. girder frame; Oregon Smelting & Refining Co., Sampter, Ore., 16x36-in. girder frame; Iroquois Iron Co., Chicago, 42 and 87x60-in. vertical long crosshead blowing engine; Shattuck Bros., Sparta, Wis., 8x24-in. girder frame; City of Henderson, Ky., 24x48-in.; Deaver, Colo., Tramway Power Co., 32 and 68x60-in. and 30 and 64x48-in. cross-compound condensing; Detroit, Mich., Copper & Brass Rolling Mills, 26x48-in.; Southern Electric Light & Power Co., Philadelphia, 42 and 86x60-in. combined horizontal and vertical duplex compound condensing; Horseshoe Mining Co., Deadwood, S. D., 14x42-in., and 16 and 24x42-in. tandem compound; E. H. Dyer & Co., Cleveland, O., 12x36-in. girder frame; Sanitary District of Chicago, for 39th St. Pumping Station, two steam and two water ends for vertical triple expansion pumping engine and a centrifugal drainage pump; City of Allegheny, Pa., a steam and a water end for a 5,000,000-gal. vertical triple pumping engine; Penna. R. R. Co., two Sederholm boilers, 384 H.-P.

The Ball Engine Co., Erie, Pa., reports the following among its recent orders: An additional unit, this being the third, for the Security Building, St. Louis, Mo.; three 400-H.-P. units for the Lewis Block, Pittsburg; two engines to Port Antonio, Jamaica, and one to Japan.

James W. Copeland, 934 Equitable Bldg., Denver, Colo., has been appointed sole agent for Colorado for the Scaife and We-Fu-Go water softening and purifying systems, manufactured by Wm. B. Scaife & Sons Co., Pittsburg, Pa.

The Pittsburgh Gage & Supply Co. has received contracts for two 250-H.-P. water-tube boilers for the Ward-Mackey Co., Pittsburg, and a White-Star filtering system for the power house of the New York & Stamford St. Ry. Co., Port Chester, N. Y.

G. M. Gest, 277 Broadway, New York, has recently secured the contract for the conduit system, amounting to over 200,000 ft., for the Schenectady, N. Y., Ry. Co.

The following firms were represented with exhibits at the annual meeting of the New England Water Works Association at Boston: Jenkins Bros., 17 Pearl St., Boston; Manning, Maxwell & Moore, 85 Liberty St., New York, representing the Hayden & Derby Mfg. Co., Ashcroft Mfg. Co., Consolidated Safety Valve Co., and Hancock Inspirator Co.; Sweet & Doyle, 238 Franklin St., Boston; Lamb & Ritchie, Cambridgeport, Mass.; Garlock Packing Co., 12 Pearl St., Boston; H. Mueller Mfg. Co., represented by Sumner & Goodwin, 287 Congress St., Boston; Union Water Meter Co., Worcester, Mass.; Pittsburg Meter Co., East Pittsburg, Pa.; Thomson Meter Co., Brooklyn, N. Y.; Hersey Mfg. Co., Boston; Harold L. Bond & Co., 140 Pearl St., Boston; Lead Lined Iron Pipe Co., Wakefield, Mass.; Walworth Mfg. Co., Boston; N. W. Stearns, 308 Warren St., Roxbury, Mass.; Charles A. Claflin & Co., 188 Franklin St., Boston, representing Nelson Valve Co., Wyndmoor, Pa.; Michigan Lubricator Co., Detroit, Mich.; Crandall Packing Co., Palmyra, N. Y., and Hills-McCanna Co., Chicago, Ill.; Stilwell-Bierce and Smith-Vaile Co., Dayton, O.; A. W. Chesterton & Co., 49 India St., Boston; the Wells Light Mfg. Co., 44 Washington St., New York; Perrin, Seamans & Co., 57 Oliver St., Boston; Coffin Valve Co., Neponset, Mass.; A. P. Smith Mfg. Co., Newark, N. J., and Frank E. Merrill, Somerville, Mass.

The following industrial establishments have recently purchased electrical apparatus from the Westinghouse Elec. & Mfg. Co.: India Rubber & Gutta Percha Insulating Co., which is installing 1, 5, 10 and 15-H.-P. alternating-current motors at Yonkers, N. Y., to replace isolated steam engines; Pennsylvania Salt Mfg. Co., which has purchased a number of direct-current motors for its plant at Wyandotte, Mich., and the Stanley Rule & Level Co., New Britain, Conn., which has purchased a 375-Kw. 500-volt direct-current generator to be operated from a marine-type Westinghouse engine for electric driving of the works.

The "Hydro-Carbon" system of fuel combustion, controlled by the Steam Boiler Equipment Co., of New York, was exhibited at the recent convention of the National Association of Stationary Engineers in Boston. Two boilers of the engineering building at the Massachusetts Institute of Technology were equipped with the system to demonstrate its ability to prevent smoke with bituminous coal, the ease of firing and the maintenance of a steady steam pressure with economy in coal consumption

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Sept. 23.	New Bremen, O.	Sept. 20
Sept. 23.	Abingdon, Ill.	Sept. 20
Sept. 23.	McRae, Ga. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Sept. 23.	Philadelphia, Pa.	Sept. 6
Sept. 24.	Kewanee, Ill.	Sept. 20
Sept. 24.	Chicago, Ill.	Sept. 20
Sept. 24.	South Deerfield, Mass.	Sept. 20
Sept. 25.	Chamberlain, S. D.	Sept. 13
Sept. 25.	Baraboo, Wis.	Sept. 13
Sept. 26.	Westerville, O.	Sept. 20
Sept. 26.	Gibbon, Minn.	Sept. 13
Sept. 29.	Dyersburg, Tenn.	Sept. 20
Sept. 29.	Lidgerwood, N. D.	Sept. 20
Sept. 29.	Winnipeg, Man. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Sept. 30.	Armstrong, B. C.	Sept. 20
Oct. 1.	Nassau, N. Y.	Sept. 20
Oct. 1.	De Smet, S. D.	Sept. 13
Oct. 3.	Cleveland, O.	Sept. 13
Oct. 3.	Weiser, Idaho	Sept. 6
Oct. 6.	Webster Grove, O.	Sept. 20
Oct. 22.	El Paso, Tex.	Sept. 6
Dec. 1.	Pumps, Seguin, Tex.	July 26
———	Cass Lake, Minn.	Sept. 20
———	Bozeman, Mont.	Sept. 6

SEWERAGE AND SEWAGE DISPOSAL.

Sept. 24.	Geneva, N. Y.	Sept. 20
Sept. 24.	Boston, Mass.	Sept. 20
Sept. 25.	New Brunswick, N. J.	Sept. 20
Sept. 25.	Jeffers, Minn.	Sept. 20
Sept. 25.	Bucyrus, O.	Sept. 20
Sept. 25.	Boston, Mass.	Sept. 20
Sept. 25.	Newark, N. J. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Sept. 25.	Chamberlain, S. D.	Sept. 13
Sept. 27.	Akron, O.	Sept. 20
Sept. 27.	Massillon, O.	Sept. 20
Sept. 29.	Scranton, Pa.	Sept. 20
Sept. 29.	Wapakoneta, O.	Sept. 20
Sept. 29.	La Grange, Ga. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Oct. 1.	Decatur, Ind.	Sept. 20
Oct. 1.	Boston, Mass. Adv., Eng. Record, Sept. 13.	Sept. 13
Oct. 2.	Ironton, O.	Sept. 20
Oct. 4.	Glenville, O.	Sept. 20
Oct. 10.	Ridley Park, Pa. Adv., Eng. Record, Aug. 16.	Aug. 16
Oct. 11.	Akron, O.	Sept. 20
Dec. 15.	Montevideo, Uruguay	Sept. 13

BRIDGES.

Sept. 23.	Harrisburg, Pa.	Sept. 6
Sept. 23.	Reading, Pa.	Sept. 6
Sept. 23.	White Haven, Pa.	Sept. 6
Oct. 1.	Castroville, Tex.	Aug. 23
Oct. 6.	Frankfort, Ind.	Sept. 20
Oct. 6.	Ellendale, N. D.	Sept. 13
Oct. 7.	East Grand Forks, Minn.	Sept. 20
Oct. 8.	Indianapolis, Ind.	Sept. 20
Oct. 11.	Canton, O.	Sept. 20
Oct. 13.	Victoria, B. C. Adv., Eng. Record, Sept. 6 to 20.	Sept. 6
Oct. 15.	Yellowstone Park, Wyo. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Nov. 5.	Chicago, Ill.	Sept. 6

PAVING AND ROADMAKING.

Sept. 23.	Milwaukee, Wis.	Sept. 20
Sept. 24.	Brooklyn, N. Y.	Sept. 20
Sept. 24.	Chicago, Ill.	Sept. 20
Sept. 24.	Windsor Locks, Conn.	Sept. 20
Sept. 24.	Nutley, N. J.	Sept. 20
Sept. 25.	Atlantic City, N. J.	Sept. 20
Sept. 25.	Boston, Mass.	Sept. 20
Sept. 25.	Montclair, Colo.	Sept. 20
Sept. 25.	Swissvale, Pa.	Sept. 20
Sept. 25.	Green Bay, Wis.	Sept. 20
Sept. 27.	Bedford, Ind.	Sept. 20
Sept. 29.	Pontiac, Mich.	Sept. 20
Sept. 29.	Fremont, O.	Sept. 6
Sept. 30.	Buffalo, N. Y.	Sept. 20
Sept. 30.	Nevada, Mo.	Sept. 20
Sept. 30.	Dunkirk, N. Y.	Sept. 13
Oct. 1.	Brooklyn, N. Y.	Sept. 20
Oct. 1.	Pittsburg, Pa.	Sept. 20
Oct. 1.	Towson, Md.	Sept. 20
Oct. 1.	Decatur, Ind.	Sept. 20
Oct. 1.	Atlantic City, N. J.	Sept. 13
Oct. 4.	Pittsburg, Pa.	Sept. 20
Oct. 6.	Columbus, Ind.	Sept. 20
Oct. 6.	Des Moines, Ia.	Sept. 20
Oct. 6.	Jefferson Barracks, Mo.	Sept. 13
Oct. 11.	San Francisco, Cal.	Sept. 13
Oct. 13.	Newark, O.	Sept. 20

POWER, GAS AND ELECTRICITY.

Sept. 23.	McRae, Ga. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Sept. 24.	New York, N. Y.	Sept. 20
Sept. 24.	Taylorville, Ill.	Sept. 13
Sept. 25.	Verndale, Minn.	Sept. 20
Sept. 25.	Ulen, Minn.	Sept. 20
Sept. 25.	Prospect, O.	Sept. 13
Sept. 29.	Dyersburg, Tenn.	Sept. 20
Oct. 1.	De Smet, S. D.	Sept. 13
Oct. 3.	Weiser, Idaho	Sept. 6
Oct. 7.	Chattanooga, Tenn. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Oct. 14.	San Pedro, Cal.	Sept. 13
Oct. 15.	Chicago, Ill.	Aug. 23
Nov. 1.	Macon, Ga.	Aug. 30
Nov. 15	Norfolk, Va.	Sept. 13

GOVERNMENT WORK.

Sept. 22.	Portland, Me. Adv., Eng. Record, Aug. 23 to Sept. 13.	Aug. 23
Sept. 24.	Chicago, Ill.	Aug. 23
Sept. 25.	Cleveland, O.	Sept. 20
Sept. 25.	Chamberlain, S. D.	Sept. 13
Sept. 25.	Dredging, New York, N. Y. Adv., Eng. Record, Aug. 30 to Sept. 20.	Aug. 30
Sept. 26.	Dredging, Cleveland, O.	Sept. 6
Sept. 26.	Washington, D. C. Adv., Eng. Record, Aug. 30 to Sept. 20.	Aug. 30
Sept. 27.	Savannah, Ga. Adv., Eng. Record, Sept. 20.	Sept. 6
Sept. 29.	Louisville, Ky.	Sept. 6
Sept. 29.	Dredging, Portland, Me. Adv., Eng. Record, Aug. 30 to Sept. 20.	Aug. 30
Sept. 29.	Ledge excav., Portland, Me. Adv., Eng. Record, Aug. 30 to Sept. 20.	Aug. 30
Sept. 30.	Memphis, Tenn.	Sept. 13
Sept. 30.	Dredging, Boston, Mass. Adv., Eng. Record, Sept. 6 to 20.	Sept. 6
Sept. 30.	Indianapolis, Ind. Adv., Eng. Record, Aug. 23, 30.	Aug. 23
Oct. 1.	Washington, D. C. Adv., Eng. Record, Sept. 6 to 20.	Sept. 6
Oct. 1.	San Francisco, Cal.	Aug. 30
Oct. 3.	Ft. Lawton, Wash.	Sept. 13
Oct. 4.	Louisville, Ky.	Sept. 13
Oct. 6.	Denver, Colo.	Sept. 20
Oct. 6.	Jefferson Barracks, Mo.	Sept. 13
Oct. 6.	Johnson City, Tenn. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Oct. 6.	Tampa, Fla.	Sept. 13
Oct. 6.	New York, N. Y. Adv., Eng. Record, Sept. 6 to 20.	Sept. 6
Oct. 7.	Joplin, Mo. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct 8.	Portland, Ore.	Sept. 20
Oct. 8.	Chicago, Ill.	Sept. 13
Oct. 8.	Montgomery, Ala. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Oct. 8.	Chattanooga, Tenn.	Sept. 13
Oct. 9.	Ft. Totten, N. D.	Sept. 20
Oct. 9.	Newport News, Va. Adv., Eng. Record, Aug. 30, Sept. 6.	Aug. 30
Oct. 10.	Mobile, Ala. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Oct. 10.	Plattsburg Barracks, N. Y.	Sept. 13
Oct. 10.	Elmira, N. Y.	Sept. 13
Oct. 11.	Ft. Lincoln, N. D.	Sept. 20
Oct. 11.	Ft Snelling, Minn.	Sept. 20
Oct. 11.	San Francisco, Cal.	Sept. 13
Oct. 11.	Philadelphia, Pa.	Sept. 13
Oct. 11.	Dry dock, Charleston, S. C.	Aug. 23
Oct. 13.	Ft. Getty, S. C. Adv., Eng. Record, Sept. 20.	Sept. 20
Oct. 14.	Aberdeen, S. Dak.	Aug. 30
Oct. 15.	Muskegon, Mich. Adv., Eng. Record, Sept. 20.	Sept. 20
Oct. 15.	St. Louis, Mo. Adv., Eng. Record, Sept. 20.	Sept. 20
Oct. 15.	San Antonio, Tex.	Sept. 20
Oct. 15.	Yellowstone Park, Wyo. Adv., Eng. Record, Sept. 6 to 20.	Sept. 6
Oct. 16.	Tampa, Fla. Adv., Eng. Record, Sept. 6 to 20.	Sept. 6
Oct. 18.	Bldg., Ft. Myer, Va. Adv., Eng. Record, Sept. 20.	Sept. 20
Oct. 20.	New York, N. Y. Adv., Eng. Record, Sept. 20.	Sept. 20
Oct. 30.	Dredging, Boston, Mass. Adv., Eng. Record, Sept. 20.	Sept. 20
Nov. 1.	West Point, N. Y. Adv., Eng. Record, Sept. 20.	Sept. 20

BUILDINGS.

Sept. 23.	Engine house, Newark, N. J.	Sept. 20
Sept. 23.	Htg. school, Springfield, N. J.	Sept. 20
Sept. 23.	Pub. bldg., Nat. Military Home, Kan.	Aug. 30
Sept. 23.	Library, Beatrice, Neb.	Sept. 13
Sept. 23.	Pub. bldg., New York, N. Y.	Sept. 13
Sept. 24.	Pub. bldg., Rahway, N. J.	Sept. 20
Sept. 24.	Engine house, New York, N. Y.	Sept. 20
Sept. 24.	Pub. bldg., Brooklyn, N. Y.	Sept. 6
Sept. 24.	Htg. city hall, Newark, N. J. Adv., Eng. Record, Sept. 13.	Sept. 6
Sept. 25.	School, Hawthorne, N. J.	Sept. 20
Sept. 25.	Pub. bldg., Schenectady, N. Y.	Sept. 20
Sept. 25.	School, Sherman, Tex.	Sept. 13
Sept 25.	Hospital, Columbus, O.	Aug. 30
Sept. 26.	School, Columbus, O.	Sept. 6
Sept. 27.	Htg. pub. bldg., Connersville, Ind.	Sept. 20
Sept. 29.	School, Thurmond, W. Va.	Sept. 20
Sept. 29.	School, Deadwood, S. D.	Aug. 30
Sept. 30.	Library, Canastota, N. Y.	Sept. 20
Sept. 30.	Hospital, Raybrook, N. Y. Adv., Eng. Record, Sept. 13, 20.	Sept. 13
Sept. 30.	School, Lancaster, O.	Sept. 13
Oct. 1.	Library, El Paso, Tex.	Sept. 20
Oct. 1.	School, Milwaukee, Wis.	Sept. 13
Oct. 2.	School, Norfolk, Va.	Sept. 20
Oct. 3.	Htg. court house, Bryan, O.	Sept. 20
Oct. 6.	Jail, Hazlehurst, Miss.	Sept. 13
Oct. 6.	City Hall plans, Houston, Tex.	Aug. 9
Oct. 7.	Court House, Miami, Fla.	Aug. 16
Oct. 10.	Pub. bldg., Springfield, O.	Sept. 20
Oct. 10.	Police station plans, Milwaukee, Wis.	Sept. 20
Oct. 14.	Hospital, Springfield, O.	Sept. 20
Oct. 15.	Hospital, Willard, N. Y.	Sept. 13
Oct. 21.	Jail, Jefferson, Ga.	Sept. 13
Dec. 2.	Capitol work, St. Paul, Minn.	Aug. 16
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
———	Factory, Baltimore, Md.	Sept. 6

MISCELLANEOUS.

Sept. 23.	Dredging, New York, N. Y.	Sept. 13
Sept. 24.	Elmira, N. Y.	Sept. 20
Sept. 24.	Garb. collection, N. Adams, Mass.	Sept. 20
Sept. 25.	Brooklyn, N. Y.	Sept. 20
Sept. 25.	Wharf, Ottawa, Ont.	Sept. 20
Sept. 27.	R. R. work, Toronto, Ont.	Sept. 6
Sept. 30.	Harbor, Port Adelaide, S. A.	July 5
Oct. 1.	Levee work, Pointe-a-la-Hache, La.	Sept. 6
Oct. 2.	Montreal, Que.	Sept. 20
Oct. 8.	R. R., Portuguese East Africa	Aug. 30
Oct. 9.	Dry dock machinery, Portland, Ore.	Sept. 6
Oct. 10.	Garb. disposal, Atlanta, Ga.	Sept. 13
Oct. 13.	Garb. disposal, Brooklyn, N. Y.	Sept. 13
———	R. R. work, Chicago, Ill.	Aug. 30

THE ENGINEERING RECORD.

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Unreasonable Contract Requirements by the Government.—II.

In the general criticism of the specifications of the Bureau of Yards and Docks of the Navy Department, for the concrete and granite dry dock to be built at Charleston, S. C., in the Engineering Record of a week ago, attention was called to the arbitrary and unreasonable provisions of paragraph 3, in which the contractor is made responsible for the "Omissions and misdescriptions" of the engineering authority of the department. It is again well enough to note that such omissions and misdescriptions "shall not operate to release the contractor from supplying all such materials and performing such work, but the same shall be fully and properly supplied and performed in the same manner as if fully and correctly shown, described and required in and by the contract, and without expense to the United States in addition to the contract price." In view of our previous general criticism this excerpt probably speaks with sufficient effectiveness for itself as a vicious method of evading responsibility both as to authorship and consequences and as an effort to compel a contractor to gamble on the exigencies of a contract.

It might naturally be supposed that a contractor should within reasonable limits direct his own force and plant in the proper performance of his work in accordance with the specifications, but in paragraph 5 of the General Provisions of these specifications the "civil engineer in charge of the work or other authorized representative, shall at all times have full control and direction of all work under the contract, . . ." This provision taken literally is drastic and unqualified. Only by sufferance of the department's engineering representative may the contractor direct and control his work. This would be bad enough if the general character of the specifications conveyed the impression of effective capacity and self-reliance on the part of the engineering personnel of the office of the Chief of the Bureau; but other paragraphs of the specifications like 3, 25 and 37 would appear to indicate that the responsible engineer of that office entertained a decided distrust of the engineering administration of the work covered by the contract, at least so far as plans and specifications are concerned. Taking the specifications as a whole one might venture to suppose it to be the part of wisdom to permit an efficient and reputable contractor to conduct his own work with but a modest and circumspect general direction from the office of the Chief of the Bureau. On well managed works the engineer must certainly exercise a close general supervision and be intimately in contact with every detail of the work so as to secure with certainty every desired result, but to assume full control and direction of all work at all times is grossly unbusiness-like and unjust to the contractor. As a matter of fact the provision would be without any effect, or otherwise it would repel every contractor who had efficiency enough to be permitted to bid on government work.

The preceding remarkable features of the specifications for a great government work are but the beginning of a list of such length that it will not be attempted to name them all, but those disclosed by reading paragraphs 7 and 15 should not be omitted. In paragraph 7 the civil engineer in charge is empowered to discharge "immediately" "any person employed upon the work" should it "appear" to him that such person "is incompetent, careless, reckless or disorderly, etc., etc." Just why it will be objectionable to discharge a man on ascertainment of fact instead of acting on appearances is not clear. Again, under the provisions of paragraph 15, if it should "appear" to the civil engineer in charge "that the work is not likely to be completed within the time allowed," "the Chief of the Bureau of Yards and Docks . . . may, in his discretion, declare the contract null and void" on report of the civil engineer to him as to those appearances. This provision is unreasonable and arbitrary and its enforcement could accomplish no good purpose. It should not be the policy of the United States government to subject those whom it engages to execute great contracts, to conditions so probable to lead to loss as to make it unwise to bid a reasonable price for the work to be done. No contractor governed by the first glimmerings of good judgment could contemplate for a moment bidding for work like that of the Charleston Dock, involving all the hazardous uncertainties of subaqueous conditions, with such provisions of a proposed contract hanging over his work, for anything less than an extravagant amount. The result of such a high-handed procedure as the annulling of a contract on mere appearances presenting themselves to the mind of a subordinate or of even a chief, would inevitably result in serious losses to a contractor in many stages of any work, and every bidder under such circumstances is forced by the specifications to add to his reasonable profits a large enough sum to cover the contingency of an arbitrary, if not incompetent, engineer. It cannot be supposed for a moment that the Navy Department deliberately intends to serve notice to that effect on bidders for its great contracts, and yet that is precisely the effect of these specifications.

There is a provision in paragraph 24 which seems to indicate that the Chief of the Bureau expects the contractor to design material parts of all portions of the work as the provision reads "For all portions of the work the contractor shall submit the necessary detail plans to the civil engineer in charge for approval." If the department's engineers are to design the work it is difficult to understand why the contractor should submit to the department's engineer detail plans for all portions of the work. It would be more natural to suppose that the submission should be in the other direction. If the engineer is designing a work to meet the requirements of his specifications in an efficient manner and for which he is to be responsible he cannot justify himself in shifting to the contractor the duty of preparing plans, verifying dimensions and making final measurements, but at the same time permitting no deviations from specified dimensions, even in case of error, until the engineer has certified to those deviations on the ground that his own figures are in error and generally unreliable. A more remarkable confession of essential incompetence and unreliability on the part of a responsible engineer than that found in paragraphs 24 and 25 is seldom seen.

It would appear from paragraph 32 that even after the dock has been completed and after "the structures and all work included under the contract" has been tested by a board of officers appointed by the Secretary of the Navy, the Chief of the Bureau of Yards and Docks will still be unable to decide whether the dock shall be accepted, although if the test prove to be satisfactory the full contract price shall be paid to the contractor, as it is provided that he (the Chief of the Bureau) may continue to "test the dry dock and appurtenances under any working conditions" for a further period of six months before the contractor and his bondsmen are to be released from responsibility. If after six months of such testing no defects appear that release will be granted, but if they do appear they are to be made good by the contractor without further compensation. If an engineering force is not sufficiently qualified or competent to determine whether material and workmanship are satisfactory during the progress of work it would seem highly reasonable and business-like to substitute another sufficiently qualified and efficient to determine the character of the work being supervised, rather than to attempt to discover and repair errors after they have been incorporated in, and possibly concealed by, a completed structure.

The remaining technical details of the specifications will be treated in a future issue of the Engineering Record.

EXTRACTS FROM SPECIFICATIONS REFERRED TO ABOVE.

3. Omissions and misdescriptions.—The omission from the contract, or from the plans, specification, or other papers attached thereto and forming a part thereof of any work or materials required to secure the result set forth in paragraph 1, or the misdescription of any details of work, the proper performance of which is necessary to carry out fully the intention above expressed, shall not operate to release the contractor from supplying all such materials and performing such work, but the same shall be fully and properly supplied and performed in the same manner as if fully and correctly shown, described, and required in and by the contract, and without expense to the United States in addition to the contract price.

5. Control of work.—The United States, by its civil engineer in charge of the work or other authorized representative, shall at all times have full control and direction of all work under the contract, and all questions, disputes, or differences as to any part or detail thereof shall be decided by such civil engineer or representative, subject only to appeal to the Chief of the Bureau of Yards and Docks.

7. Employees.—The contractor shall employ only competent, careful, orderly persons upon the work, and if, at any time, it shall appear to the civil engineer in charge that any person employed upon the work is incompetent, careless, reckless, or disorderly, or disobeys or evades orders or instructions, or shirks his duty, such person shall be immediately discharged from and not again employed upon the work.

15. Progress of work.—If at any time the progress of the work shall, in the opinion of the civil engineer in charge, appear to have been such as to indicate that the work is not likely to be completed within the time allowed, he shall report such opinion to the Chief of the Bureau of Yards and Docks, who may, in his discretion, declare the contract null and void, without prejudice to the right of the United States to recover for defaults therein or violations thereof.

24. Plans.—Twelve sheets of plans numbered 1 to 12, inclusive, dated July, 1902, accompany this specification. These plans and their principal subject matter are as follows:

Sheet 1.—Borings and general location and layout.
Sheet 2.—Cross-sections.

Sheet 3.—Plan and longitudinal section on center line. Head end.
Sheet 4.—Plan and longitudinal section on center line. Entrance end.
Sheet 5.—Wing and quay walls and track details.
Sheet 6.—Details of guard stanchions, railing, and chain.
Sheet 7.—Details of capstans, bollards, cleats, shore fastenings, ringbolts, etc.
Sheet 8.—Details of culvert, main conduit, and crane track.
Sheet 9.—Details of granite masonry.
Sheet 10.—Details of granite masonry.
Sheet 11.—Details of bilge-block pulleys.
Sheet 12.—Details of blocks and fittings.

This specification and the plans accompanying it shall be considered as supplementary one to the other, so that materials and workmanship shown, called for, or implied by the one and not by the other shall be supplied and worked into place the same as though specifically called for by both. All detail plans that may be furnished subsequently in further amplification, as well as all instructions given by the civil engineer in charge that may be necessary to more fully indicate the intention of the specification and the above-mentioned plans, shall be followed and considered as though forming a part of the original contract. For all portions of the work the contractor shall submit the necessary detail plans to the civil engineer in charge for approval, unless otherwise directed by him, before proceeding with the work. These details shall conform to the letter and spirit of the specification, to any supplementary data and instructions, and to the general and detail plans already furnished the contractor. Plans shall be submitted to the civil engineer in charge in the form of tracings on cloth of Bureau of Yards and Docks standard sizes. These will be returned to the contractor, either with blue prints of same stamped "approved," or "to be revised" as noted on the tracings. In the latter case the necessary corrections shall be made and the revised drawings submitted before proceeding with the work. Approval of plans will be of a general nature and will not relieve the contractor from errors or omissions that may exist therein.

25. Checking plans and dimensions; lines and levels. —The contractor shall check all plans furnished him immediately upon their receipt and promptly notify the civil engineer in charge of any discrepancies discovered therein. Figures marked on plans shall, in general, be followed in preference to scale measurements; but the contractor shall compare all plans and verify the figures before laying out the work, and will be held responsible for any errors therein that thereby might have been avoided. Large-scale plans shall, in general, govern small-scale plans. In all cases where dimensions are governed by conditions already established the contractor must depend entirely upon measurements taken by himself, scaled or figured dimensions to the contrary notwithstanding; but no deviation from the specified dimensions will be allowed unless authorized by the civil engineer in charge. The contractor will be held responsible for the lines and levels of his work, and he must combine all materials properly.

32. Test of completed structures.—After the dry dock and all appurtenances relating thereto, required by the contract, are complete in all particulars, a board of officers appointed by the Secretary of the Navy for the purpose, will examine and test the structures and all work included under the contract. All expense of such examination and test will be borne by the Government. After the board has reported that all work called for by the contract has been completed in every particular, according to the true intent and meaning of the specification, plans, and contract, and after the report has been approved by the Chief of the Bureau of Yards and Docks, the contractor will be paid the remainder of the contract price. For a further period of six months after the approval of the report of the above board by the Chief of the Bureau of Yards and Docks, the Government may test the dry dock and appurtenances under any working conditions which it sees fit; and, if at the end of that time, no bad workmanship, weakness, or other defect due to the fault of the contractor shall appear, the work will be accepted and the contractor and his bondsmen will be released from further responsibility; if such defects do appear, they shall be made good by the contractor without additional compensation.

37. Borings.—Sheet 1 contains a record of borings made at various places on the Government property. This record is given for the information of bidders; however, the Government does not guarantee it to be correct in all particulars, or that the conditions will be found uniform, and it will not be responsible for any additional cost of work due to any variation from the same that may be found during the progress of the work.

Lignite is used for Fuel at the Elektrochemische Werke at Bitterfeld, Germany, where there are 21 water-tube boilers supplying steam engines of 5,400 total horse-power. It is carried directly from the mines into the coal bunkers at one-third the cost of coal.

The Break in the Utica Reservoir.

In 1873-74 the old Utica, N. Y., Water-Works Company built an earthen dam under the direction of the late Thomas Hopper, president and everything else of the corporation, and this dam subsequently formed a basin known as the Savage reservoir. The construction of the dam, like that of most one-man works, has always been considerable of a mystery, but it served its purpose satisfactorily for many years and it was not until September 13 that any apprehension was felt for its safety. Early on the morning of that day a slice of the embankment about three-quarters of the way to the top and 5 feet thick slid down the slope. The engineer and general manager of the company now owning the water-works of the city, Mr. William S. Bacot, M. Am. Soc. C. E., was at once notified of this occurrence. As soon as he inspected the slide and noticed the dampness of the embankment, he ordered every outlet from the reservoir to be opened as wide as possible; there were two spillways, a 20-inch blow-off pipe and a 20-inch discharge pipe, which were available for this purpose. By the end of the day the water had been drawn down 3½ feet and by Sunday night 6½ feet. But on Sunday morning, in spite of the emptying of the reservoir, another slip occurred and cracks opened in the embankment. Everybody lower down in the valley was notified of the danger, and so when the dam finally went out on the afternoon of September 16, not only was there no one in the path of the flood, but there was fortunately a large gathering of spectators expectantly awaiting the disaster. On this account definite information is available concerning the manner in which the accident took place. In the accompanying engraving of the break in the reservoir before the completion of the washout, it may be observed that a dozen people are standing on the crest of the dam while the water is still passing through the crevasse within 75 feet of them. Except in the case of the Austin dam, it is probable that no recent failure has occurred under conditions that enable such definite information to be given.

As a matter of fact, there is hardly anything to be said concerning the failure that an engineer cannot deduce from the two engravings. The dam was about 70 feet high, 275 feet wide at the base and 20 feet at the top. It is evident from the engraving that the slopes were too great, while the sides of the crevasse afford excellent instruction concerning materials not suitable for high reservoir dams. Water having once percolated through such a structure would inevitably destroy it. Just how the first percolation began cannot be stated, but the fact that muskrats were seen in the pool left inside the basin suggests that their burrowing may have started the trouble. The accidents they have caused in sections of the Erie Canal is well known.

Water first came through the dam near the crest in small jets. These streams worked downward faster than upward and for a time there was a little earth arch over the opening. This soon fell, however, and the water cut a V-shape notch in the embankment which finally had the shape shown in one of the illustrations. No official account of the disaster has yet been given out by the owners of the reservoir.

Owing to the foresight of Mr. Bacot there was no loss of life, as before stated, and, strangely enough, not a large amount of damage to property. The largest loser is the company, which has not yet determined what will be done with the dam. If it is raised again, it will have to be rebuilt entirely from the bottom up.

BREAK IN RESERVOIR BEFORE COMPLETION OF WASHOUT.

A List of Failures of American Dams.

From the Presidential Address of W. R. Hill, M. Am. Soc. C. E., before the American Water-Works Association.

A dam at Middlefield, Mass., failed on April 21, 1901. It was of earth faced with rubble walls and with two lines of sheet piling driven 15 feet apart with the space between them filled with puddle. The dam was 500 feet long, 20 feet high, 50 feet thick at the base and 30 feet at top. The failure was caused by water flowing over the crest of the dam. Four highway bridges were carried away. (Eng. Rec., May 4, 1901.)

A dam at Victor, Col., failed on May 19, 1901. It was of earth, 430 feet long and 25 feet high. The reservoir held 70,000,000 gallons of water, all of which escaped. The cause of the failure was due to an inadequate spillway. (Eng. Rec., June 8, 1901.)

A reservoir at Lebanon, O., having an area of 40 acres failed on July 10, 1882. The embankment, which was 30 feet high, was destroyed by water flowing over its crest. Five bridges and many houses valued at about $50,000 were swept away.

A large storage reservoir near Lima, Mont., was suddenly emptied by the washing out of the spillway in May, 1894, the dam being left intact. The lower end of the spillway had a fall of 30 to 40 feet, and a flood rapidly cut a huge channel back from the fall into the reservoir. The reservoir was said to have been 15 miles long and 1 mile wide.

A dam of a reservoir near Avoca, Pa., failed on May 25, 1894, the cause of failure being insufficient spillway. The capacity of the reservoir was 350,000 gallons.

The Spartansburg dam, near Oil City, Pa., failed June 4, 1892. It was 180 feet long and 10 feet high, and impounded a lake 1½ miles long and 1 mile wide. The dam was of earth and rock with center sheet piling for 150 feet. The balance, or a length of 30 feet, was without piling. It was this part of the dam that washed out. There was no waste weir other than a small flume, and the failure was caused by water running over the crest of the dam.

Melzingah reservoirs Nos. 1 and 2 of the Matteawan and Fishkill (N. Y.) Water Company failed on July 14, 1897. Each reservoir had a capacity of 6,000,000 gallons, and was formed by dams built across the same stream. Both dams were of earth with masonry core wall. The upper dam, which was 250 feet long and 30 feet high, failed first. The lower dam was 220 feet long and 24 feet high. Seven lives were lost and $30,000 worth of property was destroyed. The cause of failure was a freshet flowing over the crest of both dams. (Eng. Rec., July 17, 1897).

The city reservoir at Grand Rapids, Mich., failed July 2, 1900. The embankment was of earth with clay puddle core, lined on the inside with rubble masonry in cement, one foot thick, resting on a layer of concrete one foot thick. The bank was 12 feet wide on top, the inner slope was 1½ to 1, and the outer slope was 2 to 1. The capacity of the reservoir was 6,000,000 gallons, with water 25 feet deep. The failure was caused by water flowing over the top of the bank, and the damage due to it amounted to about $100,000. (Eng. Rec., July 14, 1900.)

The Walnut Grove dam on the Hassayampa River, 30 miles south of Prescott, Arizona, failed on February 22, 1890. It was 110 feet high from the rock foundation to the coping, 400 feet long, 140 feet thick at the base and 10 feet at the top. It was a rock-filled dam with walls on both faces made of large granite blocks of dry masonry, with a timber lining on the water side. The walls were 20 feet thick at the bottom and 5 feet at the top. The waste weir was only 26 feet wide, while the area of the watershed was about 500 square miles. The reservoir had an area of about 1,000 acres. The cause of failure was supposed to be water flowing over the crest of the dam. About 150 lives were lost, and the damage to the dam and the property destroyed was estimated to be about $800,000.

The most appalling catastrophe and terrible lesson ever given by faulty construction of a dam in the history of this country occurred on May 31, 1889, by the breaking of the dam across the south fork of the Conemaugh River above Johnstown, Pa. The dam was constructed in 1852 for a reservoir as a feeder for the Pennsylvania Canal. In 1857 it was abandoned, and in July, 1862, a culvert in the embankment gave way owing to some imperfection of the foundation. The depth of water at that time was about 40 feet, all of which was discharged with the exception of about 8 feet, but owing to the substantial character of the dam the leakage was slow and but little damage was done. From 1862 to 1880 the reservoir was empty, and in the latter year the dam was reconstructed to a height of 2 to 3 feet lower than originally. However, a fatal mistake was made in leaving a low place or sag in the middle of the dam. Another mistake made was the obstruction of the spillway with an iron grating placed to retain the fish in the reservoir. The spillway should have been lowered because of the lowering of the crest of the dam, and enlarged because of the obstruction. On the fatal day the water rose and flowed over the crest of the dam because the spillway was too small to discharge the water, and in a short time 400 feet of the dam washed away, dissolving like a phantom. The loss of life was variously estimated at from 4,000 to 10,000, and the damage to property amounted to about $9,000,000. The reservoir had an area of about 400 acres, an average depth of 30 feet, and a capacity of about 5,000,000,000 gallons. The area of the watershed was about 60 square miles. The dam was constructed entirely of clayey earth, 72 feet high, 20 feet wide on top with an inside slope of 2 to 1, and an outside slope of 1½ to 1. The inside slope was protected with a light riprap. (Eng. Rec., June 8 and 15, 1889.)

THE FINAL SHAPE OF THE CREVASSE.

Many failures have been caused by water leaking along pipes laid through embankments. To prevent such leakage the pipes should be laid in rubble or concrete masonry surrounded with puddle. Among instances of failures due to such leakage may be mentioned:

The dam of Rock Springs Water Works reservoir, above Blairtown, Wyo., burst February 2, 1888. The cause of the failure was water leaking around a pipe laid through the dam.

A reservoir bank at Wilmington, Del., failed in October, 1900. It was of earth lined with clay and faced with brick. It was 10 feet high where the break started. The cause of the failure was supposed to be due to leakage of water along pipes laid through the bank. (Eng. Rec., Oct. 20, 1900.)

A reservoir at East Liverpool, O., failed October 13, 1901, when it was being filled for the first time. It was lined with 18 inches of concrete laid on 27 inches of puddled clay. It had a capacity of 12,000,000 gallons. The break occurred over a pipe laid through the embankment. (Eng. Rec., Nov. 2, 1901.)

The embankment of a reservoir at Ansonia, Conn., broke out November 3, 1894, making a gap 200 feet long and 35 feet deep and washing out about 200 feet of the roadbed of the New York, New Haven and Hartford Railroad. The failure was caused by water percolating along the waste pipe laid through the embankment. (Eng. Rec., Nov. 10, 1894.)

A dam of a reservoir at Gunnison, Cal., burst on May 21, 1890. The reservoir was 5 miles long, about 1½ miles wide and 20 feet deep. The accident was caused by leaks along the drain pipe.

An earthen embankment with a masonry face wall, at Staffordville, Conn., gave way on March 27, 1877. The embankment was 26 feet high and 150 feet long, and the wall was 10 feet thick at the base and 4 feet at the top. The failure was due to water leaking along the waste pipe laid through the embankment. Some lives were lost, and the damage to buildings, bridges, etc., amounted to about $300,000.

At Lancaster, Pa., a reservoir failed on October 14, 1894, while first being filled. The embankment was of earth with puddle center. The reservoir had a capacity of 15,000,000 gallons with the water 21 feet deep. The water was seen to gush out from the outer slope of the embankment and in an instant a break 30 feet in width was made, through which the reservoir rapidly emptied. The reservoir was lined with clay, protected by a coating of cement mortar, then a brick paving finished with grout. The failure was due to water leaking along the outlet pipe. (Eng. Rec., Oct. 27, Dec. 8, 1894.)

The embankment of a 20,000,000 gallon distributor reservoir at Portland, Me., failed on August 6, 1893, after having been in use four years. The embankment was without a core wall and was 10 feet wide on top, 45 feet high, and the slopes were 1½ to 1 on each side. Six feet of the inner slope was puddled clay and 6 inches of broken stone, upon which was laid granite paving blocks 8 inches thick. A drain pipe was laid through the natural surface under the embankment, and an overflow pipe was laid over it sloping downward through the embankment. The break occurred over these pipes. The cause of the failure was said to be either the action of frost, or the light embankment, or water following the pipes. Much damage was done and four lives lost. (Eng. Rec., Aug. 19, 1893.)

The dam of the Spring Lake Reservoir near Fiskville, R. I., failed August 25, 1889. The reservoir had a capacity of 35,000,000 gallons. The dam was made of clay and gravel and was 825 feet long, 18 feet high, 8 feet wide on the top and 35 feet wide on the bottom. The outside slope was retained by a stone wall, and the inner slope was paved with stone. The portion washed away was just above the waste pipe. Property valued at about $25,000 was destroyed, and three lives were lost. (Eng. Rec., Aug. 31, 1889.)

Water also displays a tendency to following along masonry laid in embankment, as is indicated in the following instances:

The Lynde Brook reservoir embankment of the water works of Worcester, Mass., failed on March 29, 1876. It was of earth, paved on the inside with rubble masonry on a slope of two to one. It was 287 feet long, 27 feet high and 25 feet wide on top. The embankment was originally built in 1854, was enlarged and modified in 1870, when it was made 19 feet higher, and a heavy face wall of masonry was added. The reservoir had a capacity of 776,000,000 gallons. Water leaked around a culvert that passed through the base of the embankment, making a breach 200 feet long and destroying property valued at nearly $1,000,000.

Many annoying failures have been caused by the bottoms of reservoirs settling and breaking, due to the weight of the water, thus giving it an opportunity to escape through the loose underlying material. To obviate this difficulty the outer walls of the reservoir if possible should be carried down to solid rock or other stable impervious material. If such material cannot be found, the greatest care should be exercised in lining both the bottom and sides of the reservoir.

Among the most striking cases of such failures may be mentioned the following:

The bottom of the city reservoir at Roanoke, Va., caved in on Nov. 10, 1888, causing a loss of about $15,000.

The puddle bottom of a double reservoir at Knoxville, Tenn., failed on May 31, 1883.

A reservoir on Conshohocken Hill, near Philadelphia, Pa., with a capacity of about 1,000,000 gallons, was lined with about 18 inches of clay, upon which was laid a brick paving in cement. The bottom lining broke away in 1873 and was repaired. It failed again in the years 1876, 1879 and 1886.

The concrete lining of a reservoir at Portland, Ore., cracked badly before water was let in. The concrete was 5 to 6 inches in thickness with ⅜-inch square twisted rods bedded in the concrete every two feet in each direction. On Dec. 13, 1894, water was turned into the reservoir and serious leaks and further cracks appeared in the bottom lining. (Eng. Rec., Feb. 2, 1895.)

The Milburn storage reservoir of Brooklyn, N. Y., was completed in 1893 and has never been in use. In August of that year 43,500,000 gallons of water were pumped into it, all of which leaked out through the bottom in a period of ten days. The puddle bottom of the reservoir was considered to have been improperly put in, although it was generally of good material. Experts have recommended that the entire bottom of 44 acres be repuddled, though nothing has yet been done in regard to their recommendations. (Eng. Rec., April 28, 1894.)

A leak in one of the basins of the Roxborough reservoir of the Philadelphia Water Works was discovered in 1891, after the reservoir had been in use nearly a year. A depression was found in the embankment about 3 feet above the bottom. Underneath the brick lining the clay had been washed away, and below there was a fissure in the rock 6 to 10 inches in width. Through this fissure the water escaped, coming to the surface 1,200 feet away. Water was first pumped into this reservoir on September 21, 1893. When it had been filled to a depth of 20 feet an increased flow was detected in a spring nearby. The leak was not located for nearly a year after. An expenditure of about $140,000 was required to reconstruct the interior lining. (Eng. Rec., Jan. 12, 1895.)

The Queen Lane reservoir of Philadelphia was practically completed on October 1, 1894. Later it was filled to a depth of 10 feet and developed leaks at many points. The bottom was lined with 4 inches of concrete and was upon a layer of clay puddle 2 feet in thickness, which was built up in layers, rolled and watered. The rock underlying is gneiss and mica, and the upper portion of this is more or less disintegrated. The cost of reconstructing the interior lining of the reservoir was about $275,000. (Eng. Rec., Dec. 22, 1894.)

Many disastrous failures have been caused by embankments and walls being undermined where they were built upon porous or yielding material. The general rule should be to build the structure upon a firm and impervious foundation in all cases if at all possible.

The dam of the Light and Power Co., at Tacoma, Wash., was undermined in December, 1892. It was built of timber and was about 120 feet long, holding back a depth of 17 feet of water. (Eng. Rec., Jan. 7, 1893.)

The Housatonic dam, near Birmingham, Conn., failed in the latter part of January, 1891. It is a curved masonry dam, 636 feet long, 40 feet high, 25 feet thick at the base and 8 feet at coping, costing $264,000. In 1869, while under construction, a heavy freshet carried away 160 feet of the partly finished work and scoured out a cavity 20 feet deep in the river bed. This cavity was filled with loose rock, and a timber apron, filled with concrete, was placed upon it. Twenty-two years afterwards 250 feet of the dam was swept away by the undermining of the loose rock under the timber apron.

A break in the reservoir embankment at Dallas, Texas, occurred in June, 1891. The embankment was of clay without a core wall, the inner slope paved with brick in cement, set on edge upon 3 inches of gravel. It was 29 feet high and 12 feet wide on top, with an inner slope of 2 to 1. The reservoir had a capacity of 140,000,000 gallons. A large part of the bank sank vertically, due as was thought to quicksand beneath the foundation. The settlement was over 300 feet in length and extended from the toe of the outer slope to within 5 feet of the top of the inner slope. The brick and cement lining was cracked in an almost straight line at 11 feet from the top, and from this line to the top of the embankment there was a slight settlement.

The Angel's dam, Calaveras County, Cal., was undermined on April 10, 1895. This dam, costing $52,000, was of rubble stone masonry, 400 feet long and 52 feet high. It was 35 feet thick at the base, and at a height of 20 feet the thickness was abruptly reduced from 21 to 13 feet. At the top it was three feet thick. The upstream face of the dam was vertical. During the time of construction workmen were engaged in digging a hole near the wall, and the foreman said "they were trying to dig out a cotton wood stump, but the blamed roots ran clear under the wall and he could not get them out."

The Mill River reservoir dam, at Williamsburgh, Mass., burst on May 16, 1874. The dam was of earth with a masonry core wall. It was 600 feet long, 43 feet high and 16 feet wide on top with slopes of 1½ to 1 on both sides. The core wall was 2 feet thick at top and 5 feet 9 inches at bottom. It was laid in a trench on an earth foundation 3 feet below the natural surface. The reservoir had an area of 114 acres and an average depth of 20 feet. Water found its way under the core wall and destroyed the embankment. The reservoir was suddenly emptied into a narrow valley, causing a loss of 140 lives and the destruction of about $1,000,000 worth of property.

The following failures are said to be due to poor workmanship or faulty designs:

The dividing wall of a reservoir at Little Rock, Ark., burst on Nov. 2, 1887. The wall was of rubble masonry 36 feet high, 12½ feet thick at the bottom and 7 feet at the top. The reservoir held 7,000,000 gallons of water in each basin. The wall is said to have been poorly constructed.

The Mud Pond dam, near East Lee, Mass., failed on April 20, 1886. This dam was of earth with a dry boulder wall on the downstream side. It was 325 feet long, 15 feet high, 28 feet thick at the base and 6 feet at top and said to have been poorly constructed. Seven lives were lost, and the damage to property amounted to about $250,000.

To increase the capacity of a reservoir about 100 feet square on Vernon Heights, Oakland, Cal., a wall of asphalt concrete was built around it. The wall was 8 feet high and only two feet thick at the base and one foot at the top. It had no depth in the soil and was built partly on made ground. It failed October 20, 1896.

A reservoir at Scranton, Pa., gave way on October 10, 1895. The walls were of rubble with dressed granite faces, filled with concrete and strengthened with stone buttresses about 24 feet apart. The wall was 10 feet thick at base, and the depth of water was 20 feet. About 120 feet of the wall gave way after having been in use ten years.

Two new reservoirs at Nebraska City, Neb., failed on April 10, 1890, shortly after being put into use. The banks were of earth 8 feet wide on top with slopes of 1 to 1 inside and 1½ to 1 outside. The depth of water was 17 feet. The soil was very porous, and to prevent the percolation of water the embankments and bottom of the reservoir were lined with 2-inch plank, which was covered with about a foot of earth.

A timber dam at Northfield, Vt., failed August 27, 1890. It was 100 feet long and 25 feet high at the deepest point. It was built of single layers of 12-inch by 12-inch hemlock timbers, 10 feet long, simply placed one above the other and drift bolted together. The dam was roughly in the form of an arch of 40 feet radius, and each set of timbers formed a 10-foot chord of the arch. They were not fastened together at the ends by spiking or by any vertical binding pieces. The only additional part to the dam, besides the 12-inch timbers, was an interior vertical lining of 3-inch planks, making the dam only 15 inches in thickness. In placing the planks the end joints were not broken. The dam stood the test of being filled twice within a period of 8 days before it failed. It seems hardly necessary to state that no engineer was employed in charge of the construction.

In several instances the weakness in construction has developed through the force of ice.

The Kinsman Street reservoir at Cleveland, O., failed in December, 1886, because of ice pressure and the sudden drawing off of water.

A concrete dam of the Water Power Company at Des Moines, Iowa, failed in March,

1893. Cause of failure due to ice, undermining and faulty construction. (Eng. Rec., April 15, 1893.)

In the year 1896 a reservoir at Montreal, Canada, of a capacity of 42,000,000 gallons, leaked at the rate of 350,000 gallons per day. The leakage is believed to have been caused by the ice near the high water line. The reservoir was formed by a masonry wall, backed first with puddle and then with an earth and stone embankment.

The upper dam of the St. Anthony's Falls Water Power Company at Minneapolis, Minn., failed on April 30, 1899. It was of coursed ashlar sandstone masonry, 530 feet long, 18 feet high, 12 feet thick at the base and 5 feet 1½ inches at top. The damage to the dam, which amounted to about $25,000, is said to have been caused by ice pressure. (Eng. Rec., May 13, 1899.)

The following structures failed for miscellaneous or unknown reasons:

Dam No. 2 of the Mahanoy City, Pa., Water Company gave way June 17, 1892. It was of puddled clay without a core wall. The inner slope was paved and the outer slope covered with large stones. It was 130 feet thick at the bottom and 25 feet at the top. The depth of water was 18 feet and the capacity of the reservoir 3,000,000 gallons. The dam had been under repair. Much damage was done and one life was lost.

The bursting of a dam of a reservoir at the head of Goodrich Creek, 12 miles from Baker City, Ore., on June 15, 1896, caused extensive damage in the valley below. One farm house was carried away and an entire family of seven persons were drowned.

The bursting of a dam of the lake at the fair grounds at Staunton, Va., Sept. 30, 1896, due to high water, caused a flood which did considerable damage to property and in which five lives were lost. (Eng. Rec., Oct. 10, 1896.)

A small dam near Ward, Jefferson County, Col., burst July 9, 1897. Two lives were lost and $50,000 worth of property was destroyed.

Two of the reservoir dams on Beaver Brook, near Ansonia, Conn., were carried away on March 26, 1884, liberating about 50,000,000 gallons of water. One railroad and two highway bridges were destroyed, and the total damage amounted to about $250,000.

A rock-filled dam across Pecos River, six miles above Eddy, New Mexico, failed on August 6, 1893. It was 1,040 feet long, 45 feet high, 21½ feet wide at water level and 6½ feet at top. On the upstream slope the rock was laid 1½ to 1, faced with earth with a slope of 2 to 1, and the downstream slope was 1 to 1. (Eng. Rec., Aug. 26, 1893.)

On September 18, 1890, a dam near the head of Broad Brook in the town of Ellington, Conn., gave way, and the flood swept down the valley, carrying away five dams, two railway trestles, six highway bridges and other property, making an aggregate loss of about $50,000.

A masonry dam on the Colorado River at Austin, Tex., costing $1,400,000, failed on April 7, 1900. It was 1,275 feet long, 68 feet high, and 66 feet thick at the base. A freshet and great depth of water flowing over the crest forced 500 feet of the dam down the river. The damage to property amounted to about $500,000. (Eng. Rec., April 14 and 21, May 19, June 30 and July 28, 1900.)

In addition to the cases cited above, forty-eight other failures of dams and reservoirs in this country have come to my notice. It is very unfortunate that the records relating to them do not contain any description of the structures, the purpose of their construction or the cause of the failures.

Rapid Base Line Measurement for the Ninety-Eighth Meridian Triangulation.

Some very important changes in the manner of measuring primary base lines have been instituted in the Coast and Geodetic Survey, which will doubtless receive the hearty approval of all who are acquainted with the possibilities and limitations of that branch of surveying. Early in 1899, Dr. H. S. Pritchett, then Superintendent of the Coast and Geodetic Survey, made several suggestions preliminary to the work of triangulation along the ninety-eighth meridian. Among them were the following: First, that it would be better to measure many bases at comparatively short intervals with a moderate degree of accuracy, than to measure few at longer intervals with a very high degree of accuracy; second, that the bases could be measured at a much smaller cost if one party measured as many as possible in one season in advance of the traingulation than if

Location of Bases.

the customary plan were followed of measuring one base at a time; third, that the degree of accuracy which it would be necessary or desirable to attain should be ascertained, and the plans for the measurement made with reference to securing an accuracy no greater than this as quickly and economically as possible.

In a report "On the Measurement of Nine Bases Along the Ninety-eighth Meridian," Appendix 3 of the 1901 report of the Superintendent of the Coast and Geodetic Survey, is given a detailed and elaborately illustrated description by Mr. A. L. Baldwin, computer and chief of party, of the methods used in following out these suggestions, and also a preface by Mr. John F. Hayford, inspector of geodetic work, stating in more detail the reasons for conducting the work in the manner stated. A resume of this valuable report follows.

An examination of the manner in which errors of length in a triangulation accumulate in passing from a base to a remote side, shows clearly that the most accurate portion of the operation is the base measurement; that the accumulation of error is most rapid in passing from the base to the border lines of the base net; and that the errors of length accumulate much more slowly in the chain of triangles between the base nets than in the base nets, but that even here the errors are large in comparison with those involved in the base measures. Accordingly the reconnaissance party sent out to select the sites for the bases was instructed to pay especial attention to securing good geometrical conditions in the base nets even at a sacrifice of accuracy in the bases, and was informed that the accuracy of the base measures could be kept up to the standard on any grade not exceeding 5 per cent., and that narrow, deep ravines should not be considered as obstructions.

It became evident from a consideration of previous triangulation in the United States and in foreign countries that very little increase in the average accuracy of the lengths of the triangle sides would result from increasing the accuracy of the base measurement beyond that represented by a probable error of 1 part in 500,000. The party was therefore instructed to keep as far within this limit as possible by the use of good judgment and skill, but to restrict the time and money expended upon each operation to that required to keep barely within this limit.

A careful study of past base measures indicated clearly that although they are ordinarily of more than sufficient accuracy in so far as accidental errors are concerned, they have two weak points with reference to constant errors. Each base has usually been measured with but one set of apparatus, or at least with but one type of apparatus; and the apparatus has usually been standardized under one set of conditions at headquarters and used under another set of conditions in the field. Almost without exception, whenever a base has been measured with two types of apparatus, discrepancies between the measures have developed which were too large to be consistent with the degree of accuracy which was supposed to be attainable with the apparatus. In the base measures of 1900, it was therefore decided to reduce such errors to smaller proportions by making the length of each base depend on several sets of apparatus of two different types, and it was also determined to standardize the apparatus in the field under conditions as nearly as possible corresponding to those encountered in the base measures.

The nine bases measured in this work, together with the Salina base of the transcontinental triangulation along the thirty-ninth parallel, control the lengths on 1,100 miles of the arc of the ninety-eighth meridian. Their location and the route followed by the party in going from one to another is shown on the accompanying map. The date of arrival and organization of the party at Shelton, Neb., was June 16, 1900, and after this date 26 days were occupied in transportation from each site to the next. The departure from Seguin base began on January 18, 1901. In a period of six months, therefore, all the apparatus was standardized twice under actual working conditions, and these nine bases, averaging 7.7 kilometers (4.8 miles) in length, were measured with an average probable error of 1 part in 1,200,000, this accuracy being obtained largely through skill in manipulation. The largest probable error in the measurements was that at the Alice base, 1 part in 690,000; and the smallest was at the Bowie base, 1 part in 1,639,000.

The Eimbeck duplex base bars, two 100-meter tapes, and two 50-meter tapes were used in the measurement. A portion of each base about one kilometer (3,280 feet) in length was measured with all five sets of apparatus, and, of the remainder of each base, about one-fifth was measured with the duplex bars and about two-fifths each with the 50-meter and the 100-meter tapes.

All the apparatus was standardized at Shelton before beginning operations, and at Seguin afterwards. As the comparators were located only a short distance away from their respective base lines, the lengths of each of the five sets of apparatus were determined under the same conditions in which they were used, and by the same observers. The comparators consisted of two spherical-headed brass bolts cemented into stone monuments imbedded in the earth approximately 100 meters apart. As the comparator interval was to be determined by means of the iced-bar apparatus, preparations were made accordingly. Well seasoned pine posts, 5½ inches square and about 6 feet long were driven to about half their length every 5 meters apart between the monuments to be used as supports for the intermediate microscopes. The end microscopes were provided with more stable supports. Alongside of the post three sections of portable track were moved along with the progress of the measurement and were supported on intermediate stakes. On this track the measuring bar was supported.

The comparator interval was determined by means of a 5-meter steel bar immersed in melting ice. The length of this bar referred to the international meter at Paris, is known with a probable error of 1 part in 4,500,000. The bar was properly set to grade by means of a striding level resting on plugs about a meter apart, and its alignment was accomplished by mounting a theodolite in the line of the end microscopes and bringing the intermediate microscopes into position as each was adjusted. What is known as a cut-off cylinder was used at the ends to refer the line to the brass bolts. The speed of this measurement varied only slightly from 100 meters per hour, although single measures of the comparator interval were recorded in 50 minutes.

The distance between the terminals of the Shelton comparator was measured ten times with this iced-bar apparatus and the Seguin comparator five times. In the course of these measurements it was seen that there was a decided tendency toward a large result when measuring away from the sun. This was accounted for by the fact that each microscope was shaded only while the corresponding measurement was being made. As soon as the microscope is shaded, the side of the iron cap toward the sun begins to cool, and the microscope therefore begins to move toward the sun. As a result of this, when the measurement proceeds toward the sun, too short a length for the interval is obtained, and when proceeding away from the sun the value is too large. This discrepancy is of course small, and by making two measurements, one directly after the other and in the opposite direction, and taking the average as one determination of the length, this source of error was eliminated. Taking into consideration the probable error in the length of the iced-bar itself, the probable error of each 100 meters of the bases measured, so far as the determination of the lengths of the comparators is concerned, is 0.037 millimeter, or 1 part in 2,700,000. This was a much higher degree of accuracy than was required.

Each unit of the duplex bar apparatus consists essentially of two 5-meter measuring bars of steel and brass respectively, freely supported side by side in a brass case. The measuring bars are of exactly the same length only at a certain temperature known as the duplex temperature, and the difference between the mean temperature of the bars during a measurement and this duplex temperature is in proportion to the difference between the values for the length recorded by the steel and the brass, respectively. There is thus provided a means of obtaining from the coefficients of expansion of the two metals the mean temperature of the bars throughout the base line measurement, from which what is known as the duplex measurement can be obtained. In addition to this, three thermometers are placed with their bulbs between the two bars, and a record is kept of the indicated temperatures throughout the measurement. By using the measures obtained from the two bars as entirely independent values, and these observed temperatures as the actual ones, two additional values for the length of the line are obtained. Thus by the use of the duplex bars three partially independent determinations of the length of the base are made simultaneously, and are known as the duplex, the brass, and the steel, respectively.

The method of manipulating this duplex bar apparatus was modified somewhat from that of previous surveys in order to gain speed. No attempt whatever was made to protect the apparatus from the weather. On starting a measurement, the trestles having been arranged at a convenient height, but in the rear of the section mark, the zero bar was aligned and put in position face up, the front end of that component which was in the exact line of the base being brought over the section mark. In referring to the section mark a transit was used at a distance of 30 feet and at right angles to the bars. The other component was then set normal, either by the plane mirror or with the front scale whose reading when normal was known. The components are said to be set normal when their front agates are in the same plane normal to the bars. The bar scales on this bar were then read, recorded and checked. The temperature was noted, and if higher or lower than the duplex temperature (26.45 degrees Centigrade) the brass component was shifted backward or forward by an amount sufficient to permit the measuring of 250 meters if possible without another set-back or set-up. This was done to make as few delays as possible in the measurement.

The first bar of the measure was then placed on the trestles and simultaneously with the rough alignment by the observer at the forward end, the rear end of the bar was raised or lowered by means of a sliding wedge, and securely clamped when at the correct height. The preliminary contact was then established by seizing the bar under the left arm and sliding it backward bodily while the contact slides were held back and protected as much as possible with the forefinger of the left hand. The signal "Ready for line" was given when this approximate contact was begun, and generally with its completion the perfect alignment was completed by the forward observer, who bisected the line flag at the next section post ahead, which had previously been set five-heights of an inch from the line. It will thus be seen that one of the components traveled in the exact line of the base. The final contacts were then established between the components as quickly as possible by means of the contact screws, and at the same time the thermometers and the inclination sectors were read and recorded. This completed the laying of the first bar. Unless a set-up or set-back of brass became necessary no more scale readings were taken until the end of the half section, usually after the laying of the hundredth bar.

Next the zero bar was launched and carried ahead by two men and brought into line and contact as the second bar of the measure. The inclination sectors and the thermometers were then read, checked and recorded as before. On the third bar and until the ninth was reached the thermometer readings were omitted, the mean temperature from eight sets not differing materially from that from twenty. At the end of the half section, where a stop was usually made, the forward agate of the steel component was referred to the ground and the scales of the last bar read and checked. The brass component was then shifted to normal with steel, the scales read and the bars left standing. On resuming the measure the front agate was referred to the ground mark and the start made as described for the beginning of the section. When transferring to the ground the readings were never made on a scale, but the end of the measurement was preserved by a mark on a copper tack so that the set-ups (or set-backs) could be checked at any time with a quarter-meter scale and dividers.

DUPLEX BASE BARS IN USE.

The observer in charge of the trestles spaced them and made them stable. The gain in speed over former measures was in a great measure due to the observer aligning the trestles simultaneously with the rough bar alignment, so that when he finally left the bar it was certain that the trestles ahead were in line. He then went to the front trestle, and by sighting under the fixed bar set its roller at the general grade of the ground. This enabled the forward bar man to immediately clamp his forward trestle and assist in the work at the rear trestle. At the conclusion of the measurement of 250 meters and at 750 meters the bars were both reversed with care, but no scale readings were made unless a shift of the brass was required to equalize the amount of projection of the components beyond the protecting case. The speed with which these duplex measurements were made varied from a little over 25 bars per hour at the start to 100 bars per hour for a half section at the Seguin base. The average was 52.9 bars (about 870 feet) per hour.

An inspection of the results obtained from the duplex apparatus reveals the fact that the result from steel is in every case between that from duplex and that from brass. Moreover, the differences, steel minus duplex and brass minus steel, bear a fixed relation to each other. The mean value of this ratio is 1.67 and the individual values agree closely with this; so that there is not a single case where a correction of less than 0.2 millimeter to one of the values will not produce exactly the ratio 1.67. This peculiarity forms a valuable check on the computation. An inspection of the results obtained from this apparatus at the Salt Lake base in 1896, in which measurement the bars were carefully protected from inequalities of weather, reveals this same ratio. That this peculiarity is due in some manner to inaccuracies in temperature measurement is shown by the fact that wherever the range in temperature was least the results from the three methods are most nearly in accord, and in special cases where the temperature was constant the accord is perfect. Computing the probable errors of the three values obtainted and assigning weights in inverse proportion to the squares of the probable errors, the weights of the three determinations were: duplex, 10; steel, 5; and brass 2.

A careful consideration of the probable errors obtained in measuring the comparator intervals, compared with what would be expected in a 100-meter length judging from the probable errors obtained in measuring the nine test kilometers, led to the conclusion that the results from the duplex follow closely the laws of accidental errors, the probable errors increasing but little faster than the square root of the lengths. With the steel and brass it is quite different. In the case of the steel the errors increase very closely as the length, while with the brass the errors increase more rapidly than the length. Because of the removal of the tent and the subjection of the bars to different conditions of the weather, the probable errors have not been much affected for the duplex result, but the probable errors for the steel and brass have increased greatly. The evidence of constant errors is therefore greatest in the results from brass and steel, while the duplex result is apparently not entirely free from such errors.

Both the 100 and the 50-meter tapes used in the base measurements were about ¼ inch wide and 1/50 inch thick, and weighed about 22 grams per meter. Instead of graduations ruled on the tape itself there are end graduations ruled on silver sleeves riveted to the tape.

Only one tape stretcher was used, the rear end of the tape being simply held by a staff driven into the ground. The spring-balance used to apply the proper tension to the tape was one reading directly to 25 grams. The tension used was 15 kilograms (33 pounds), in place of 11.5 kilograms formerly used. The two thermometers used were tied in a horizontal position near the ends of the tape, with their metal backs in contact with it.

When in use the tapes were supported at 25-meter intervals, the intermediate supports consisting of wire nails driven into 2x4-inch stakes. These support nails were ranged into line for any tape length by means of one telescope of the binoculars brought to the right height at the forward end of the tape. At the forward end the tape was supported and aligned over the marking stake by the tape stretcher. These marking stakes were 4x4-inch posts securely driven to the proper height, and with the top surface about parallel with the surface of the ground. Copper strips were nailed on top of these posts parallel to the line of the base and distant from it half the width of the marking sleeve of the tape. The thickness of these strips brought their top surfaces into the plane of the marking sleeve and allowed the tape graduation to be prolonged onto this strip by means of a sharp awl and without the use of a try-square.


MEASURING COMPARATOR WITH ICED-BAR APPARATUS.

The tape measurements were all made at night Eight men for the 50-meter tapes and twelve for the 100-meter tapes were employed in the measurement when possible. However, it is stated that it was seldom possible to use this number without delay to the leveling, and eight men were often used when measuring with the 100-meter tapes and only six with the 50-meter tapes. For the 50-meter tapes there were required two observers, one at each end, who also read the thermometers, and the front observer also helped to carry the tape ahead; one recorder, who also furnished the light for reading the tension; two men to apply the tension at the front end and hold it in the rear; and three men to handle lamps and carry the tape ahead. The field procedure was as follows: When the balance had been brought to the proper height and nearly to the proper reading the observer at the front end called "Tension." As soon as the rear-end observer had adjusted the tape graduation to coincidence with the mark on the copper strip he called "Contact." The tension was then made perfect and when the position of the front graduation had been marked the front observer called "All done," and both observers read the thermometers. The front observer unhooked the tape from the balance, and at the command "Come ahead" each carried the tape above his head to the next stake.

The mean speed attained in this process was two kilometers (6,560 feet) per hour, and a single kilometer was measured in 15 minutes. As far as the actual measurement is concerned the speed with the 100-meter tapes was somewhat greater than that with the 50-meter tapes. The former varied from 1.31 to 2.86 kilometers per hour, and the latter from 1.15 to 2.27 kilometers per hour. The speed of all the measurements increased in a very marked degree as the men became familiar with their various duties. The determination of the lengths of the tapes by the 100-meter comparators was carried on in the same way as any similar section of a base was measured except that with the end microscopes pointings were made on the end graduations of the tape after making the readings on the cut-off.

The rather unusual topography for a base line encountered on four of the nine lines deserves notice. No grading on any of the lines was attempted, and the 25-meter spans of the tape measurement were nearly parallel to the surface of the ground traversed, except where such parallelism would necessitate placing an intermediate support below the grade of the marking stakes, a tall support being substituted in all such cases. On section 1 of the Lampasas base it was necessary to break the grade (have the middle support above the grade of the marking tables) on three-fifths of the section. On this section also the maximum grade of the season was encountered, 3.15 meters in 25 meters, or 12.6 per cent., which involved a correction to the measured length of 201 millimeters. No appreciable loss in accuracy was found to result from the measurements on these grades.

The results of these base measures showed that the use of 25-meter intervals instead of the 10-meter intervals formerly used was fully warranted. As a matter of economy this change shows a reduction in labor of preparation of something over one-half, by reducing the number of tape supports in a kilometer from 100 to 40. If the reduction in the lumber and the cost of transporting it were added, the comparison would become still more favorable to the long interval. The setting of the supports was done by a party of four or five persons, consisting of one officer who had immediate charge of the work and handled the forward end of the tape, one officer who aligned the tape supports, and two or three men. The time necessary for such a party to set one kilometer of tape supports varied from two to six hours.

In comparing the work done with the tapes with that done with the duplex bars, it is found that 7.1 days' work for one man was required to measure a kilometer twice with the tapes, and 19.5 days' work with the duplex apparatus. In making this comparison one-half of all the time required for the leveling was charged to the tape measures, and none to the duplex measures, because the profile of the line necessary when bar measures only were made would require much less time than the leveling for the grade of the tape. From this it is seen that the labor required for the bar measurement is 2¾ times that required for the tapes. It is probable, however, that the accuracy is greater from the duplex for two reasons: First, the duplex gives three results which, although they are not independent, are desirable checks on a portion of the accidental errors to which the apparatus is subject; and second, because the errors due to determinations of the grade are displayed in the case of the bar apparatus, while in the case of the tape measures such errors would affect both measures alike.

The probable error of a single measure of a kilometer when computed from all the sections was slightly less for the 50-meter tapes than for the 100-meter tapes; and the ease with which the 50-meter tapes may be adapted to obstructions of topography makes the labor of setting the supports about equal to that required for the 100-meter tapes. The choice between the two then must be made in the comparison of the number of operatives required with each length of tape. The minimum number for the 100-meter tape is eight, and for the 50-meter tape is six, which means that it always takes one-third more help to manipulate the longer tape.

While the speed of measurement with the 100-meter tape is about one-fifth faster than with the 50-meter tape, this is unimportant because the time required for the measurement is much less than that required for the preparation of the line for measurement, and because it is always desirable to keep the measurement following closely the setting of the stakes. In measurements through pasture it was found convenient to complete the measurement as soon as three kilometers had been prepared. The work of measuring three kilometers was readily accomplished in an evening without regard to whether it was the 100-meter or the 50-meter tape. The conclusion therefore is that the 100-meter tape has few if any advantages over the 50-meter tape, and requires a party at least one-third larger for its manipulation.

Constant errors peculiar to each apparatus were revealed in these measures, and it may be inferred that the absolute accuracy is at least as great as in previous bases where but one type of apparatus is involved. These constant errors are shown in the results of the measures of the nine test kilometers. The maximum range in the results was 20 millimeters (nearly an inch), the tapes as would be expected, agreeing among themselves more often than with the bars. The bars give a smaller result than the mean, ranging in the kilometer from 2.1 to 10.3 millimeters. One of the 100-meter tapes shows a tendency to give the largest result, being above the mean in seven of the nine cases. The source of these constant errors is still problematic.

The total amount expended for field expenses in these operations was $7,511.65. This includes all items of transportation, freight, etc., beginning and ending in Washington, all material, camp equipage, and pay and subsistence of the entire party, except salaries of officers. After adding the pay of the officers and the cost of preparing the results for printing, including all computations, the total cost of the bases is $11,074.78, which is about $1,231 per base, or $260 per mile.

A Liquid Air Plant that was erected some time ago at Cornell University has been tested by Messrs. Frank Allen and William Ambler, and the results are given in the "Physical Review." The compressor is of the four-stage type, and the air is cooled as it leaves each cylinder, passing finally into the liquefier, where a pressure of 180 atmospheres is maintained. A 30-horse-power motor supplies power. Liquid air begins to flow from the nozzle of the liquefier within 10 minutes of the start. The quantity of air liquefied is about 5 per cent. of the amount passing through the system. The performance of the plant is 0.28 pound per horse-power-hour; the efficiency of compressor and liquefier, 2.2 per cent.

An Unusual Water Supply Plant.

The town of Arad, in Hungary, derives its supply of water from a gravel stratum underlying an impervious bed of clay. The wells are driven to a depth of about 135 feet and the water is raised by means of an air lift. It is then filtered by means of the Fischer system of plate filters, descriptions of which have appeared from time to time in The Engineering Record, passes into a storage reservoir and is then pumped into the town mains by two triple expansion Worthington pumps. Before final distribution the water passes through a large air chamber to equalize the pressure in the various mains. The following description of this plant, which combines so many interesting and unusual features, has been taken mainly from an account of the works published in "Engineering" some time ago.

The wells, of which there are two, 9 inches in diameter, are about 135 feet in depth, and pass through a layer of clay 20 feet thick, the bottom of which is about 63 feet below the surface. Below that point the material passed through is mostly gravel and sand, with a few thin streaks of clay. Each well is capable of delivering 540 imperial gallons per minute, and only one is ordinarily in operation at a time, as that is found to deliver sufficient water for the needs of the town. The supply of compressed air for raising the water is carried down the well by means of a wrought iron tube. The air issuing from the bottom of this tube through a suitably arranged connection, raises the water through the casing of the well into a small cast iron well at the surface. The compressor furnishing air for the lifts has compound steam-jacketed cylinders, two in number, each being 11 inches in diameter, the stroke of all the cylinders being 18 inches. The exhaust steam from the engine is carried to a surface condenser fixed below the floor of the engine house, the circulating water required for the condenser being supplied by connecting thereto the pipe which conveys the water from the cast iron service well to the filters.

The Fischer filter plates were first devised at the city of Worms because the capacity of the sand filtration plant there had been reached and no further extensions could well be made along the old lines. The engineers in charge of the works, noting that the actual work of purification was effected by the top layer of sand, 3 or 4 inches thick, set to work to devise a means of supporting this filtering film in a manner more economical of space than by means of a horizontal bed of sand. Their studies resulted in the production of a hollow artificial stone block about 39 inches square and 8 inches thick, the interior space being about 0.8 foot wide.

These blocks or plates are made of quartz sand carefully washed to free it from clay or earthy matter and then mixed with powdered glass. This mixture is placed in suitable molds and burnt at a temperature of from 1,800 to 2,100 degrees Fahrenheit. By this means the glass is melted and binds the grains of sand together without filling the interstices to an appreciable amount.

In the filter chambers the plates are placed vertically in the water, thus giving a considerable filtering surface, though occupying a small area, and the plates being hollow, the filtered water, which accumulates in the interior, is removed by means of pipes to the filtered water reservoir. The operation of cleaning is effected in the simplest manner in the case of the Fischer plate filters, by reversing the direction of the flow, thus allowing the filtered water to percolate through the plates from the inside to the outside, which is said to clean the surface of the plate in about ten minutes. An installation on the Fischer system, it is stated, only occupies one-eighth of the space required for a sand filter of equal filtering capacity.

In the works at Arad there are four filter chambers with concrete walls and floors, each 27 feet long by 10 feet 2 inches and 12 feet 2 inches deep. They are covered over with brick and concrete arches similar to those used for the filtered water reservoir. Each of the chambers contains 100 filter plates placed on edge in two tiers, each two plates being connected at the top to the horizontal collecting pipes running lengthwise of the chambers. In the inlet chamber an overflow pipe is arranged so that the level of the unfiltered water will not exceed a fixed height. The collecting pipes for the filtered water are connected in a central valve chamber to the force main for the purpose of cleaning the filters. At the other end of the valve chamber are the two outlets into the filtered water reservoir, which is divided into two sections with a total storage capacity of 66,000 imperial gallons.

From the reservoir the water passes through a 12-inch pipe into the pump well sunk in the basement of the engine house, the pumping engine and the air compressors for the air lift being housed in the same room. The water is pumped from the well into the town mains, by means of two triple-expansion Worthington pumps, each having six steam-jacketed steam cylinders in three pairs of 6, 9 and 16 inches diameter respectively. The pumps are provided with surface condenser and two double-acting water plungers of 10 inches diameter, all having a uniform stroke of 15 inches. Each pump is capable of delivering 666 imperial gallons of water per minute against a head of 125 feet. From the main pipes the water raised is carried into and through a large air vessel of wrought iron 20 feet high by 5 feet in diameter, for the purpose of equalizing the pressure on the town mains; and, as an additional security, a safety valve is attached to each of the town mains (in duplicate) leading from the air vessel. For the purpose of supplying steam for the steam-engine, the air compressors, and the various pumps, two marine type boilers are provided.

In connection with the compressed air lift an arrangement for intermittent working is used which suits cases like that at Arad, where the supply of water flowing to the well is not sufficient for constant working. Messrs. Hughes & Lancaster, of London, were the engineers and contractors for these works.

The Number of U. S. Patents issued during 1901 was 27,292 and the number that expired was 19,147. More patents were issued to residents of Connecticut than any other State, in proportion to population, and then followed the District of Columbia, Massachusetts, New Jersey, Rhode Island, and Colorado. Of patents granted to foreigners, Germans received the largest number.

An Unsuspected Leak in a large water main was detected in St. John, N. B., last year under circumstances which show clearly how large a waste of water may occur and yet be unnoticeable at the place where it takes place. In this instance the water came to the surface 400 feet from the cracked pipe from which it escaped, and many pits had to be dug before the spot was located, as the water flowed in a blind drain near the pipe. In mentioning the matter, Mr. William Murdock, the city engineer, states that a sheet of rubber packing was placed over the crack, which was 2½ feet long, and covered by an iron plate, the whole firmly held by nine heavy iron straps.

The Power Plant of the Stecher Lithographic Company, Rochester, N. Y.

The Stecher Lithographic Company has recently completed a model plant in Rochester, N. Y., facing the grounds of the University of Rochester and located in a quarter of the city that has led the company to pay considerable attention to the appearance of both works and grounds. The plant is all under the one roof and consists of a 146x225-foot two-story mill construction building with saw-tooth roof, a headhouse containing the offices which rise above the saw-tooth portion with a flat roof, and an extension containing the power plant. Toward improving its outward condition, the grounds, which are large enough to allow for future buildings, have been graded and planted with grass, and instead of a more or less lofty smoke stack, forced draft is provided for the boilers with a short steel chimney extending but a few feet above the power-house roof. The plant is equipped for the electric transmission of power and is warmed by the blower system.

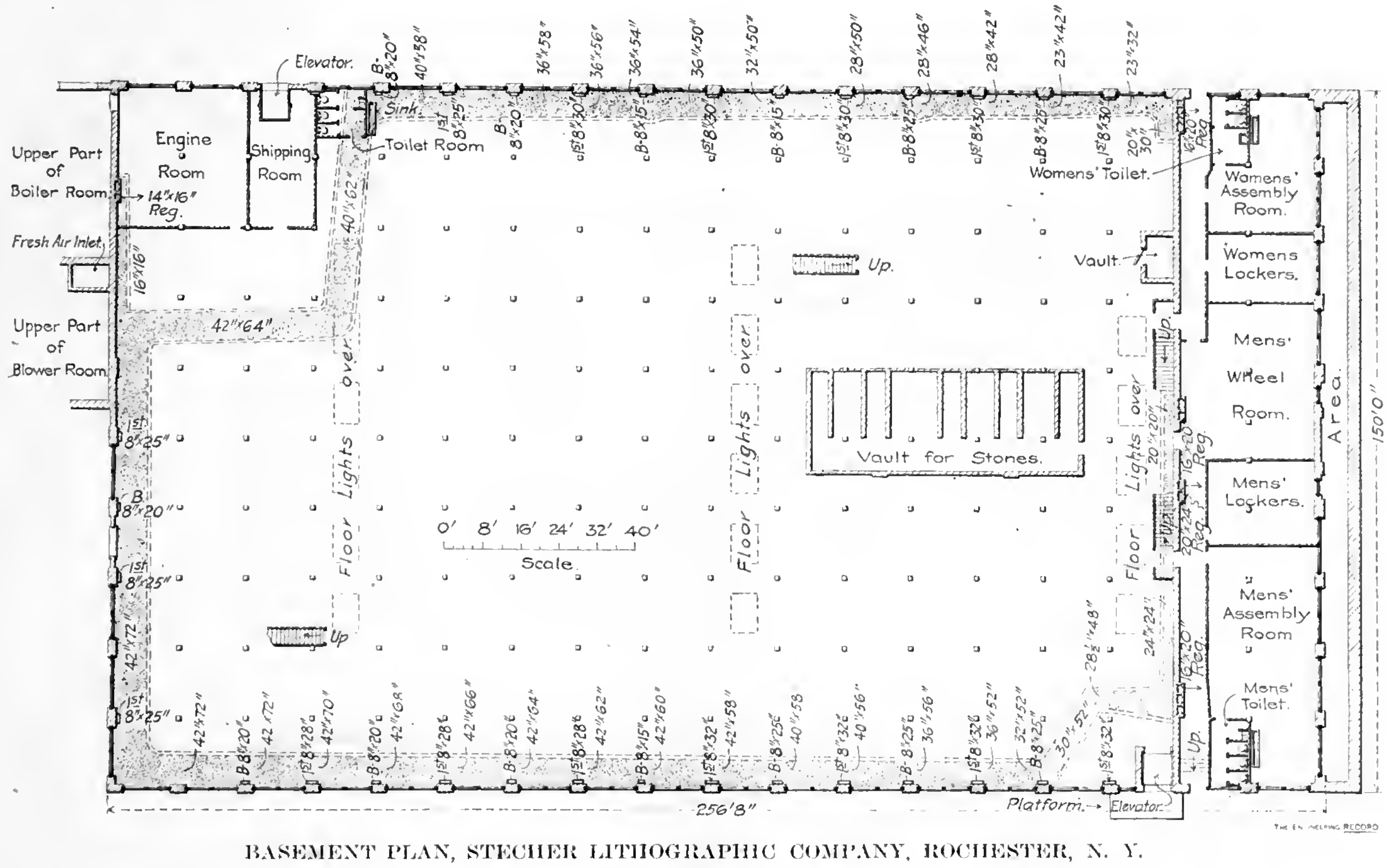
A plan of the basement of the plant in the accompanying drawings shows the outline of the buildings. The general basement floor is a few feet above grade level, while the headhouse basement, which is given up to the men and women employees, as indicated, is below grade. The two floors above in this part of the works are occupied chiefly by the offices of the company. The saw-tooth roof is in five sections, each about 29 feet wide and 225 feet long, with the skylights facing in the regular way toward the north. There is a large amount of window surface in the side walls, but to allow as much light as possible to the basement, floor lights are provided in the first floor. The buildings are equipped throughout with an automatic sprinkler system furnished by the General Fire Extinguisher Company, of Providence, this system connected on the city mains and arranged to receive water also from a fire pump installed in the extension. Two Otis freight elevators electrically operated have been installed, one serving the floors of both the main building and the office structure.

A plan of the powerhouse is also shown herewith. It consists of two rooms, one for the boilers and auxiliary apparatus and the other principally for the heating apparatus, the electric generating machinery and the switchboard being located in the adjacent corner of the main floor of the factory. The boiler room contains two 200-horse-power water-tube boilers built by the National Water-Tube Boiler Company, of New Brunswick, N. J., and there is space for an additional boiler of the same capacity. Each boiler is equipped with the Jones underfeed stoker, furnished by the Underfeed Stoker Company of America, and is operated under forced draft for which a Sturtevant blower belt driven from a Sturtevant 9.78 horse-power vertical engine has been installed.

The coal for the plant is stored in a pit extending underground from the end of the boiler-room. It is located immediately underneath a railroad siding to the works and coal is dumped from the cars through three covered coal holes. It is built with brick walls and has an I-beam and brick arch roof supported underneath the rails of the siding by cast-iron columns. It is about 6 feet high and has a capacity of about 80 tons. There are three openings from it into the boiler room, corresponding to the three boilers. The forced draft fan is of the double-inlet type, with a 42-inch blast wheel and is designed to supply the ultimate installation of three boilers. Under present conditions it is run at 668 revolutions per minute. The smoke stack is of steel, 5 feet in diameter and at the top is 50 feet above the boiler room floor.

At present but one of the two generating sets that it is intended to install is in place. This consists of a horizontal tandem-compound McIntosh & Seymour engine, 13 and 19x15 inches in cylinder dimensions and a General Electric multipolar direct-current generator directly connected to it, rated at 435 amperes at 230 volts and 250 revolutions per minute. Steam is generated at 100 pounds pressure and extra heavy piping with peaned flange joints has been provided. Each boiler has a 5-inch connection to a header which is 10 inches in diameter. Its area is thus four times that of each boiler branch and it is capped with two blank flanges, one in the boiler room for the third boiler and the other in the engine room for the second generating set.

The boiler-feed pumps are located in the boiler room between the boilers and the main building wall, the fire pump is located in the fan room, as stated, and all these, together with the forced draft fan engine and a 29.6 horse-power horizontal engine for driving the heating system blower receive steam from the main header. The exhaust from this machinery and from the electric generating set is collected into a 10-inch main near the feed pumps, with the exception of that from the fire pump, which was most conveniently given an independent free exit to the atmosphere. A grease separator of the Austin type has been inserted in the pipe for the general exhaust, after which the exhaust steam is utilized for heating purposes. It first passes through a vertical Berryman feed-water heater, and may then pass into the heating plant for the building or into the atmosphere through a 10-inch exhaust pipe, this fitted in the usual way with back-pressure valve to allow an escape of steam only when its supply is greater than its demand. This has an exhaust head on top to catch condensation.



BASEMENT PLAN, STECHER LITHOGRAPHIC COMPANY, ROCHESTER, N. Y.

The condensation from the heating system, and the drips from the live-steam lines, from the feed-water heater and from the exhaust head are all conducted into an iron receiving tank behind the boilers, 3 feet in diameter and 6 feet long. To this is also brought, when necessary, fresh water from the city mains and the boiler feed pumps draw from it, pumping through the feed-water heater to the boilers. The tank is provided with a vapor pipe which joins a pipe carrying the discharge of the boiler safety valves through the roof. The feed pumps are installed in duplicate and are of the Deane duplex type, 6x4x6 inches. A Metropolitan injector has been provided as a relay to the pumps. The steam piping throughout is covered with Keasbey & Mattison asbestos sectional covering.

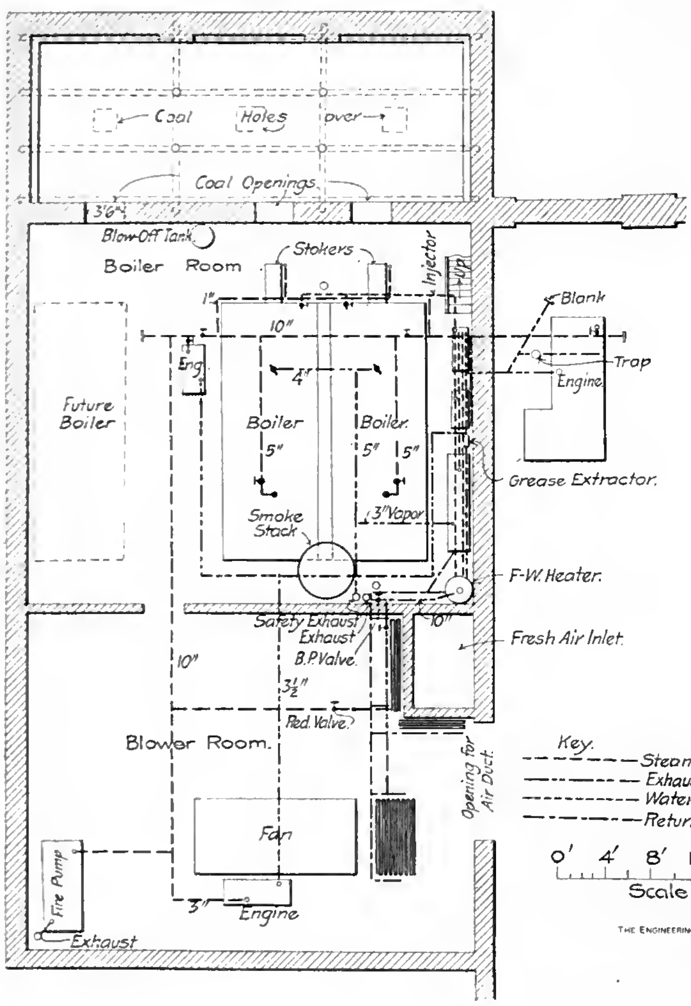
The electric installation is controlled from a black enameled slate switchboard in the engine room furnished by the General Electric Company. The board consists of two generator panels, one for the machine yet to be installed, and of two feeder panels. Two sets of bus bars are provided for light and power, and both generator and feeder switches are double throw, so that circuits can be fed from either set of busses. Each generator panel is furnished with a circuit breaker and a Thomson ammeter; the bracket type of voltmeter, fixed at one end of the board is used. Altogether 250 32-candle-power incandescent lamps and 100 800 to 1,200-candle-power arc lights are supplied. There are 80 motors all told, ranging from ½ to 10 horse-power.

The heating apparatus is of the blower type of forced circulation, as stated, with the heating medium all concentrated in the fan room. Air is ordinarily taken from the first story of the building, or it may be taken from out of doors, or partly from the building and partly from outside, the air being drawn down a shaft to a fan room. Two dampers linked together and operated by a pull chain in the fan room control the inflow of air, one damper mounted in the outside air inlet and the other in the building air inlet. At the bottom of the shaft the air passes through tempering coils, placed as indicated, and enters the fan room. It is then taken by the blower and discharged all or in part through the main heater and thence by underground ducts to flues distributed along the outside walls and delivering by vertical flues to the different outlets.

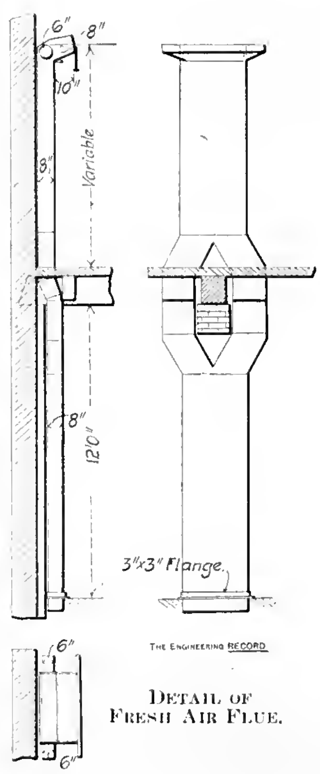
There are two groups of tempering coils, each group consisting of two sections of the usual 1-inch pipe coil with cast-iron base, one section of four pipes width and the other of two. Each section is 82 inches wide and 8 feet 8 inches high. The fan is a three-quarter housing centrifugal blower, with blast wheel 11 feet in diameter, and is direct driven from a 10x12-inch horizontal steam engine. Immediately beyond the fan is the main heater, which is provided with a by-pass underneath, the by-pass furnished with a damper controlled by a Johnson thermostat placed in the plenum chamber beyond the heater. The main heater consists of 10 four-row, cast-iron base, pipe coils of the same size as the tempering coils, the heater coils being arranged two across the width of the air passage and five deep. The steam supply to each group of five heaters is distributed from a vertical drum in the steam supply pipe, and the tempering coils are similarly supplied from one drum located near both coils and supplying two steam connections to each. In the two groups of tempering coils there are about 3,744 lineal feet of pipe and in the main heater 14,515 feet, and the whole steam heating apparatus is calculated to raise the temperature of the air supply to a maximum of 150 degrees in zero weather.

The accompanying basement plan shows in dotted line the approximate run of the underground air duct, which is constructed of brick on a concrete bottom. Assuming that the blower under operation at a speed of 150 revolutions per minute delivers 80,000 cubic feet of air, it will be found that the velocity of the air flow through the ducts, allowing for expansion of the air due to heating in the main heater, is about 2,000 feet per minute. Similarly, the velocity of the air through the vertical flues varies from 1,000 to perhaps 1,500 feet, with an average of 1,250 feet per minute. A detail drawing herewith shows the construction of the flues which are capped with three outlets in each case, two circular in cross-section and discharging in opposite directions across the adjacent windows, and the other wide and narrow and pointing toward the interior. The latter is fitted with the Shumaker distributing damper, which is a sort of bonnet hinged at the flue top and controlled by a handle pointing downward from it, to cover such a portion of the long and narrow outlet as desired. The circular openings are not provided with any gate and the office of the air issuing from them is to offset the cooling action of the windows and afford a positive air circulation from the walls toward the interior. The total area of the three outlets to each flue is equivalent to that of the flue itself, so that the average velocity of the air issuing from them is 1,250 feet per minute. In the basement the outlets are 9 feet above the floor; in the first story, from 8 to 12 feet. The flues are all 4 inches deep and are varied in size by changes of the width. As indicated, the headhouse or office building is also connected to the system, partly by flues supplied from the underground ducts and partly from overhead circular ducts in the basement, these ducts starting from the plenum chamber and having a connection with the tempered air space between blower and heater, with Johnson dampers for mixing the heated and tempered air under the control of independent thermostats. Vent outlets are provided for the office structure, the air escaping by flues to the atmosphere. The air from the works proper is taken, as stated, down the fresh-air shaft to be reheated and recirculated.

The architect for the plant was Mr. Leon Stern, of Rochester, N. Y. The general contractor for mason work was A. Friederich & Sons Company; for carpenter work Messrs. John Luther & Son; for the steam piping, Messrs. Howe & Bassett, all of Rochester.



The Power and Heating Plant.



Detail of Fresh Air Flue.

Waste Gases from the blast furnaces of the Union Steel Company will be used under the boilers of the power plant of the company's new mills. The power plant will furnish alternating current to the works, where five Westinghouse rotary converters will be installed. The electric plant includes an 800-kilowatt direct-current and two 800-kilowatt alternating-current Westinghouse generators.

The Influence of Capacity in Electric Transmission of power is well realized when its magnitude in large plants is expressed in figures. In a recent paper read before the Massachusetts Institute of Technology and printed in the "Technology Quarterly," on "Success in Long-Distance Power Transmission," Dr. F. A. C. Perrine referred to its importance in connection with the plants of the Standard Electric Company, and of the Bay Counties Power Company, in California, where transmission of approximately 150 miles is undertaken at 50,000 volts and 60 cycles per second. In these cases the charging current is approximately 40 amperes, or, in other words, the line requires the full capacity of a 2,000-kilowatt machine for charging it as a condenser. The complete neutralization of this capacity effect, he finds, would require the continuous working of something in excess of 5,000 kilowatts of induction motors with average normal power factors. The power house is practically unable to have much knowledge of the loads actually applied on the lines, except by observing the wattmeters or the wheel nozzles, as the current from no load to a load of several thousand kilowatts remains practically constant. As there are many branching lines supplied from the system, the dynamos are operated with constant electromotive force and the regulation of the long lines is affected by the capacity, which influences everything from the step-up transformers to the last motor. To overcome troubles due to this source, the Bay Counties Power Company has arranged to place upon its lines impedance coils capable of practically neutralizing the entire capacity of its long lines. With the capacity of the line neutralized, Dr. Perrine advocates keeping the load as nearly non-inductive as possible by continuous care in the balance of synchronous against induction motors.

Complicated Underpinning.

The new steel building for the Bank of the State of New York occupies a lot about 100 feet square on Exchange Place, between William and Broad Streets, New York, and will rise to a height of about 240 feet above the curb. Unlike some of the very tall office buildings in the same district, its lower stories do not extend to a great depth below the curb, and the cellar floor will be only about 21 feet below grade, but the foundations have been carried to a much greater depth and the work on them has involved some difficult and delicate operations in underpinning the adjacent walls of the neighboring high buildings. The soil and general conditions here are similar to those where other tall steel buildings have been erected in this vicinity, as the Corn Exchange Bank, the Blair Building, the Stock Exchange, the Hanover Bank and others which have been recently illustrated in the Engineering Record, but some restrictions were involved which made it necessary to introduce special features in the auxiliary work which will be here described.

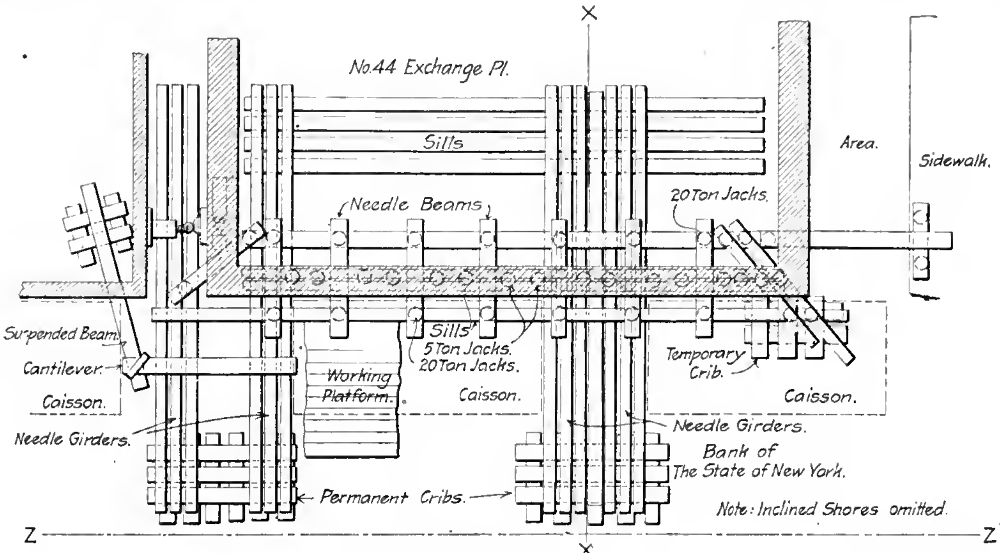
The soil consists of earth and fine sand with a little gravel to a depth of about 30 feet, then about 6 feet of clay in thin layers, then 4 feet of hard pan and then rock. Mean high tide level is about 15 feet below the curb and the ground water level corresponds approximately with it. Below that plane the saturated soil becomes quicksand which is slippery with mica and sticky in places with clay. All the foundations are concrete piers sunk in pneumatic caissons to rock, and those adjacent to the lot lines have rectangular cross-sections about 7 feet wide and 14 feet long with only 2 or 3 inches clearance between their long sides and the walls of the next buildings, which were of ordinary brickwork with concrete footings in the sand about 8 feet below the curb. There was no cellar under the old building which formerly occupied the site of the bank building and the 3-foot excavation there was increased to 6 or 7 feet after the old buildings were razed. Then the caissons were sunk, and after the completion of the foundation piers inside them the cellar excavation will be carried to a depth of 21½ feet in the center and to 18 feet around the edges of the lot.

The foundation piers along the lot lines are set with only a few feet clearance between their ends so that they form a retaining wall with short gaps and will serve to prevent much caving in of the sides, when the cellar excavation is made below the footings of the old walls. The sinking of the caissons, however, in such loose soil was considered sure to produce some settlement, which was estimated at 2 inches at the lot lines, and would be likely to cause some flow of material from under the shallow footings, both results being inadmissible for the integrity of the tall buildings. It was, therefore, determined to support them so that they could be continually raised to compensate for any settlement while the caissons were being sunk, and to permanently underpin them afterwards with new footings carried down approximately to the level of the new cellar floor. This plan was complicated by the necessity of leaving a large space in front of the walls and next to them, clear for the sinking of the caissons. It became necessary to devise special temporary supports for the wall and to change its bearing four times while different supports were successively introduced and withdrawn.

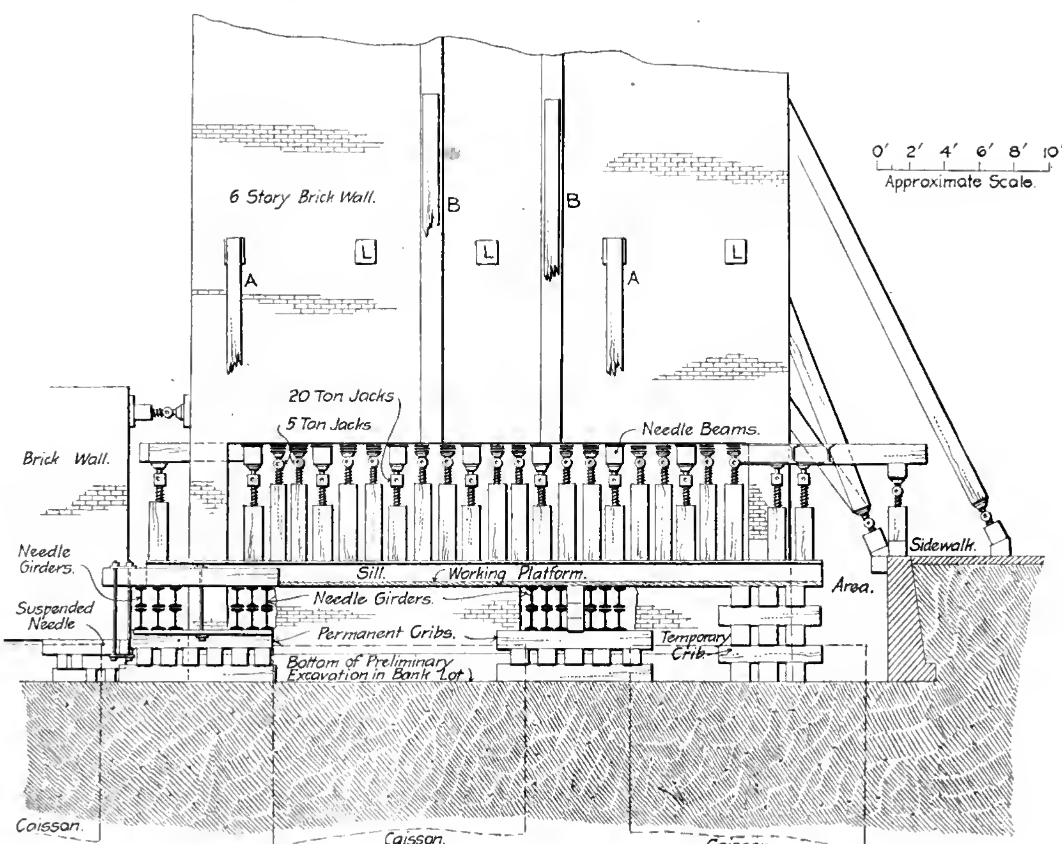
The office building on the east side of the bank, at No. 44 Exchange Place, has a 6-story wall about 20 inches thick at the base, 35 feet long and 90 feet high above the street which was estimated to weigh about 12 tons per lineal foot. The face of the wall was braced by two sets of 12x12-inch inclined shores, A and B, set on jackscrews, and a 5-foot panel in the middle where the thickness was reduced to 4 inches was strengthened by special planks and braces as shown in the front elevation. The front and rear walls were weakened by vertical lines of doors and windows near the corners. The corners were supported on diagonal needle beams and the front wall was braced by three shores from the street inclined at different angles. The rear wall was cracked through vertically between windows from the foundation up to the roof, and was additionally braced by a horizontal strut to an adjacent building and by a short inclined shore in its plane, set in a lower door opening as indicated by dotted lines in the plan.

A horizontal row of holes 3 or 4 feet apart on centers were alternately cut through the lower part of the wall and through them 12x12-inch needle beams 6 feet long were inserted and supported on special 20-ton jackscrews. The jackscrews were seated on a pair of 12x12-inch longitudinal timbers, one inside and one outside the wall, which rested on two groups of long transverse needle girders about 18½ feet apart between centers of groups, and on temporary intermediate blocking which is not shown in the drawings. The needle girders were double tiers of 15-inch 60-pound I-beams 28 feet long, sixteen in one set and twelve in the other, the latter being separated into two groups, one outside and the other inside the rear walls.

Steel packing plates were placed between the two tiers so as to reduce the clear span of 14 feet of the beams in the lower tier to 10 feet for the beams in the upper tier. The groups of needle girders were located so as to lie between the wall caissons and just clear them and projected several feet beyond the inner faces of the caissons in the bank lot where they were supported on ordinary timber cribbing, also clear of the caisson locations. These are marked permanent cribs on the drawing because they remained in service until after the underpinning was completed while the other cribs, marked temporary, were removed before the caissons were set. The opposite ends



Plan of Preliminary Underpinning I.

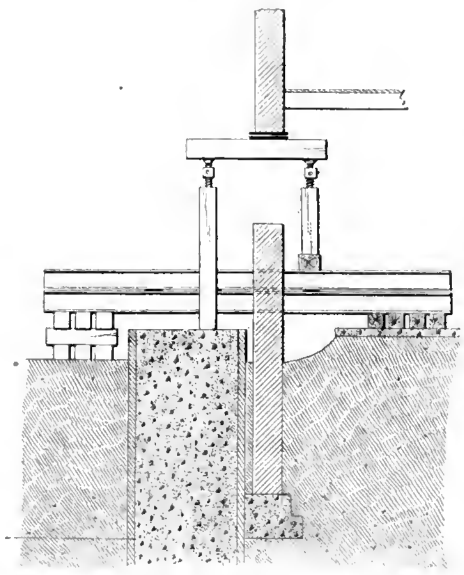


Elevation Z-Z of Preliminary Underpinning 2.

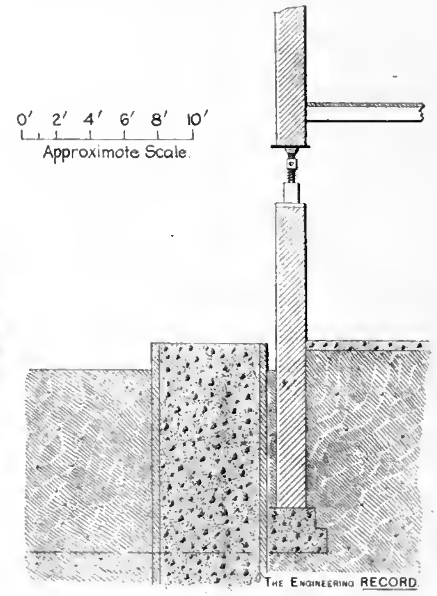
UNDERPINNING AT THE BANK OF THE STATE OF NEW YORK.

of the needle girders were carried on longitudinal sills which distributed their loads on the concrete cellar floor far enough from the face of the excavation to be considered out of danger of caving in. One needle beam was inserted in an arched opening where it was not necessary to cut through the brick wall and short blocking was put on top of it to support a horizontal longitudinal timber about 4 feet long in the plane of the wall, which had its ends nearly in contact with the intrados of the arch and formed a chord to its curve. The segmental space between the beam and the arch was packed full of thin shingles driven in tight so as to distribute the load of the beam uniformly across nearly the full span of the arch.

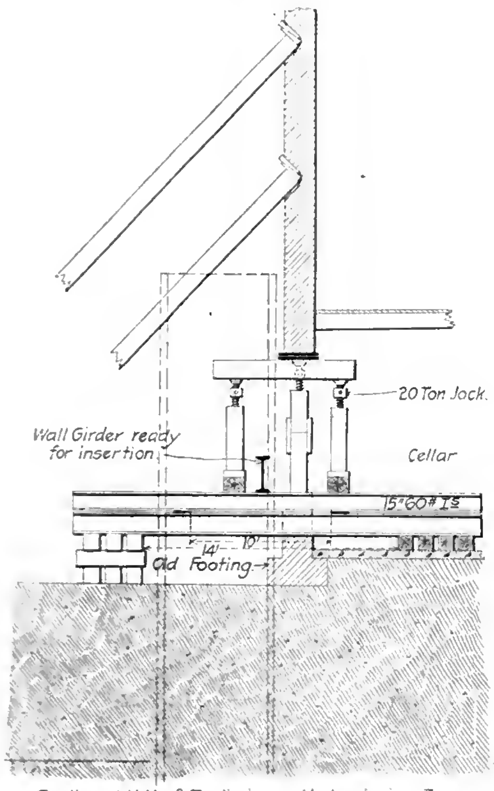
Several level blocks, marked L L L in the elevation, were accurately set with their lower edges in the same horizontal plane, and nailed to the face of the wall about 5 feet above the curb, for reference points. A leveling instrument was set up and their elevation taken from the permanent bench mark which had been established across the street and the jackscrews under the needle beams were operated to raise the wall ⅛ inch as determined by the instrument. Then the brickwork between the needle beams was removed sufficiently to allow a row of 5-ton jackscrews to be set on top of the lower part of the wall and temporarily support it between the needle beams, as shown in the front



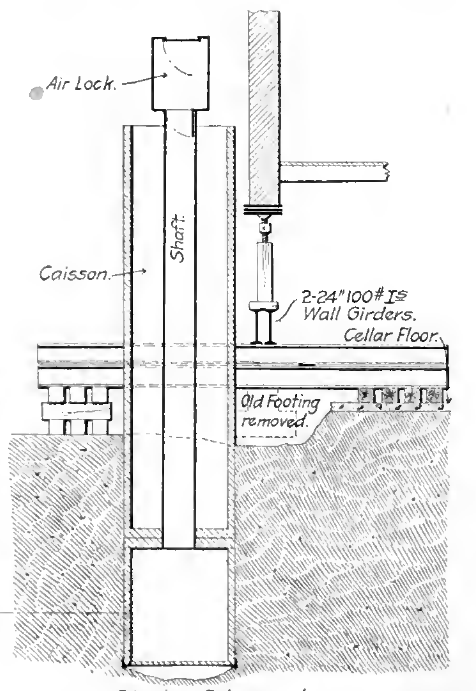
Removing Wall Girders and Building New Wall. 6.



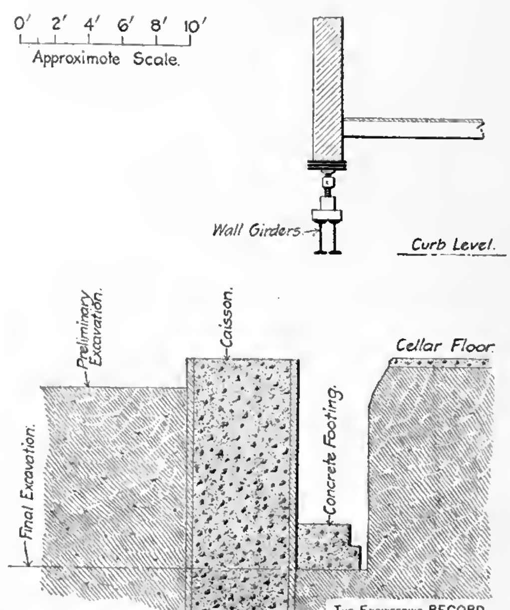
Loading New Wall. 7.



Section at X-X of Preliminary Underpinning 3.



Sinking Caisson. 4.



Building New Footing. 5.

UNDERPINNING AT THE BANK OF THE STATE OF NEW YORK.

elevation. These jackscrews and those under the needlebeams are indicated by full circles in the plan.

A pair of 24-inch 100-pound I-beams 30 feet long were successively introduced between the front row of jackscrews and the wall, under the needle beams and slid across on the needle girders until they were side by side under the center of the wall. The middle row of jackscrews were removed to admit these wall girders and were immediately replaced on top of them, and those under the needle beams were removed. The whole weight of the wall was thus carried by the 24-inch I-beams and the needle beams and their sills and the temporary cribs were removed and left the site clear for the caissons to be set close to the wall between the groups of needle girders. The two 24-inch I-beams were then carrying in the middle, a load of about 180 tons uniformly distributed over a clear span of 15 feet and at the street end a load of about 72 tons on the cantilever of about 6 feet clear overhang. Besides this they carried about 108 tons directly above their supports on the needle girders which did not produce flexure. Levels were frequently taken on the wall marks and the jackscrews were operated if necessary to maintain the level of the wall.

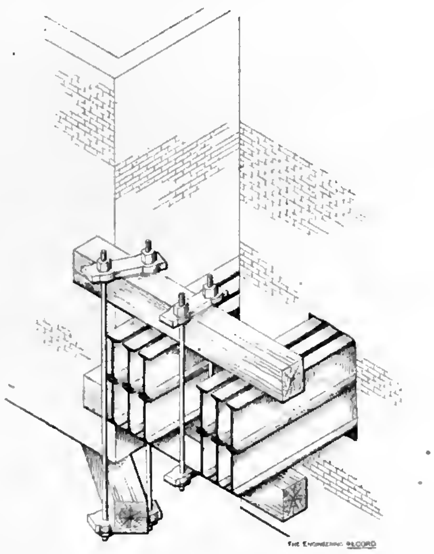
The old footing was removed and the caisson was sunk to rock with a load of about 300 tons without causing any injury or displacement to the wall or disturbing the operation of the elevator machinery and other mechanical plant installed in the building. After the caisson work was completed a trench was dug alongside and the new footing and lower part of the wall was built in it. The longitudinal sills and short needle beams were replaced and the weight of the wall was transferred to them, releasing the wall girders which were removed and allowing the lower part of the brick wall to be built on the new footing. A row of jackscrews were inserted between the top of this wall and the foot of the old wall and were screwed up to bring all the load on the new footing and release the needle beams which were then permanently removed. The weight of the building caused some settlement of the new footing and the jackscrews were operated to compensate for it and the work was allowed to remain several weeks, after which the screws were gradually taken out, one by one, and the spaces they had occupied were filled by new brickwork completing the walls. This method not only compensated for the compression of the earth under the footing, but for that which takes place in the masonry itself when fresh brickwork is heavily loaded. That the latter is not negligible when important walls are very heavily loaded is shown by the records of similar work recently executed under the same supervision and by the same contractors.

In the underpinning of the Decker Building, which was described in the Engineering Record of May 10, a section of wall 9 feet high, 20 feet long, 3 feet thick on top and 4 feet thick at the bottom was seated on a concrete base 5 feet wide and 2½ feet high which was built on the solid rock. This wall was built of selected hard brick laid up with thin joints of Portland cement mortar, and when it was seven days old the full load of 400 tons which it was estimated to carry from the upper part of the old wall and floors was concentrated on a buttress which formed an enlargement in the center of the wall. The buttress was 7 feet long and had a constant thickness of 4 feet, top and bottom.

The load was uniformly distributed on it and caused a compression of 3/16-inch, accurately measured and checked.

In the rear of No. 44 Exchange Place there is a small building with a brick wall about 12 feet high facing on the line of the bank lot. A caisson was to be sunk directly in front of it and to support it without having cribs or sills to interfere with the caisson a needle beam was put under the footing close to the side wall and the outer end of it was suspended from a 12x12-inch cantilever resting on and anchored to the needle girders under the large building. The cantilever had an overhang 3 or 4 feet long and was loaded and anchored with pairs of 2-inch steel rods with nuts bearing on 4x2-inch steel saddle plates placed transversely and diagonally across the beams and having their ends punched and spread hot so that there was no loss of metal in making the holes for the vertical rods.

The underpinning was done by the George A. Fuller Company, who are the general contractors for the Bank of the State of New York Building. Mr. A. E. Riendeau planned and executed the underpinning.



Needle Beam suspended from Cantilever on Needle Girders.

Experiments With Wet, Medium and Dry Concrete.

Some large blocks of concrete were made in January, 1901, under the direction of Mr. W. H. Parkhurst, M. Am. Soc. C. E., for the purpose of determining the effect of using different amounts of water in mixing on the character of the resulting material. The concrete was mixed by hand on a plank platform adjacent to the molds, the ingredients being measured in a box holding 4.42 cubic feet when full, and the quantities checked after measuring by weighing them. The water was also measured and weighed. The details and results of the experiment were described by Mr. Parkhurst in a paper before the Western Society of Engineers, from which the following notes have been taken; the full paper and discussion was printed in the Society's "Journal" for June, 1902.

The accompanying table gives the general data concerning the three blocks. In the case of the dry block, the endeavor was to employ enough water to make a mealy concrete but not to flush it. No amount of ramming the thin layers would bring water to the surface. With the wet concrete men could not stand on the material to ram it; the mass quaked easily, and the mortar clung to the tamping iron. In the case of the medium block, there was enough water so that the top of each layer was flushed by the tamping, but there was no quaking, and the mass was always hard. The top surface had enough free water on it to spatter when the tamping was finished. The blocks were left exposed to the sun, rain and snow for several months and then drilled and broken by plug and feather. Dragon Portland cement was used. The sand and gravel were obtained by a washing plant from the Fox River, and the crushed stone was of "medium" size.

Data of Concrete Test Blocks.

Block.	Dry.	Medium.	Wet.
Port. cement, cu. ft....	4.42	4.42	4.42
Port. cement, lbs.......	392	382	382
Sand, cu. ft...........	8.84	8.84	8.84
Sand, lbs.	908	895	908
Gravel, cu. ft..........	11.05	11.05	11.05
Gravel, lbs.	1,104	1,078	1,059
Crushed stone, cu. ft...	11.05	11.05	11.05
Crushed stone, lbs......	939	915	919
Water, cu. ft..........	1.81	2.65	3.35
Water, lbs.	113	166	209
Vol. concrete, cu. ft....	25.31	22.69	22.97
Weight per cu. ft., lbs..	136.2	151.5	151.4
Loss of weight per cu. ft. during 10 mos., lbs.	1.7	4.5	5.9

In mixing the concrete, the sand and cement were made into a mortar on which the crushed stone and gravel were spread. The materials were turned over several times by shovels and then placed in the molds, where they were tamped in layers 6 inches thick. The dry mixture was placed in its box in 25 minutes, the medium in 21 minutes and the wet in 23 minutes. The dry concrete required and received the most tamping; the wet concrete required nearly as much time to be placed in the mold because so little could be handled on the shovel. After the blocks were finished the surplus water on those of medium and wet concrete froze; this freezing was of short duration.

The blocks stood for about four months exposed to the weather before they were weighed again. As there was not enough water used in making the dry blocks to permit a finish on the sides or top, the surface could be easily abraded. The gravel and stone came away from the mass quite easily, and the block could not be handled to weigh it without crumbling the edges and top surface. At the end of the four months all the blocks were found to have lost in weight, but the loss of the dry block was not due wholly to the same causes as that of the others, owing to this abrasion. The loss at the end of ten months is given in the table. After the blocks were split, the texture of those of medium and wet concrete was excellent, while that of the dry concrete was poor and not well compacted.

The conclusions drawn by Mr. Parkhurst from his experiments are as follows: First, a medium concrete, or one that has not enough surplus water to produce quaking while having enough to permit easy and thorough ramming, is most desirable. The specification that the concrete shall not quake in the barrow nor while handling, but that it may be wet enough to quake when heavily rammed, would seem about right for regulating the amount of water to be used. Second, it is probably safer to have an excess than to permit a deficiency of water. Above all, however, it is of the utmost importance that the concrete shall be consolidated thoroughly by ramming.

In the discussion following the presentation of the paper Mr. Finley called attention to another discussion of concrete before the Society in 1896, when Mr. Alfred Noble summarized his opinion as follows: "It thus appears that while there is considerable diversity of opinion as to the exact degree of wetness concrete should have, none of the engineers quoted advise such dry mixtures as are commonly required here. The writer believes that a more homogeneous, a denser, and stronger material will be obtained if the concrete is made so wet that the mass will quake after ramming; and, furthermore, that where concrete is to be placed in contracted spaces, as between timbers, it may be with advantage made still wetter, so that it can be pushed into place with the shovel, and, by treading, filling all the spaces solidly, with no important diminution of strength at any point, but stronger as a whole." In commenting on this opinion, Mr. Parkhurst approved Mr. Noble's suggestion of using wet concrete, well rammed, in contracted spaces. If this plan is followed a very much better material is obtained, in his opinion, than where dry concrete is used, which will contain many voids.

Some experiences with concrete mentioned by Mr. Parkhurst are also of interest. In one case certain columns resting on pile foundations were constructed under the head-house of a railroad station. To protect them concrete walls were built connecting one column with the adjacent one between tracks, the walls being 4½ to 5 feet above ground and extending 2 to 3 feet below the surface. As they were built simply for protection, little attention was paid to the foundation. The ground had been solid 3 or 4 years before, but was all dug up when the building was constructed and had not been thoroughly compacted afterward. Crushed granite and limestone were used, with no sand at all in some cases, and a layer of mortar was placed over the walls as soon as possible after the molds were removed and before the concrete had set. The walls developed long, irregular, vertical cracks in many places, which were evidently due to bad foundations and not to internal stresses. They were cut to pieces in places, and the interior was in excellent condition; in all such cases where wet concrete was used the material was found to be very well compacted.

In using concrete in walls Mr. Parkhurst suggests placing the expansion joints from 20 to 30 feet apart. In one wall on the Illinois Central road there are three concrete sections, making together a length of 100 feet, with pilasters every 33 feet. An artificial joint was made adjacent to each pilaster by putting a septum in the mold and building up to it, then taking it away and building the next section, and repeating the process again. The wall was built while the temperature was 50 to 60 degrees. The temperature sometimes falls to 20 degrees below zero, and in such extreme weather the joints open fully 1/16 inch. No cracks had been observed elsewhere.

The Association of Railway Superintendents of Bridges and Buildings will hold its twelfth annual convention at the West Hotel, Minneapolis, on October 21, 22 and 23. Committee reports will be presented on auxiliary coaling stations, roof coverings for railway buildings, mail cranes, the protection of overhead structures from locomotive gases, bed plates and the use of concrete for their bases, railway pile-drivers, roundhouse pits, and materials for the wearing surface of highway bridge floors. After the convention there will be an excursion to Duluth and the Missabe Range mines.

The Many Complaints of slippery asphalt pavements in Brooklyn after light snow storms followed by mild weather have led Mr. Nelson P. Lewis to recommend paving a system of connecting streets with material giving the horses a good footing at all times. "Although petitions are constantly received for repaving with asphalt," he says, "certain streets should be set aside for repaving with granite or other non-slippery material, and while it may take some years to carry out such a plan, it should be made and adhered to in deciding on repaving for the future."

Sanitary Progress.

An address by Sir Alexander R. Binnie, M. Inst. C. E., President of the Section of Engineering and Architecture of the Manchester Sanitary Congress.

Looking back at the advances in sanitary science which I have witnessed during the past forty years of my professional life, I must congratulate the Sanitary Institute on the great success which has followed their endeavors in promoting the health and happiness of the people of this country. Compared with forty years ago, the cleanliness and sanitation of our large towns has wonderfully improved; but not only is this the case, for there has grown up in the public mind during that period a conviction that it is only by the rigid enforcement of proper sanitary regulations that the public health can be preserved. Much has been learnt and many theories have disappeared as increased experience led us to look at the subject from a practical rather than a theoretical point of view, and the main directions in which advances have been made are by endeavoring to conform to the great laws of nature which govern the removal of dead organic matter and the preservation in a state of purity of the air we breathe and the water we drink.

At an early period it was seen that it was dangerous to public health to live in the immediate neighborhood of decaying organic matter. But as to the nature and cause of this decay little was known. In a general and in a not very clear manner it was conceived that dead and decaying organic matter was in some way acted upon by the oxygen in the air, and in a certain sense burnt up or reduced to innocuous substances. During the past twenty years this crude idea has after much study by many of the ablest scientific men of our day given place to a certainty which now rests upon an irrefragable basis. It is now known that the decay of dead organic matter is a very complex process carried on by countless numbers of micro-organisms, which in their turn divide the work to be performed into various stages. In this country, where most of our sewage is water-borne, the processes are best illustrated by the functions performed by the liquefying and nitrifying organisms respectively.

At the present moment I am merely referring to the subject for the purpose of drawing attention to what I conceive to be the greatest advance in sanitary science during the past forty years. And the lesson which we learn is that advance can only be made by long and patient observations, such as those which characterize the work of such men as Pasteur, Koch and a host of others. Our object now is not to veil the process of decomposition by the introduction of what were called disinfectants and deodorizers, which too often merely resulted in substituting one unpleasant smell for another, which was more objectionable, but as far as possible to remove from our inhabited areas all decaying organic matter, and as far as possible by proper appliances, not yet completely understood, hasten those processes of nature which lead to the reduction of decaying matter from a harmful to a harmless condition.

While this may be said to be in broad general terms the lines along which we are now traveling, yet its application is rendered more difficult than might at first appear, owing to the fact that most of the sewage of our large towns is water-borne sewage, in which the quantity of decaying matter bears but a very small proportion to the total bulk of fluid to be dealt with, as well as to the fact that even the smallest quantity of decomposing matter is sufficient to destroy the purity of exceedingly large volumes of water. And from these latter facts we have gradually learnt the lesson that in a humid climate like that of Great Britain perennial irrigation on a large scale cannot be carried out with that financial advantage which was at one time expected. I do not wish by this to be understood as implying that sewage irrigation may not form a very important function in the purification of our sewage effluents, but rather that such a process is not likely to prove profitable in the long run. Besides the water-borne sewage of our towns there is always a large amount of comparatively dry matter, such as street sweepings, ash-bin refuse, and the like, which does not enter our sewers, and which is an exceedingly expensive matter to dispose of, especially in the large and congested areas of our great towns. Gradually there is growing up for the disposal of these substances a return to one of the oldest known sanitary processes, viz., destruction by fire; and under the improved modes now adopted we are arriving at processes which can be carried on with celerity and without offense, in the immediate neighborhood from which the substances are derived, and at the same time a certain amount of heat, which is evolved in their destruction can be utilized for secondary purposes.

Intimately connected with sewage disposal and the preservation of the public health is an ample and sufficient water supply, the importance of which has led almost all our large towns to resort to uncontaminated sources of supply far removed from the possibility of pollution. And there can be no doubt that a pure and uncontaminated water supply is one of the first necessaries of public health. As to whether the water should be soft or hard is largely a matter governed by local circumstances, or in some cases by trade requirements; and the experience which we have gained up to the present leads to the conclusion that provided that the water is otherwise pure and unobjectionable the public health is little or not at all affected, except perhaps in the case of such diseases as calculus and the like. I was brought up in the belief which I still hold, that a water-supply should be not only pure and uncontaminated, but beyond suspicion of any possible pollution whatever. However, in recent years I fear that a little laxity, due probably to our improved sewage purification, is creeping in, and that we find large populations supplied with water which has received directly or indirectly many sewage effluents.

From this I draw the conclusion that either our large towns, such as Edinburgh, Glasgow, Manchester, Leeds, Liverpool, Bradford, Birmingham and many others, have uselessly expended millions of money in attaining an ideally pure water supply, or that the people of London are running a great risk in continuing to depend almost entirely on the waters of the Thames and the Lea, which receive the more or less clarified sewage effluents of over a million and a quarter persons. And I am inclined to believe with the late Sir George Buchanan that large populations can continue to drink water which has been contaminated with apparent impunity, but that sooner or later such water takes upon itself morbific qualities which lead to death and disease.

Nearly connected with a pure water supply is pure air. This to some extent is insured by proper drainage and house sanitation, but it cannot be denied that the air of our large towns is far less pure than could be desired. And this to a large extent is no doubt due to the smoky atmosphere in which our town dwellers reside, and this when combined with mist and fog becomes at times one of the greatest evils from which our urban populations suffer.

As to the prevention of fogs, no doubt a great improvement is effected by proper drainage, but when towns or cities are situated in large river valleys, such as the Thames, and like London, one-tenth of which is situated on areas below high-water level, it is unreasonable to expect that fogs can be abolished. However, much can be done in the future to alleviate a great deal of the dirt and misery caused by a combination of fog and smoke, by a proper and more economical application of our fuel for heating purposes. As at present used the domestic fire in London, which burns coal in an open grate, is largely responsible for the contaminated state of the air; not only so, but it is a most wasteful mode of utilizing our fuel.

What really is required is a cheap and economical heating gas; at present, however, our gas manufacture being principally directed to produce a pure gas of high illuminating power, owing to its expense is in most cases a bar to its utilization for heating purposes. However, it is not an impossibility to produce a cheap gas of great heating power, but of low illuminating efficiency, which latter can be increased by the use of proper incandescent mantles. Nor is this an imaginary or ideal conception, for in the present Session of Parliament one of our largest London gas companies has obtained power to purchase 120 acres of land for the purpose, as stated by their chairman, Sir George Livesey, of carrying out a system of gas manufacture such as that I have above described. With electricity for the internal illumination of our houses, with gas fuel instead of the crude coal for heating and cooking purposes, and a cheap incandescent gas lamp for street use, I feel certain a great improvement could be made in the air breathed by our urban populations.

One of the greatest evils of our modern town life is the crowding together in congested areas of vast masses of the less affluent members of the community, and unfortunately owing to their circumstances they are unable to live in any but the poorest tenements. The difficulties which surround this problem are due in great part to the large rise in the value of land in our great towns, owing to that aggregation of population the evils of which we desire to avoid. But perhaps we may draw a lesson and see how this problem of increased urban land value versus dense population, is working itself out in a class somewhat above the poorest.

The City of London, properly so called, and the districts of Holborn and the Strand, as an example, were formerly thickly inhabited by traders and tradespeople, together with the vast commercial population which follows commercial life. Within the last fifty years, however, so enhanced has become the value of land and houses for purely business and commercial purposes that the former residents have found it impossible to reside in those districts and more economical to migrate to suburban areas; consequently our census returns show us that the resident population in the City, Holborn and the Strand is rapidly decreasing. The consideration of these facts at once points to the conclusion that some means of transit must be afforded for the workers, who are employed in our centers of commercial industry during the day, to their places of residence in the suburbs.

Much has already been done by the provision of railways and tramways to meet modern requirements, but I think that the lesson that we have to study in the future in dealing with this question is the dispersal of our redundant population over larger areas, and the removal, as far as practicable, of our manufactories from our towns into the country. This latter with our improved telegraphic and telephonic communication should not be impossible of achievement, and may even prove an economy to the manufacturer by locating his works in districts where land is cheap, which would allow of the construction on an enlarged area of more healthy dwellings for the laboring population.

The dispersal of our London population in the manner above suggested has been well illustrated during the past few years by the result of the working of the Central London Electric Railway and the Electric Tramways, which extend from its western extremity towards Hounslow, Isleworth and Uxbridge. An investigation of the low fares at which our working population can travel by this route, together with the fact that the Central London Railway alone is able to pay its shareholders 4 per cent. per annum on their investments, should prove an encouragement to other persons to do likewise. But when we have done our utmost to disperse our population as far as practicable, there will always remain a very large proportion of workers who must from the nature of their occupations reside on or near the site of their labors, and for their accommodation improved dwellings must be provided, and we have in London in the Boundary Street area, opened some years ago by the King and Queen, and in the new buildings being erected at Millbank by the London County Council, examples of what can be done to improve the habitations of our laboring classes.

In the above remarks I have briefly touched upon what have been the great improvements in the past, and on the various topics which to my mind deserve attention in the future. This is not the time to dilate upon the details connected with these various subjects, even were I qualified to grapple with them. To attain, however, the desired ends, I consider that much could be done if all these subjects touching upon municipal life, such as drainage, water supply, gas supply, housing problems and transit, were left more fuly in the hands of the governing bodies of our large municipal towns. These bodies are elected by the public suffrages of the ratepayers; they are representative in the fullest sense of the word, and their members are all of them (and I have had a life-long experience of our municipal bodies), fully competent to deal with these subjects, and could do so, I feel confident, were they relieved from many of the restrictions now placed upon them by our sanitary legislation. Could this be effected not only would a great advance be made in the carrying out of these important sanitary improvements, but the Imperial Parliament would be relieved of a vast amount of work now pressing upon our legislature. I cannot conceive a greater waste of energy and valuable time, which could be devoted to matters of higher national concern, than to see committees of Parliament and the House of Commons discussing for hours and days matters of purely local interest, of which its members can have in most cases little knowledge and still less interest. I feel strongly as an old municipal officer that more is to be gained by giving a free hand in all these matters to our local governing bodies and county councils, than in devising new sanitary legislation, which unfortunately appears to hinder rather than expedite the great objects which we all have in view.

The American Society of Municipal Improvements will meet at Rochester October 7, 8 and 9. In addition to important committee reports and descriptions of public works in Rochester, a long list of papers will be presented, some of which are the following: "Residential Septic Tanks," Burton J. Ashley; "Sewer Maintenance," John H. Emigh; "Practical Operation of Sewage Purification Plants," John W. Alvord; "Description of Interesting Sewer Construction in Brooklyn," Henry R. Asserson; "Street Cleaning," J. Herbert Grant; "Economic Theory of Municipal Lighting," Nicholas S. Hill, Jr.; "Cost of Pavements and Roads in Small Towns," Emmet J. Steece.

Letters to the Editor.

Unreasonable Contract Requirements by the Government.

Sir:—In the same issue of The Engineering Record (Sept. 20, 1902) which contains your article entitled "Unreasonable Contract Requirements by the Government," there appears in another column a list of the bids received by the Bureau of Yards and Docks for the construction of the dry dock at Norfolk, Va. The six bids range from $1,214,677 to $1,320,000, averaging $1,265,000. The appropriation for the work for which bids were received was $850,000, or $415,000 less than the average of bids received. In other words, the average contractor's estimate of doing the work under the specifications and plans, which were very similar to those for the Charleston dock, was 49 per cent. greater than the engineer's estimate. It seems to me that this confirms the statements made in your criticism of the result of inviting bids on such inadequate and unreasonable specifications. M. C. H.

The High-Level Bridge, Newcastle.

Sir:—One of the engineering achievements that attracts the attention of a visitor in England is the high-level bridge at Newcastle-on-Tyne, connecting Newcastle and Gateshead. Designed by Robert Stevenson and built more than fifty years ago, it stands a magnificent monument to his great engineering abilities. In comparison with modern bridges it still maintains a high place in the scale. It is unique in that the main compression members—the arches—are cast-iron. Through the kindness of Mr. J. W. Walker, managing director of Robert Stevenson & Co., Ltd., the following description of the bridge was obtained. The picture showing two of the spans was taken by myself with a pocket kodak from the top of a tottering lumber pile alongside the river. Believing the description and picture of sufficient interest to warrant their publication, I am sending them to you.

Yours truly,

Forrest R. Jones.

Birmingham, Sept. 1, 1902.

Old High-Level Bridge.—Contract let August 17, 1846; bridge completed August 14, 1849; open for traffic, February, 1850.

The width of the river at the point where the bridge crosses the Tyne is 515 feet. There are five piers 138 feet 10 inches apart, center to center. These piers are built of a hard, durable sandstone obtained from quarries in the neighboring coal formation. They are built on piles, the spaces between which are filled up with concrete. The majority of these piles are 40 feet long and all are driven through the hard sand and gravel forming the bed of the river till they reach the solid rock below; the piles are 13 inches square, and are placed 4 feet apart from center to center. The greatest weight that can come upon each is 70 tons, supposing none to be carried by the intervening spaces of concrete. This is considered a very heavy load, which could only be warranted by the goodness of the strata into which the piles are driven. In moderately compact clay it is usual to consider the maximum bearing power of a pile 12 tons, in hard clay 25 tons, but in gravel, of which the Tyne consists, 70 or 80 tons are often allowed. Many engineers consider the bearing power in such strata only limited by the resistance of the fiber of the timber. In this case the piles rest on the solid rock, which puts all doubt at rest as regards stability. In fact, one of these piles was tested to 150 tons, which was allowed to remain for several days, but no settlement whatever took place.

The masonry of the piers commences about 2 feet below low-water level, the lower portion being provided with cut-waters. The foundation surface of each pier is about 76.5x22.5 feet; the section of the tall shaft of the pier is about 46x14 feet, lightened by an arched opening 12 feet wide.

The High-Level Bridge, Newcastle.

Each span or bay is crossed by four main girders, the chief feature of each girder consisting of a cast-iron arch or bow, the ends of which are connected together and the thrusts taken by a wrought-iron tension rod or tie. The rise of the cast-iron arch is 17.5 feet, or a little less than one-seventh of the span. It is made in five segments strongly bolted and accurately fitted together, the depth at the crown being 3 feet 6 inches. The section is that of a double-flanged girder having 133 square inches area of metal in the two outer girders, and 189 square inches in the inner ones, which have more weight to support. The tension ties or strings of the bow consist of flat wrought-iron bars 7x1 inch, each outer girder being tied by four of these and each internal girder by eight. The girders are all strongly braced together with diagonal frames.

The railway platform is placed above the top of the arches, a series of pillars being carried up throughout the spandrels so as to support entablature beams lying horizontally above them the whole length of the bridge. Cast-iron cross bearers rest on these, extending in one length over the four main girders. These again support longitudinal timber joists on which a flooring of double diagonal planking jointed and tongued with hoop iron and well caulked with pitch is laid. The three lines of rails are fastened down to the planking in the ordinary way. The lower roadway for common traffic is hung from the arches by wrought iron suspending rods bearing longitudinal beams similar to those on the top platform, and upon these cross bearers rest carrying a double-plank roadway in like manner. This is paved with wood blocks set in pitch and covered with sand and gravel. The four girders are placed to leave room for a carriage way 20 feet wide and the two footways are 6 feet each. The total width of the bridge from outside to outside is 46 feet.

Provision is made for the expansion and contraction of the iron superstructure by fixing the girders firmly to the first, middle and fifth piers, and making them free to move on the second and fourth, as well as on both the abutments. There are no rollers; the bearings have surfaces fitted for sliding on each other. The motion caused by a variation of 32 degrees temperature was found by experiment to be 0.153 of an inch for each span.

As far as the construction of the bridge was concerned the mixture employed for the principal parts, viz., the arch, ribs and transverse girders, was selected from the following mixtures:

	Cwts.
Ystalifera Anthracite No. 3	40
Resdale Hot Blast No. 3	40
Crawshay (Welsh) Coal Blast No. 1	40
Blaenavon Cold Blast No. 1	30
Coalbrook Dale Cold Blast No. 1	30
Selected Scrap	30

The total weight of the cast-iron employed was 4.728½ tons. The amount of wrought-iron was 321½ tons. The total quantity of masonry employed was 686,000 cubic feet.

The total length of the bridge is 1,337 feet; the height from high water to carriage way, 85 feet; height from high water to rails, 112 feet. The cost of the bridge was as follows: Bridge, £243,096; approaches, £113,057; land, compensation, etc., £135,000; total, £491,153.

A Double Water Tower.

Sir:—The Board of Trustees of the Ohio Soldiers' and Sailors' Orphans' Home near Xenia have recently accepted the water tower erected at that place this summer at a cost of $6,000. This tower differs in some respects from other towers, in that there are two tanks, one inside of the other. One is for hard water and the inside tank for soft water, each to hold 1,000 barrels. The foundations consist of four stone pillars, 8 feet square at the base, 3 feet square at the top and 6 feet high. Upon these rest four columns 68½ feet high, and on these are the girders which hold the tank, which is 35 feet high and 18 feet in diameter. The inside tank is 12 feet in diameter. The first 10 feet is ⅜-inch steel, the second 10 feet 5/16-inch, the next 15 feet ¼-inch. This is surmounted by an ornamental steel cover.

At the base of the tank, 68 feet from the ground, is a walk 4 feet wide, with concrete floor 4 inches thick at the tank and 2 inches thick at the outside of the guard rail. From the bottom of the tank are connected three pipes, one for hard water, one for soft water and an overflow pipe, which conveys the waste water to an artificial lake, which keeps it fresh.

When the tank was first tested, water was pumped into the outside tank, leaving the inner one empty, and while doing so the inside tank collapsed and had to be taken apart and shipped to Dayton to be reconstructed. There is a difference of opinion as to the cause of this accident. One engineer says it was caused by not calking the seams on a swinging staging. The staging was made the whole width of the outside tank, and when the wood swelled the inner tank sprung. Another says that the water being pumped into the outside tank commenced to swirl rapidly, and as this continued the tank commenced to swing in the direction of the current, which caused the trouble.

They have now put in 48 braces from the inner to the outer tank, held to each by angle plates and two bolts. The braces are made to allow for expansion and contraction. The tower was then accepted by the board.

This tower was built to take the place of a brick one 87 feet high, which had four tanks and held 580 barrels of water. This was constructed thirty-one years ago and collapsed in April, 1901. A singular thing about the old tower was that it did not topple over, but crumbled in almost the space it occupied on the ground.

Yours truly, George F. Cooper,
Genl. Manager, Water Works.
Xenia, September 17.

Book Notes.

The popularity of the writings of Dr. Samuel Rideal on chemical and biological subjects relating to sanitary engineering is demonstrated by the appearance of new editions of two of his books. One of these, "Water and Its Purification," is published by the J. B. Lippincott Co., Philadelphia. It is a 350-page volume on the characteristics of natural waters, animal and vegetable impurities, the different classes of water, storage, distribution, water purification on a large scale and in the household, water softening, and water analysis and the interpretation of results. The additions in the new edition relate to recent epidemics of water-borne diseases and to sand filtration. The author's experience as analyst for public boards in Great Britain renders his remarks of more practical engineering value than is usually the case with the sanitary publications of chemists, and in spite of some statements which seem strange to the American reader, the book is one full of useful data for health officers and water-works officials. His second volume is the treatise on "Sewage and the Bacterial Purification of Sewage," published at $3.50 by John Wiley & Sons, New York, the first edition of which was noticed so recently that an extended review is unnecessary. It is indispensable to those desirous of obtaining a clear conception of the changes that occur in sewage during its mutations into innocuous substances. The new edition is marked by the revision of some misleading statements in the first edition and by the addition of new data on both theoretical and practical subjects.

Another work on sewerage which deserves careful study is Mr. Gilbert J. Fowler's "Sewage Works Analyses," published at $2 by John Wiley & Sons, New York. The author's long experience as the superintendent and chemist of the sewage disposal works of Manchester, England, has made him an authority on the subject. While the work is mainly chemical, as the title implies, the engineer will find no small part of it valuable as indicating the reasons for certain classes of analysis and explaining the meaning of the results.

Still another book on sanitary subjects is Dr. William T. Sedgwick's "Principles of Sanitary Science and the Public Health," published at $3 by the Macmillan Co., New York. The author needs no introduction to the readers of The Engineering Record, for his good work in reducing hygiene to sanitary science is well known to its readers. It may not be known, however, that his technical writings are marked by a vigor and happy gift of expression which lifts them far above the plane of dull accuracy on which such works rest so firmly and solidly. The book is in two parts, of which the first is a general discussion of the conceptions of health and disease. The nature of the vital machinery is explained, the various theories of disease are traced in their historical order, and the wonderful teachings of bacteriology are outlined. The second part is an outline of so much of hygiene as may safely be called sanitary science. That is to say, there are chapters on infection and contagion, dirt and disease, sewage, water, ice, milk and food as vehicles of infectious diseases, and the prevention, inhibition and removal of infection. There are few subjects which ought to receive more attention from citizens than these, for it is not legislation so much as education that is needed to improve the general tone of health of our towns.

A book in which conciseness and accuracy of statement are materially assisted by excellent illustrations, many of unique interest, is "City Roads and Pavements," by Mr. William Pierson Judson, M. Am. Soc. C. E. It is intended to supply information useful mainly in cities of moderate size, and is wholly free from padding of any sort, which makes it a good textbook for schools as well as a practical manual for the officials of cities and villages. The preparation of streets for pavements, the construction of concrete foundations, and the relative merits and methods of laying stone block, wood, brick and asphalt are fully explained. The information is such as an engineer will find really useful, and the figures of cost of work are fair averages. In the section on foundations, the author supplies directions for simple cement tests with an outfit costing not over $4 and giving results which will reject no good cements but will keep out poor material. The detailed and practical directions for making monolithic concrete include valuable features of actual good practice which are not known to be elsewhere published. The chapters on telford and macadam road building form by all odds the most practical and useful collection of data on the subject with which this journal is acquainted. In the author's endeavor to be concise, he has perhaps stated without qualification opinions on a few disputed features of street and road work which some engineers will question, but in such matters his views are those of most road experts except as regards granite block pavements. His condemnation of these is too sweeping, as they give excellent streets at a fairly low cost in parts of the country where the blocks are prepared at local quarries. The book is sold for the author at $2 by Engineering News, New York.

Although Pierre Simon, Marquis de Laplace, may have been a political sycophant, as a mathematician his work reached the highest plane of originality. His greatest work was unquestionably in the application of mathematical analysis to astronomical problems, where, spurred by friendly rivalry with Lagrange, he made a succession of brilliant demonstrations which only ceased when no more problems worthy of his attention remained unsolved. His work in other lines was equally important, and that in the theory of probabilities has been of great practical value. His "Analytical Theory of Probabilities" is a treatise which can only be grasped by the ablest mathematicians, but they have interpreted and expanded it in their works so that it is available at second hand. It is characteristic of Laplace's genius, however, that when he wished to express the results of his studies in simple form for the general public, the result was always a lucid essay of the most interesting character. "The theory of probabilities," in his eyes, "is at bottom only common sense reduced to calculus; it makes us appreciate with exactitude that which exact minds feel by a sort of instinct without being able oftentimes to give a reason for it. It leaves no arbitrariness in the choice of opinions and sides to be taken; and by its use can always be determined the most advantageous choice." These views were explained in one of the most pleasing essays on a mathematical subject which was ever written. A translation of the sixth French edition has recently been made by Profs. F. W. Truscott and F. L. Emory under the title "A Philosophical Essay on Probabilities," which is published by John Wiley & Sons, New York. It will undoubtedly prove useful to a large circle of readers unable to secure a copy of the French edition.

Another mathematical essay which it is a pleasure to see rescued from the oblivion of bibliographies is "The Study of Mathematics," by Augustus De Morgan. The author was one of the great mathematicians of the last century, and the first English writer to insist on the strict logical development of analytical processes. He was truly a prophet crying in the wilderness of the mathematical world, and for a long time his protests against the current views passed unheeded. But to-day all is changed, and it is interesting to notice how closely the workers in the line of mathematical logic are following out the plans sketched by him fifty years ago. His great aim was to show that the most logical proof of a proposition was the simplest to understand when properly presented, and many of his writings were intended to raise the standard of instruction in elementary subjects. In the book mentioned, for example, he shows how the development of arithmetic, algebra and geometry can be taught without any of the mechanical severity of the methods in common use, yet with a rigorous regard for logic that leaves nothing to be desired. It is one of his best and most useful essays, and is published by the Open Court Publishing Co., Chicago, at a price, $1.25, which is very low for a mathematical book of nearly 300 pages. The same publishers have also brought out a new edition of Mr. T. J. McCormack's translation of Mach's "Science of Mechanics." This well-known critical and historical account of the development of the science has met with a remarkable reception from the leading mechanical specialists of Europe and this country, while its general popularity is evident from the numerous editions which have been issued. Its aim is to show how the principles of mechanics have been worked out slowly from the first rude theories and crude experiments, through mathematical analysis and careful investigation, into the form they now possess. The various steps in the development, told in places in the quaint language of the past and illustrated by the rude woodcuts of rare volumes two or three centuries old, serve to fix the basic facts of mechanics in the mind with a firmness which other methods often lack. The new English edition contains the extensive additions made by Professor Mach to the German editions and differs from them only in one short section on units and measures. Here, with the author's consent, Mr. Charles S. Peirce has rewritten a number of pages in order to make the treatment applicable to the system commonly taught in this country. The work is a well-illustrated 600-page volume and is sold at $2.

The third bulletin of the University of Texas Mineral Survey is a profusely illustrated 138-page book covering the following subjects: Chapter I, location of coal and lignite mines and character of output; Chapter II, the financial and technical values of Texas coals and lignites; Chapter III, the asphalt rocks of Texas; Chapter IV, the uses of asphalt and asphalt rocks; Chapter V, the chemistry of some of the Texas asphalt rocks. The last chapter is by Dr. H. W. Harper and the others by Dr. W. B. Phillips, director of the Survey. It is hardly necessary to refer to the general interest in the portions of the report relating to the Texas asphalt rocks, which have been used successfully in laying large areas of pavements in a number of cities, of which useful data are given. Copies of the bulletin can doubtless be obtained by addressing Dr. Phillips at Austin.

A classified list of makers of machine tools and metal-working machinery is being issued by the Industrial Press, New York. Section A, a 159-page pamphlet sold at $1, gives the names and addresses of makers of bicycle machinery, blacksmiths' tools and appliances, bolt and nut machinery, machine tools and accessories, machinists' small tools, metal-working machinery, wire-making apparatus. There are English, German and Spanish indexes to the numerous classes of tools and appliances under which the firms are listed.

"A Graphic Method for Solving Certain Questions in Arithmetic or Algebra," one of the Van Nostrand Science Series by Prof. George L. Vose, has reached a second edition. It makes use in an ingenious manner of the principle of the train sheet as applied in railroad offices, to the solving of many mathematical problems. The method is simple and effective, and affords a convenient mode of obtaining a comprehensive view of several complex problems. It is published at 50 cents by the D. Van Nostrand Company, New York.

Personal and Obituary Notes.

Mr. S. H. Kupp has resigned as city engineer of Carbondale, Pa.

Mr. Howard Smith has been elected city civil engineer of Rochelle, Ill.

Capt. J. H. McRee, State engineer of North Carolina, died September 9 of apoplexy, at Lumberton, N. C., at the age of about 50 years.

Mr. D. Everett Waid, of New York City, has been commissioned architect to the Bond and Mortgage Division of the Metropolitan Life Insurance Company.

Mr. W. G. A. Millar, formerly manager of the ornamental department of the American Bridge Co., has been appointed purchasing agent of the company with offices at 259 South Fourth St., Philadelphia.

Mr. James J. Ryan, formerly city engineer of Muscatine, Ia., and Mr. James E. Bradford, have formed a partnership for general engineering work with an office in the Olds Opera House Block, Muscatine.

Lieut. R. E. Peary, civil engineer, U. S. N., has been promoted to the rank of commander. Since 1881, when he entered the service of the navy, he has spent all but about four years in Arctic exploration.

Mr. Alexander C. Humphreys, who recently accepted the presidency of Stevens Institute tendered him several months ago, has begun his administration with the largest freshman class in the school's history.

Mr. W. B. Hampson, a graduate of Purdue University in 1893, and for five years instructor of mechanical engineering at the University of Nebraska, has assumed new duties as professor in engineering at the University of Washington, Seattle.

Mr. J. E. Willoughby has been appointed chief engineer of the Knoxville, LaFollette & Jellico Railroad, succeeding Prof. W. D. Taylor, who has returned to the University of Wisconsin to resume his work as professor of railway engineering.

Thomas Frazer, at one time resident engineer of the Michigan Central Railroad, and later general agent and paymaster, died September 23 at Detroit at the age of 88 years. He was engaged in the thirties as a civil engineer in laying out the Lake Shore & Michigan Southern Railroad.

Mr. F. M. Marsh, for five years chief engineer of the Fremont, Elkhorn & Missouri Valley Railroad, has resigned to accept a position as assistant to chief engineer J. B. Berry, of the Union Pacific Railroad. Mr. A. A. Schenck, division engineer of the Chicago & North Western Railway, at Boone, Ia., has been appointed to the vacancy.

Josiah D. Cook died of apoplexy at his home in Toledo, O., on September 17. He was born on April 26, 1830, in Warren County, Va., served in the Civil War, and, resuming engineering work at its close, in 1873, he became chief engineer of the Smith Bridge Co., Toledo. He is best known as a water-works engineer, having designed and constructed water-works plants in some 63 cities in the United States, among them being Toledo, Sandusky, and Galveston, Tex.

Mr. E. A. Bond, M. Am. Soc. C. E., has been renominated as the Republican candidate for the office of New York State Engineer and Surveyor. His engineering experience began in 1868 on the Lackawanna Railroad. Two years later he joined the staff of the Utica & Black River Railroad, of which he was soon appointed chief engineer. From 1886 to 1889 he was chief engineer of the Carthage & Adirondack Railway, resigning in the latter year to become a member of the engineering firm of Hinds & Bond, with offices in Watertown.

Charles H. Latrobe died September 19 in Baltimore at the age of 69 years. He was graduated from St. Mary's College and began his career with the Baltimore & Ohio Railroad. After the Civil War, in which he served in with the Confederate Army, he entered the practice of civil engineering in Baltimore, where for nearly 30 years he had charge of, or was engaged in city improvements. Among his more important works, perhaps, were the walling in Jones' Falls, and laying out Mount Royal Avenue. He was also consulting engineer for a number of railroads, including important work in the Andes in Peru.

Maj. J. W. Powell, director of the Bureau of Ethnology at the Smithsonian Institution, at Washington, died at his summer home at Haven, Me., September 23. He was born in Mount Morris, N. Y., in 1834, but spent the early part of his life in Illinois, Wisconsin and Iowa, where he developed a fondness for the natural sciences. He served during the Civil War, enlisting as a private and becoming a major. At its close he was made professor of geology at Illinois Wesleyan University, and since that time has conducted many exploring parties, given many lectures and done considerable writing along his chosen field. He is said to have been the first man who ever went through the Colorado Canyon. He was regarded by many scientists in Washington as in the foremost rank of the geologists and anthropologists of the world. He received the degree of Ph.D. from Heidelberg and LL.D. from Harvard, and in 1887 was president of the American Association for the Advancement of Science.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xvi, xviii and xxvii.

WATER.

Tonawanda, N. Y.—Bids will be received by the Village Municipal Bd. until Oct. 14 for pumping engines, as advertised in The Engineering Record.

Brockton, Mass.—Bids are wanted Nov. 8 for furnishing and erecting complete one (6,000,000-gal. daily capacity) pumping engine, as advertised in The Engineering Record.

Long Branch, N. J.—The Home Water Co., recently organized with a capital of $100,000, is reported to have accepted the terms of a 10-year contract to serve this city with water for all municipal purposes. Incorporators: Louis Rothenberg, B. P. Morris, and others.

Brooklyn, N. Y.—The construction of 3 pumping stations which when completed will increase the water supply of this city by from 10,000,000 to 12,000,000 gals. per day, was recently authorized by the Bd. of Aldermen and plans for same are now being prepared by the Engrs. of the Brooklyn Water Dept. Total estimated cost, $154,000.

Brooklyn, N. Y.—Bids are wanted Oct. 9 for furnishing material and delivering, erecting and connecting a new boiler at the Mt. Prospect Pumping Station, Boro. of Brooklyn. Robt. Grier Monroe, Comr. Water Supply, Gas & Electricity.

Pittsburg, Pa.—Local press reports state that the National Water Works & Guarantee Co., of Pittsburg, has started to absorb the water companies supplying many towns in western Pa., by the purchase of the Latrobe Water Co. at a reported price of $400,000. W. A. Johnson, Mgr. of the system, will, it is stated, retain his position under the new ownership. The Latrobe Co. drew its supply from the headwaters of the Loyalhanna, and it is reported that the system operated from this watershed will be largely increased, and many other towns and hamlets in that vicinity supplied.

Altoona, Pa.—City Engr. Harvey Linton writes that the Altoona Water Dept. has employed C. W. Knight to make a survey of Tipton Run watershed, for an additional water supply.

Oneida, N. Y.—The Bd. of Pub. Wks. has instructed City Engr. Vedder to prepare plans and specifications for a new cement spillway at the storage reservoir of the water works system

Philadelphia, Pa.—The contract to build, at Race St. and Delaware Ave. a pumping station for the special fire main service has been awarded by Dir. of Pub. Wks. Haddock to Henderson & Co., for $56,533, to complete the work in 180 days.

The contract for building engine and boiler house No. 2 of the pumping station at Lardner's Point near the Forresdale filtration plant, has been awarded to Geo. C. Dietrich for $532,000, to complete the work in 240 days.

The contract for laying a 20-in. water main on Water St. has been awarded to the Hoffman Engineering Co. for $35,000.

Ogdensburg, N. Y.—The Com. (Thos. Spratt, Chmn.) which was appointed by Mayor Geo. Hall to investigate and report to the Water Sewerage Comn. the causes of the overflow of Oswegatchie River from Gouverneur to the River St. Lawrence in Ogdensburg, and the Indian River from Theresa to the head of Black Lake, has reported recommending the construction of a dam at a point known as the Eel Weir; also that the present reservoir at Cranberry Lake be enlarged by raising the dam and putting in proper gates and bulkheads; the committee also suggests that a reservoir be constructed near Harrisville on the west branch of Oswegatchie River.

East Rutherford, N. J.—The Water Com. has reported in favor of the construction of a municipal system of water works at an estimated cost of $48,000. The proposed system includes 8 miles of 10 to 4-in. pipe, 50 hydrants, and 220 10 to 4-in. gates, with driven wells, 2 engines and 2 pumps, standpipe, etc.

Jersey City, N. J.—The New Jersey Suburban Water Co., Jersey City, has been incorporated, with a capital of $100,000. Incorporators: Frank Koch, Jos. Odell, Horace S. Gould and Kenneth K. McLaren, Jersey City.

Bridgeport, Conn.—The Bd. of Health has recommended that the Bridgeport Hydraulic Co. be directed to install a system of filtration for the city's water supply.

Rochester, N. Y.—The Joint Com. of the Finance and Water Works Com. has reported recommending the adoption of the ordinance authorizing the Comr. of Pub. Wks. to acquire land on Cobb's Hill, for a 7,000,000-gal. reservoir. Estimated cost of land, reservoir and pipe, $682,000.

Philadelphia, Pa.—Local press reports state that the only bid received Sept. 23 for installing preliminary filters at the Lower Roxborough plant was from the Maignen Filtration Co., of Philadelphia; their bid, which was as follows, covered the furnishing of rough filters guaranteed to pass 12,000,000 gal. a day of partly filtered water into the sand filters: $49,800 to rough filter the water at the rate of 1,377 gals. a sq. ft. a day, and $69,500 at the rate of 2,066 a sq. ft.

Paulsboro, N. J.—Bids are wanted Oct. 11 for 330 short tons of 8, 6 and 4-in. cast-iron pipe; 10 net tons of special castings; 21 8-in., 6-in. and 4-in. stop valves, with boxes and covers; 41 4-in. double nozzle fire hydrants; steel standpipe, 12 ft.x100 ft.; stone foundation for standpipe; brick power house, and triplex pumping machinery and gasoline engine. Wm. J. Adamson, Secy., Paulsboro Water Co.; Isaac S. Cassin, Jr., Consulting Engr., Philadelphia, Pa.

Carthage, N. Y.—Eaton & Brownell, of Carthage, are said to be making surveys for the proposed water and sewer system for this village.

Martinsburg, W. Va.—City Clk. A. F. Lambert writes that the matter of improving the water works is being considered, but no definite steps have as yet been taken.

Chester, S. C.—Bonds are reported to have been voted for the construction of water works.

Clarksburg, W. Va.—A charter has been granted to the Steelton Land Co., of this city, for the purpose of dealing in real estate, building houses, water-works, etc. The authorized capital is $750,000, and the incorporators are T. G. Brady, J. M. Crouch, E. R. Davis, and others, of this city.

Big Stone Gap, Va.—An election will be held in Oct. to vote on the issue of $20,000 bonds for street improvements and for increasing the water supply.

Moline, Ill.—Bids are wanted Oct. 29 for furnishing work and material for the improvement of the city water works system, as advertised in The Engineering Record.

Webster Groves, Mo.—Through error an item calling for bids (to be opened Oct. 6) for 940 net tons of 12 to 4-in. pipe and 12½ net tons of special castings, delivered f. o. b., Webster Groves, appeared last week in The Engineering Record under Webster Groves, O., instead of Webster Groves, Mo. Wm. H. Bryan, Consulting Engr., 706 Lincoln Trust Bldg., St. Louis, Mo. Edw. S. Hart, Chmn. Com. on Water Supply, Clayton, Mo.

North Milwaukee, Wis.—Village Clk. W. E. Chase writes that the following bids were opened Sept. 19 for furnishing 466 tons of 4, 6 and 8-in. iron water pipe; prices are per net ton; M. J. Drummond & Co., New York City, $33.45; J. B. Clow & Sons, Chicago, Ill., $36.75; U. S. Cast-Iron Pipe & Fdy. Co., Chicago, $34.75.

New London, Wis.—Geo. Cadogan Morgan, Hydraulic Engr., 808 Royal Insurance Bldg., Chicago, Ill., writes that contracts for machinery, supplies, etc., for a water works plant, f. o. b. cars, New London, have been awarded as follows (bids opened Aug. 28): Deane Steam Pump Co., Holyoke, Mass., pumping machinery, $999; Fairbanks, Morse & Co., Chicago, boiler, etc., $696; Stilwell-Bierce & Smith-Vaile Co., Dayton, O., heater, $210; U. S. Cast-Iron Pipe & Fdy. Co., Chicago, Ill., pipe and special castings at $33.60 per ton for 8 and 10-in.; $34.60 per ton for 6-in.; $36.60 for 4-in. and 3 cts. per lb. for specials. Rensselaer Mfg. Co., Troy, N. Y., hydrants, valves and boxes, $1,435; Ft. Wayne Fdy. & Mch. Co., Ft. Wayne, Ind., standpipe, steel work erected, $2,700. All other materials purchased in detail and home labor employed to do the work. Total cost about $35,000.

Findlay, O.—Bids are wanted until Oct. 7 for water works extension improvements: approximate quantities 4,200 tons of 20-in. iron pipe at 1,875 lbs. per 12-ft. length, 126 tons 8-in. iron pipe at 504 lbs. per 12-ft. length, 15 tons of special castings, 56,000 ft. 24-in. double strength vitrified pipe, and 1 receiving basin, average cut 7½ ft. Wm. Demland, Secy. Bd. of W. W. Trus. John W. S. Riegle, City Engr.

Jacksonville, Ill.—The City Council has passed an ordinance which will lease the present water plant for 30 years to F. W. Mayhon and others, of Chicago; the lessees are agreed to lay a pipe line to the Illinois River, 20 miles away, and use driven wells as a source of supply. The work proposed will cost $500,000, according to local press reports.

Kansas City, Mo.—The Bd. of Pub. Wks. is stated to have accepted the bid of the Barr Pumping Engine Co., of Philadelphia, to furnish the city with a vertical triple expansion pumping engine to be set upon foundations built by the city and to be ready for use within 8 months; capacity of engine, 15,000,000 gal. per day; price, $130,500.

Springfield, O.—The City Council has sold $30,000 water works bonds.

Harshaw, Wis.—A water works system is said to be projected.

Steubenville, O.—The Water Works Trus. have been authorized to purchase a tract of land for the proposed low pressure reservoir to furnish an additional water supply of 3,000,000 gal.

St. Paul, Minn.—Judge Giddings has appointed a commission to condemn lands in Anoka Co., wanted by the Bd. of Water Comrs.; said Bd. is desirous of securing about 200 acres of land adjacent to Peltier and Centerville Lakes, for the purpose of constructing a reservoir and putting in a dam at the outlet of Peltier Lake.

Evanston, Ill.—The City Council has passed an ordinance providing for the construction of a system of 4-in. cast iron water mains in Washington Place and Wesley Ave.

Mishawaka, Ind.—Mayor Mix has recommended to the Council the installation of water meters, and the employment of Mr. Walker, of Flint, Mich., to investigate the situation here for the purpose of locating the artesian strata.

Grinnell, Ia.—H. F. Lanphere, Secy., writes that the Grinnell Water Co. has awarded the contract for water works to the Des Moines Bridge & Iron Wks., of Des Moines, Ia.

Westbrook, Minn.—Village Recorder John E. Villa writes that M. B. Haynes, of Mankato, Minn., is the Engr. in Charge of proposed water works system, to be built at a cost of $7,000.

Cadillac, Mich.—This city has granted to Jacob Cummer, Wellington W. Cummer, Delos F. Diggins and others a 25-year franchise to maintain and operate water works, electric light and power plants.

Bowling Green, O.—Local press reports state that the new water company proposes to enlarge the plant, put in pipe extension and drill several new 10-in. wells.

Houma, La.—Hydraulic Engr. Geo. C. Morgan, 808 Royal Insurance Bldg., Chicago, Ill., writes that contracts for the construction of the water works (bids opened Sept. 9) have been awarded as follows: Fairbanks, Morse & Co., Chicago, Ill., pumping machinery, f. o. b. cars Houma, $635; Henny & Castanedo, New Orleans, boilers and heater, $932; Washington Steam Boiler Wks., Chicago, Ill., steel work of water tower erected, $1,713; Dimmick Pipe Co., Birmingham, Ala., cast-iron pipe and specials, f. o. b. Houma, at $37 per ton for pipe, specials 3¼ cts. per lb.; Rensselaer Mfg. Co., Troy, N. Y., hydrants, valves and boxes, $1,450; all other materials to be purchased of local parties and home labor will be employed to construct work. Total cost, $27,000.

Sherman, Tex.—Press reports state that bids will be received by the City Council until Oct. 6 for $50,000 water and sewer extension bonds.

Marshall, Tex.—Press reports state that this city will put in a new standpipe and purchase a boiler for the water plant. T. D. Ledbury, Secy.

Mena, Ark.—This city is reported to have voted $25,000 water works bonds.

Fayette, Miss.—Bids will be received at once by C. H. Jenks, Engr., Fayette, Miss., for sinking the following deep wells: At Terry, Miss., 1 6-in.; at Woodville, Miss., 1 7-in.; at St. Francisville, La., 1 8-in.; each to have 20 ft. of Cook strainer and guaranteed to supply not less than 100 gals. per minute. Price based upon a minimum depth of 300 ft. State in offer how soon work can be done.

Hobart, Okla. Ter.—Plans and specifications for the water works system for this city are being prepared by Burns & McDonnell, Postal Telegraph Bldg., Kansas City, Mo.

Colorado Springs, Colo.—City Clk. K. M. MacMillan, writes that bids will be wanted when plans are completed (probably in a few weeks) for the reservoir to be constructed for the water works at a cost of $75,000. E. W. Case, Engr. in Charge.

Dallas, Ore.—Bonds to the amount of $12,000 have been voted for municipal water works, and the contract for construction is stated to have been awarded to H. V. Gates.

Williston, N. D.—J. A. Johnson, of Fargo, has applied for a franchise for an electric light plant and water system.

Sterling, Colo.—The question of establishing a municipal system of water works is being considered by this city.

Tacoma, Wash.—The City Council has directed the Comr. of Pub. Wks. to ask for bids and let the contract for sinking a well and making a test of the air-lift system for the proposed new water plant at Edison to supply the city of Tacoma.

Walsenburg, Colo.—The Town Bd. has appointed a committee to investigate the water works question. The present Water Co. is willing to sell its plant for $50,000.

Salt Lake City, Utah.—The Mountain Home Irrigating Light & Power Co., of Salt Lake City, has filed articles of incorporation. Capital, $300,000. Geo. L. Nye, Pres.; W. J. Turner, Vice-Pres.; E. P. Sears, Secy., and A. G. Smith, Treas.

Florence, Colo.—The Colorado Fuel & Iron Co. is said to be making surveys for a line from Canon City to Beaver Creek for a canal about 50 miles long, which it is proposed to build in order to secure a more plentiful supply of water for the Minnequa Steel Wks., at Pueblo. Probable cost of canal and reservoirs, about $100,000.

Montreal, Que.—Local press reports state that certain boilers at the water works pumping station need to be replaced with new ones, and it is proposed to ask appropriations for new boilers and for the increase of the city's pumping capacity.

Torreon, Coahuila, Mex.—Press reports state that a concession has been granted by the State of Coahuila to Mackin & Dillon, of Monterey, Mex., for building the water works and sewerage system at Torreon, the estimated cost of which is from $300,000 to $400,000. Work is expected to be completed within 2 years.

SEWERAGE AND SEWAGE DISPOSAL.

Athol, Mass.—The contract for building 5 miles of sewer is reported to have been awarded to Long & Little, of Leominster, Mass., for $20,000.

Hanover, Pa.—The charter of the Hanover Sewer Co. has been entered for record. The company is formed for the purpose of laying pipes, conduits, sewers and erecting sewage disposal works, catch basins, etc., necessary to construct a sewer system and to maintain and operate same. Directors: John H. Cromie, Jr.; Hugh Robertson and J. H. McNeal, all of Philadelphia. Capital stock, $1,000.

Medford, Mass.—The Comrs. of Sewers have ordered the construction of a 30-in. circular masonry storm water sewer in 3 streets, with tide gates at the outlet, all work to be done under the direction of City Engr. Wm. Gavin Taylor.

Calcutta, India.—Fred Gainsford, Secy. to the Corporation of Calcutta, writes that the following bids were opened July 15, 1902, for furnishing and delivering pipe and specials:

Bidders.	Maker of Pipes, Etc.	Straight pipes, 2,688 tons.	Specials, 114 1/5 tons.	Totals.
D. M. Stevenson & Co., Glasgow	Cie Generale of Liege Belgium or first class British makers	$33.54	$58.73	$97,620
*Balmer Lawrie & Co., Calcutta	R. Maclaren & Co., Glasgow	34.32	54.72	98,345
Burn & Co., Howrah	D. Y. Stewart & Co., Glasgow	35.54	55.25	101,860
Martin & Co., Calcutta	Stanton & Co., Stavely & Co., Cochrane Grove & Co., Macfarlane Strang & Co	35.42	59.80	102,050
Jessop & Co., Calcutta	Macfarlane Strang & Co., Glasgow	38.60	59.40	111,080

*Contract awarded.

Westfield, Mass.—Local press reports state that Town Engr. O. E. Parks has about completed plans and specifications for the southern section of the surface drainage system.

East Orange, N. J.—The city officials are said to have arranged for the proposed completion of the 3d Ward drainage system.

Batavia, N. Y.—County Judge Washburn, attorney for the Bd. of Sewer Comrs., has filed with City Clk. Steele the final report of said Bn. for a permanent sewerage system for this village. Plans prepared for same, by J. W. Holmes. of Batavia, have been approved by the State Bd. of Health.

New London, Conn.—A survey of Ocean Beach is being made under the direction of the Sewer Bd. for the construction of a sewer.

West Carthage, N. Y.—The contract for constructing the sewer system is stated to have been awarded to Geo. S. Miller & Co., of Oneida, for $19,338.

Elizabeth, N. J.—Bids are wanted Oct. 1 for constructing sewers in certain streets. N. K. Thompson, St. Comr.

Dedham, Mass.—Bids are wanted Oct. 1 for $53,000 sewerage bonds. E. A. Brooks, Treas.

Brooklyn, N. Y.—Bids were opened Sept. 17 by the Boro. Pres. for constructing sewer crossings under Atlantic Ave. Improvement Subway, as follows:

Items.	John M. Waddle.	John O'Grady.
30-in. brick sewer, 2,300 ft	$8.25	$10.00
24-in. cast iron pipe, 36 ft	13.00	6.00
18-in. cast iron pipe, 108 ft	10.00	6.00
12-in. vit. pipe, 200 ft	3.50	1.75
30 manholes	88.00	100.00
Planking, 22 M. ft	35.00	18.00
Sheeting, 430 M. ft	35.00	18.00

Carthage, N. Y.—See "Water."

Skaneateles, N. Y.—By recommendation made by Engr. Olin H. Landreth and approved by State Health Comr. Lewis, the city of Syracuse is called upon to meet the expense of constructing a system of sewerage for the village of Skaneateles as a measure for preventing the pollution of the city water supply at Skaneateles Lake, the ownership to remain, however, with the village of Skaneateles.

Kenmore, N. Y.—A correspondent writes that the village of Kenmore is to have a system of sewerage, and that the Engrs. Dept., Buffalo, is preparing plans for same.

Watseka, Ill.—Press reports state that Iroquois, Ford and Livingston Counties will expend $100,000 on a new drainage ditch to prevent the recurrence of the annual floods.

Waukegan, Ill.—Bids are wanted Oct. 10 for the construction of a system of sanitary sewers, as advertised in The Engineering Record.

Lansing, Mich.—Bids for the construction of sewers in the 1st Ward have been rejected and action deferred until next spring. H. A. Collar, City Engr.

Grand Rapids, Mich.—The new date for receiving bids for the construction of a public sewer along the line of the West Side Ditch is Oct. 17, as advertised in The Engineering Record.

Dayton, O.—Bids will be received by the Bd. of City Affairs until Oct. 3 for constructing storm water sewers in portions of 4 streets, requiring approximately 840 lin. ft. of 42-in. brick or concrete sewer, 135 lin. ft. of 42-in. brick or cement sewer, and 2,976 lin. ft. of 24-in., 18-in., 15-in. and 12-in. pipe sewers, 25 catch basins, etc. Robt. H. Ferguson, City Compt.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Oct. 1 for furnishing material and constructing sewers and drains in portions of several streets; also until Oct. 15 for furnishing material and constructing a trunk sewer and drains, with appurtenances, in a portion of Lindwood Ave. Geo. F. Holmes, Clk.

Davenport, Ia.—Bids are wanted Sept. 30 for constructing sewers in several streets. Thos. Murray, City Engr.

Cleveland, O.—The following bids were opened Sept. 17 for sewer construction: for Spafford and other streets: W. J. Townsend bid $7,136; C. T. McCracker Co., $7,520; C. Burkhardt, $8,004; R. P. Burnett, $8,301; and John Potts Co., $8,795. For Wellington and other streets: C. Burkhardt bid $17,731; Reagh Const. Co., $18,098; Clements Bros., $18,149; W. J. Townsend, $18,324; and John Potts Co., $19,721.

Clay Center, Kan.—City Clk. W. K. McAulis writes that it is proposed to construct about 17 blocks of sewers in Dist. No. 1 and 850 ft. of public sewer; main sewers to be 15-in. tiling and laterals of 6 or 8-in. tiling; bids will probably be wanted in about 30 days. Estimated cost about $7,000.

Burlington, Ia.—Bids are wanted Oct. 6 for constructing the North Oak St. sewer and branches. Emmett Steece, City Engr.

Milwaukee, Wis.—It is stated that bids are wanted Sept. 30 for constructing a brick sewer in Delaware Ave. and a pipe sewer in Scott St. Chas. J. Poetsch, Chmn. Bd. Pub. Wks.

Irvington, N. J.—The following bids were opened Sept. 16 for building a sewerage system for this town. Alexander Potter, of New York City, Ch. Engr.:

Items and Quantities.	*Headley & Christie, Newark.	Jas. Conway, Orange, N. J.	David Peoples, Phila., Pa.	Ludwig Batt, S. Orange, N. J.
8-in. pipe sewer, 0—6 ft. deep, 3,370 ft	$.45	$.58	$.63	$.60
8-in. pipe sewer, 6—8 ft. deep, 29,491 ft	.50	.60	.70	.75
8-in. pipe sewer, 8—10 ft. deep, 12,770 ft	.55	.65	.80	1.00
8-in. pipe sewer, 10—12 ft. deep, 4,395 ft	.60	.75	.90	1.15
8-in. pipe sewer, 12—14 ft. deep, 1,570 ft	.65	.85	1.10	1.25
8-in. pipe sewer, 14—16 ft. deep, 770 ft	1.00	.90	1.80	1.35
8-in. pipe sewer, 16—20 ft. deep, 20 ft	2.00	1.75	2.30	2.00
10-in. pipe sewer, 0—6 ft. deep, 420 ft	.55	.65	.70	.75
10-in. pipe sewer, 6—8 ft. deep, 1,585 ft	.60	.75	.80	.80
10-in. pipe sewer, 8—10 ft. deep, 1,490 f	.65	.85	.90	1.10
10-in. pipe sewer, 10—12 ft. deep, 920 ft	.70	.95	1.40	1.25
10-in. pipe sewer, 12—14 ft. deep, 1,155 ft	.80	1.05	1.60	1.40
10-in. pipe sewer, 14—16 ft. deep, 630 ft	1.50	1.15	2.00	1.50
10-in. pipe sewer, 16—20 ft. deep, 160 ft	2.00	1.75	3.00	2.00
8-in. C. I. pipe extra, 300 ft	.75	1.50	2.00	2.00
10-in. C. I. pipe extra, 100 ft	1.00	2.00	2.50	3.00
Manholes, 136	30.00	35.00	35.00	36.00
Manholes over 10 ft., 50 ft	3.00	5.00	4.00	4.00
Intersection manholes, 10, each	40.00	30.00	42.00	45.00
Drop manholes, 20 ft	1.50	20.00	5.00	5.00
Flush tanks, 46, each	40.00	80.00	44.00	55.00
Branches on 8-in. pipe, 2,000	1.00	.40	.70	.50
Branches on 10-in. pipe, 250	1.50	.50	.90	1.50
Sheeting, 100 M. ft. B. M	10.00	25.00	35.00	27.00
Found. lumber, 20 M. ft	10.00	30.00	35.00	40.00
Rock excav., 1,000 cu. yds	2.00	3.00	2.75	1.50
Asphalt or tar joints, 8-in., 500	.30	.20	.30	.10
Asphalt or tar joints, 10-in., 100	.35	.20	.40	.10
6-in. tile drain, 2,000 ft	.35	.35	.30	.20
Totals	$46,021	$57,063	$65,595	$67,491

*Contract awarded.

Washington, D. C.—Supt. of Sewers D. E. McComb writes that the following bids were opened Sept. 13 for the construction of sewers: *a*, Sewer A; *b*, Sewer B; *c*, Sewer C, etc.: Jno. F. Joyce, Washington, *a* $2,055.50, *e* $4,501.90, *f* $2,910.95, *g* $1,455; The Warren F. Breniger Co., Washington, *a* $28,079.60, *b* $9,490.53, *c* $2,035.90, *d* $2,032.20, *e* $3,082.23, *f* $2,282.55, *g* $1,229; M. F. Taity, Washington, *a* $29,936, *b* $9,191.65, *c* $1,621.50, *d* $2,250.50, *e* $3,091; Andrew Gleeson, Washington, *a* $21,360, *b* $12,495.68 *c* $1,974.10, *d* $2,476; Coyle & Co., Washington, *a* $24,591.89, *b* $11,841.75, *c* $2,494, *d* $2,130.65, *e* $2,733.75, *f* $2,424.60, *g* $1,301; Lyons Bros., Brookland, D. C., *a* $28,656.60, *c* $2,008, *d* $2,481, *e* $2,963.24, *f* $2,291.20, *g* $1,264.

Roanoke, Va.—Bids will be received by W. E. Thomas, Clk. of the City Council, until Oct. 3 for furnishing material and constructing sewers in Section 8. J. H. Wingate, City Engr.

Washington, D. C.—The Supt. of Sewers has transmitted to the Commissioners a plan and specification for the construction of a sewerage system at the Industrial Home School.

Cape Charles, Va.—Local press reports state that surveys are about to be made for an improved sewerage system.

Toledo, O.—Bids are wanted Oct. 6 for furnishing material and constructing 24-in. circular brick sewer, with 4-in. shell, in portions of 2 streets; also for furnishing material and constructing 15, 12, 10 and 8-in. circular pipe sewers in portions of several other streets. Chas. H. Nauts, City Clk.

Kansas City, Mo.—Contracts for sewer construction (bids opened Sept. 19) have been awarded as follows: To Mat. Kinlin, Kansas City, Dist. 198, which includes 7,000 ft. of pipe sewer, 18 manholes, 8 catch basins and 5 flushtanks, at a total of $11,469; to R. W. Mullens, Kansas City, Dist. 162, which includes 7,300 ft. of pipe sewer, 28 manholes, 5 catch basins and 5 flushtanks, at a total of $7,342. The lowest bid on Dist. 208, which includes 13,400 ft. of pipe sewer, 2,200 ft. of brick sewer, 55 manholes, 45 catch basins and 7 flushtanks (contract not awarded), was from Michael Walsh at $36,340.

Clinton, Ia.—City Engr. Chas. P. Chase has placed the estimated cost of 5th St. storm water sewer system, comprising about 4 miles of brick and pipe sewer, at $18,500.

Wichita, Kan.—The construction of a storm water sewer system is under consideration.

Jerseyville, Ill.—The City Council has passed a resolution authorizing the construction of a sewerage system.

Two Rivers, Wis.—The contract for constructing a sewerage system is stated to have been awarded to Murphy & Gray, of Manitowoc, for $16,000.

Indianapolis, Ind.—City Engr. Nelson has completed plans for the Bloyd Ave. sewer, which will be a circular drain 3 ft. 9-in. in diameter at the beginning and taper to an 18-in. pipe.

Lake Charles, La.—Press reports state that the City Council has decided to install a complete system of sewerage.

Lexington, Ky.—The General Council has passed an ordinance authorizing the submission to a vote of the people at the Nov. election of the question of issuing $150,000 bonds for the construction of a sanitary sewer system.

Nashville, Tenn.—The City Council has passed bills appropriating $73,000 for the extension of the Eaglefield branch sewer, and $2,200 for extension of Wharf Ave. sewer.

Sherman, Tex.—See "Water."

Little Rock, Ark.—It is stated that bids are wanted by Jas. F. Kieser, Engr. in charge, until Oct. 4 for constructing about 4 miles of 6, 8 and 10-in. pipe sewers.

Douglas, Wyo.—Bids will be received until Oct. 1 by Otto H. Bolln, Town Clk., for constructing a system of sewerage in this town.

Ft. Keogh, Mont.—The contract for constructing a sewer system at this post has been awarded to M. Ilgen & C. Armberg, of Miles City, Mich., for $9,639. Bids were opened Sept. 22 by Ch. Q. M. Geo. E. Pond.

Denver, Colo.—Citizens from Globeville and Elyria have protested to the Bd. of Pub. Wks. against the emptying of the Denver sewer into Platte River near their towns; they ask that the main line be extended at least one mile.

Torreon, Mex.—See "Water."

BRIDGES.

Reading, Pa.—Bids will be received by John F. Ancona, Co. Compt., until Oct. 1 for constructing a bridge in Washington Township.

Scranton, Pa.—Bids will be received by the Co. Comrs. until Sept. 30 for constructing the following bridges: 1 expanded metal concrete arch bridge near D., L. & W. station at La Plume; the following steel girder corrugated iron, concrete floored bridges: 1 in Glenburn Boro. near Waverly line; 1 over Kennedy's Creek in North Abingdon turnpike; and 1 over Whitney's Creek in West Abingdon Township; 1 steel truss bridge over Spring Brook in Spring Brook Township. E. T. Jones, Co. Compt.

Trenton, N. J.—The Berlin Iron Bridge Co., East Berlin, Conn., is reported to have secured the contract to construct a bridge at Olden Ave. for $20,300.

Downingtown, Pa.—It is stated that the Co. Comrs. and the Trolley Co. are considering the building of a bridge across Brandywine Creek, in this city. Walter McDonald, Co. Surv., West Chester, Pa.

New York, N. Y.—Bids are wanted Oct. 2 for taking down and rebuilding the westerly abutment of bridge across the tracks of the N. Y., N. H. & Hartford R. R. at the crossing of the Bronx and Pelham Parkway. Wm. R. Willcox, Comr. of Parks.

Pulaski, Pa.—Y. B. Zohniser, of New Castle; W. P. Davis, of Towanda; Chas. E. Hoke, of Chambersburg, and W. H. Middleton and F. P. Snedgrass, both of Harrisburg, have been appointed as viewers to inquire into the necessity of rebuilding a bridge across Chenango River, at Pulaski.

Philadelphia, Pa.—Local press reports state that according to plans agreed upon by the Rapid Transit Co. and the City authorities, the present piers of the Market St. bridge will be extended on the south and the entire bridge moved several feet toward Chestnut St. The piers on the north will also be extended and strengthened and an elevated structure built on them.

Philadelphia, Pa.—The following bids were opened Sept. 20 by Wm. C. Haddock, Dir. Dept. of Pub. Wks., for the approaches to and piers of proposed bridge over Schuylkill River on the line of Passyunk Ave.: Armstrong & Printzenhoff, $39,390; time 9 months; Hoffman Engineering Co., $36,230; 7 months; David Peoples, $23,927; 6 months; Henderson & Co., Ltd., $49,777; 12 months; McGaw & Gray, $29,266; 5 months.

Bids opened at the same time for the construction of an intercounty bridge over Poquessing Creek on the line of Frankford Road: Henderson & Co., $42,000; time 6 months; McCormick & Co., $34,000; 6 months; David Peoples, $38,000; 6 months.

Boston, Mass.—Bids will be received by the City Engr. until Oct. 8 for steel superstructure of Sections A and B, Broadway Bridge, and giving bond of a Surety Co. in $25,000.

Vickers Ferry, N. Y.—It is stated that bids are wanted by J. R. Strong, Village Pres., until Oct. 1 for constructing a 3-span, 162 ft. long, 16 ft. wide, iron bridge on stone foundation; estimated cost, $35,000. C. E. Hicks, Des. Engr.

Doylestown, Pa.—Local press reports state that the following bids were received by the Co. Comrs. Sept. 20 for constructing an intercounty bridge at the Red Lion Hotel, Torresdale: Henderson & Co., $42,000; David Peoples, $38,000, and McCormick & Co., $34,000.

Harrisburg, Pa.—Press reports state that the State Bd. of Pub. Bldgs. & Grounds has awarded contracts as follows, for bridges to be built by the State (bids received Sept. 23): To Nelson & Buchanan Co., Chambersburg, Masontown bridge, Bradford Co., $24,000; Taylorsville bridge, Bradford Co., $25,000; Old Forge bridge, Lackawanna Co., $6,000; Lycoming Creek bridge, Lycoming Co., $19,000; Loyalsock Creek bridge, Lycoming Co., $19,144; Tuscarora Creek bridge, Juniata Co., $16,660; Tionesta Creek bridge, Forest Co., $21,000; White St. bridge, Brookville, Jefferson Co., $20,447. To Penn Bridge Co., Beaver Falls, Pa.; Honesdale bridge, Wayne Co., $40,745; Mang's bridge, Wayne Co., $6,939; Sugar Creek bridge, Bradford Co., $21,690; Tunkhannock bridge, Wyoming Co., $141,375. To National Bridge Co., New York City, Bowmanstown bridge, Carbon Co., $63,900. To York Bridge Co., York, bridge over Schuylkill River at Cross Keys, Berks Co., $19,250. To W. H. Gulick, Phoenixville, Dixon bridge, Wyoming Co., $25,100. To King Bridge Co., Cleveland, O., White Haven bridge, between Carbon and Luzerne Counties, $80,460, and Humphrey bridge, near Curwensville, Clearfield Co., $26,100.

Northeast, Md.—The Co. Comrs. are reported to have condemned the bridge across Mill Creek at Main St., in this city, and will replace it with an iron structure, to cost about $8,000.

Savannah, Ga.—Press reports state that H. M. Steele, Ch. Engr. of the Central of Ga. Ry. Co., is preparing plans for alterations to be made in the St. Augustine bridge. Said plans when completed will be submitted to Capt. C. E. Gillette, Corps of Engrs., U. S. A., in charge of Government work at Savannah, who will forward them to the War Dept. for approval.

Norfolk, Va.—Local press reports state that the Bay Shore Terminal R. R. Co. contemplates building a viaduct across the Norfolk & Western tracks.

Jacksonville, Fla.—This city, together with the interested railroads, propose to rebuild the Bridge St. viaduct: it will be a 1st class steel structure, 1,000 ft. in length with 40-ft. roadway and 2 sidewalks 6 or 8 ft. wide

Thomaston, Ga.—It is stated that bids are wanted Oct. 13 for constructing a 216-ft. lattice bridge across Flint River between Upson and Talbot Counties. W. B. Adams, Comr. of Upson Co.

Punta Gorda, Fla.—See "Railroads."

Sac City, Ia.—The Geo. E. King Co., Des Moines, Ia., is stated to have received the contract to construct a steel bridge at North 5th St., for $5,750. The bridge is to consist of 2 80-ft. spans, and to have a 20-ft. roadway and a 6-ft. walk on one side.

Joliet, Ill.—The Co. Comrs. have agreed with the Highway Comrs. to assist in replacing Red Mill Bridge. It is reported that the proposed structure will cost about $14,000.

Portsmouth, O.—The building of a bridge in this city is being considered. The cost of a stone structure is reported to be placed at $18,000 and that of an iron structure at $14,000.

Springfield, O.—The Co. Comrs. have been petitioned to construct a bridge across Beaver Creek, about 4 miles east of this city.

Painesville, O.—The King Bridge Co., Cleveland, O., is reported to have submitted the lowest bid for building a bridge, 175 ft. long, across Chagrin River, at $9,850.

Kalamazoo, Mich.—Local press reports state that 2 cement arches are soon to be constructed in this city: 1 across Axtell Creek, at Burdick St., the other across Arcadia Creek at Park St.

Grand Haven, Mich.—See "Electric Railways."

Carthage, Mo.—Bids will be received until Sept. 30 for furnishing material and constructing a steel bridge across Turkey Creek on the line between Townships 27 and 28. T. V. Grieb, Co. Surv.

Toledo, O.—The building of a bridge at Jefferson St. is being discussed.

Youngstown, O.—Local press reports state that E. M. Scofield, of Pittsburg, formerly engineer of the Youngstown Bridge Co., has prepared plans for a viaduct to be built from Belmont Ave. to Federal St., and estimates the cost at $60,000. The plans provide for the crossing of the railroads by 2 spans, one 72 ft. long, the other 135 ft. long, and the distance from Federal St. to the railroads (240 ft.) to contain 12 20-ft. spans.

Coal Grove, O.—It is stated that the Camden Inter-State Railway Co. has decided to construct a bridge in this city. C. Lake, Ch. Engr., Huntington, W. Va.

Rock Island, Ill.—The Bd. of Supervisors has reported in favor of a bridge over Rock River, site and cost to be determined later.

St. Joseph, Mo.—Bids will be received by the Co. Comrs. until Oct. 1 for repairing and building several small county bridges. Theo. Steinacker, Co. Surv.

Indianapolis, Ind.—It is stated that bids are wanted Sept. 30 for constructing 2 arch culverts and 1 concrete arch culvert. Harry B. Smith, Co. Surv.

Tahlequah, Ind. Ter.—It is stated that a $40,000 bridge is to be constructed across Arkansas River, just above the mouth of Grand River.

New Orleans, La.—The building of a bridge at Hagan Ave. is being considered.

Memphis, Tenn.—The Nashville, Chattanooga & St. Louis R. R. Co. is reported to have awarded to the Miller Paving Co. contracts for building 2 concrete culverts in this city, 1 to be located at La Rose St. and Broadway, to cost $15,000, the other at Dean Ave. and Broadway, to cost $5,000.

Knoxville, Tenn.—It is stated that the old Maryville bridge across Tennessee River in this city, is to replaced with a steel structure.

Shreveport, La.—The citizens on Sept. 15 are stated to have voted in favor of constructing a traffic bridge across Red River, to be used in place of the present railroad bridge.

Brandon, Miss.—It is stated that bids are wanted Oct. 6 for constructing a 128 ft. bridge across Dey Creek; also a 68 ft. bridge across the same creek. G. W. W. White, Clk.

Los Angeles, Cal.—Local press reports state that the Southern Pacific R. R. Co. has submitted to the Bd. of Pub. Wks. plans for a double track steel bridge to be built across Los Angeles River, near Los Felix Road.

White Sulphur Springs, Mont.—It is stated that bids will be received by the Co. Comrs. for building a wagon bridge across Smith River.

Hamilton, Mont.—The Co. Comra. have agreed to grant the petition of the citizens residing on the east fork of Bitter Root River, for the building of a road and bridge, provided the right of way be secured and fenced without cost to the county.

Oregon City, Ore.—It is stated that bids are wanted Oct. 1 for constructing a Howe truss bridge across Tualatin River. John W. Meldrum, Co. Surv.

Bigtimber, Mont.—Bids will be received by the Bd. of Co. Comrs. until Dec. 1 for constructing a bridge across Sweet Grass River, at Mydland Crossing. J. H. Moore, Co. Clk.

Eureka, Cal.—It is stated that bids will be received by the Bd. of Superv. until Oct. 13 for constructing a bridge across Redwood Creek at Orick. Address Co. Clk.

Victoria, B. C.—The time for receiving bids for the Point Ellice bridge has been extended from Oct. 13 to Oct. 27. Notice of change was received too late to make correction in proposal advertised in The Engineering Record.

PAVING AND ROADMAKING.

Reading, Pa.—Mayor Yeager has signed the ordinance providing for the paving with brick of portions of Cherry, Chapel Terrace and 13th Sts.; appropriation, $11,387.

Allegheny, Pa.—The Select Council has passed ordinances authorizing the grading, paving and curbing of Simpson and Iowa Sts., and Arthur Ave., the regrading and repaving of Marion Ave. and Monterey St.

Geneseo, N. Y.—The village has under consideration the proposition to issue $30,000 bonds for the construction of stone roads.

Niagara Falls, N. Y.—Supt. Welch, of the Niagara State Reservation, has been directed to take up the matter of a boulevard from the terminus of the State lands in this city to Lake Ontario.

Killingly, Conn.—Bids will be received by the Bd. of Selectmen until Sept. 30 for constructing 1 section of macadam and 2 sections of gravel roads in this town. John A. Gilbert, 1st Selectman.

Trenton, N. J.—Local press reports state that on Sept. 16 the following bids were opened for 16,931 yds. of asphalt to repave Warren, Bank and E. Hanover Sts. Prices are per sq. yd., with 5, 10 and 15-year guarantees, respectively: Wm. F. McGovern, Kentucky, asphalt, $1.66, $1.89, $2.43; new curb, 39 cts.; old curb, 5 cts. J. C. Rock, of New York, on Venezuela asphalt, $1.52, $1.98, $2.48; new curb, 35 cts.; old curb, 5 cts. John H. Hurley, on Trinidad asphalt, $1.91, $2.39, $2.70; new curb, 40 cts.; old curb, 7 cts. Robt. A. Montgomery, on Kentucky asphalt, $1.45, $1.75, $2; new curb, 34 cts.; old curb, 4 cts. Barber Asphalt Paving Co., $1.65, $1.85, $2.40; new curb, 35 cts.; old curb, 5 cts.

New York, N. Y.—Bids are wanted Oct. 2 for paving with rock asphalt mastic on concrete base, etc., the walks of the "Ramble," Central Park. Wm. R. Willcox, Comr. of Parks.

Providence, R. I.—The Bd. of Aldermen has passed an amendment to the Appropriation Bill, giving an additional $30,000 for highways, which makes a total of $280,000.

Syracuse, N. Y.—On the recommendation of the City Engr., the amount of money to be raised by local assessment for paving Oak St. has been fixed at $5,650 and for repairing the asphalt in W. Genesee St., $9,200.

Plans of the City Engr. have been approved for paving portions of N. Warren and W. Willow Sts. with asphalt or brick.

McKeesport, Pa.—Bids are wanted Oct. 7 for grading and paving with brick on a portion of Strawberry Alley. R. A. Hitchens, Compt.

Troy, N. Y.—Bids will be received by the Bd. of Contract & Supply until Oct. 3 for regulating, curbing and paving with vitrified brick on a concrete foundation portions of Pawling Ave. and Front St. Jas. M. Riley, Clk. pro tem.

Old Saybrook, Conn.—Bids will be received by the Bd. of Selectmen until Sept. 30 for constructing a macadam and telford road in this town. Wm. H. Smith, 1st Selectman.

Newton, N. J.—Bids will be received by the Co. Bd. of Chosen Freeholders until Oct. 20 for constructing about 4 miles of macadam road in the county. A. H. Konkle, Engr.

Hartford, Conn.—The Common Council has voted to pave Pearl St. with sheet asphalt in 1903, bids to include a 10-year contract.

St. Augustine, Fla.—The City Council has ordered a report on the probable cost of paving Charlotte St.

Miami, Fla.—The County Comrs. are said to be completing arrangements for building a rock road for the entire length of the county.

Big Stone Gap, Va.—See "Water."

Baltimore, Md.—The Com. on Highways has reported favorably on ordinances to pave a portion of Hoffman St. with brick and portions of Windsor Ave. and Stockholm St. with cobblestones.

Chicago, Ill.—Bids are wanted by the Bd. of Local Improv. until Oct. 1 for the following street improvements: for paving with asphalt, granite blocks and novaculite on portions of several streets, for wooden curbing, limestone curbing and constructing granite concrete combined curb and gutter on several streets. Andrew M. Lynch, Pres.

Lima, O.—The estimated cost of paving Lakewood Ave. is $29,700 and Cole St., $26,000.

Decatur, Ill.—The lowest bid received for paving Main St. was from the Kentucky Asphalt Co., at $1.60 per sq. yd. for asphalt on concrete.

Crookston, Minn.—The City Countil has awarded the contract for paving the business streets to the Barber Asphalt Paving Co.

Grand Rapids, Mich.—Local press reports state that it is proposed to pave Wealthy Ave., probably with brick.

Toledo, O.—Bids are wanted Oct. 6 for furnishing material and paving with various kinds of block pavement on portions of several streets. Chas. H. Nauts, City Clk.

Cincinnati, O.—Bids will received by the Bd. of Pub. Service until Oct. 1 for improving portions of several streets by grading, curbing and paving with brick; also until Oct. 15 for grading, setting curbs and paving with asphalt on a portion of Pleasant St. Geo. F. Holmes, Clk.

Connersville, Ind.—Karl L. Hanson, City Engr., writes that bids will be received until Oct. 1 for constructing approximately 125,000 sq. ft. of cement sidewalks, 4,000 lin. ft. of combined curb and gutter, etc. J. S. Clouds, City Clk.

Akron, O.—Bids are wanted Oct. 4 for furnishing material and constructing sidewalks and crossings for the year beginning Oct., 1902. Chas. H. Isbell, Clk. Bd. City Comrs.

Jerseyville, Ill.—Wolf, Maupin & Curdie, of Alton, Ill., have the contract for 2 blocks of paving at $1.49 per sq. yd., Wabash brick on concrete to be used.

Janesville, Wis.—Brown & Connors, of Janesville, have received the contract for improving portions of several streets at the following prices: excavation, 39½ cts. per cu. yd.; macadam pavement, 48½ cts. per sq. yd.; cement curbing, at 53½ cts. per lin. ft.; combined cement curb and gutter at 74 cts. per lin. ft. Total estimated cost, $15,222.

Carthage, Ill.—The City Council has passed an ordinance ordering paving around the square and on North Main St., work to commence about Oct. 1. The estimated cost is given as $40,000.

Cedar Falls, Ia.—The lowest bids received for macadamizing the 1st Ave. road (toward which the Co. Bd. of Superv. appropriated $6,000) was from R. E. Jackson at 65½ cts. sq. yd.

Milwaukee, Wis.—The Western Paving & Supply Co. has been awarded contracts for asphalt paving in 5 streets, in all about 8,584 sq. yds., at $2.29 and $2.34 per sq. yd.

Maryville, Mo.—City Engr. Geo. Custer writes that the following bids were opened Sept. 20 for 10,649 sq. yds. of brick paving on a sand foundation: *a*, sandstone curbing; *b*, vitrified curbing; *c*, paving, per sq. yd.: Likes Improv. Co., Des Moines, Ia., *a* 58 cts., *b* 22 cts., *c* $1.32; J. E. Lynch, Moberly, Mo. (awarded), *a* 50 cts., *b* 18 cts., *c* $1.24.

Aurora, Ill.—A petition is being circulated for the paving of State St. with brick or asphalt.

St. Joseph, Mo.—The Muncipal Assembly has pssed ordinances for the paving of Jule St., with asphalt, from 6th to 13th Sts., the paving of a portion of Felix St. and the macadamizing of Edmond St.

Leavenworth, Kan.—City Clk. M. A. Przybylowicz writes that the following bids were opened Sept. 17 for paving and repaving Bwny.: A, Abbot-Gamble Contr. Co., Kansas City, Mo.; B, Barber Asphalt Paving Co., Kansas City, Mo.; C, Gilsonite Roofing & Paving Co., Kansas City, Mo.; D, Green River Asphalt Co., St. Louis, Mo. (awarded):

Bidders.	Asphalt wearing surface.	Regrading.	Resurfacing.	Granite block.	Concrete.
A	$1.62½	$.52	$.25	$3.25	$.65
B	1.49½	.45	.23	3.25	.63
C	1.55	.58	.21	3.20	.57
D	.99	.28	.15	2.09	.45

The engineer's estimate was as follows: regarding 3,676 cu. yds. @28 cts.; concrete, 10,866 sq. yds. @45 cts.; surfacing, 31,516 sq. yds. @15 cts.; asphalt, 45,862 sq. yds. @$1.10; granite blocks complete, 1,166 sq. yds. @$2.09.

St. Paul, Minn.—The estimated cost of curbing and boulevarding a portion of Dale St. is $8,250.

Atchison, Kan.—City Engr. Fred Giddings writes that the following bids were received Sept. 2 for paving 10th St. with 1 course vitrified brick on 3-in. sand foundation, with sand filler and 20-in.x5½-in. curbing. Bidders both of Atchison. Contract awarded to O. E. Seip & Co.:

Items and Quantities.	O. E. Seip & Co.	L. Wines.
Grading, 5,346 cu. yds.	$.23	$.26
Curbing, 2,410 lin. ft.	.41	.42
Curb reset, 28 lin. ft.	.20	.15
Br. sidewalk, 224 sq. ft.	.07	.06
Br. walk relaid, 6,812 sq. ft.	.02	.02
Oak plank, 625 ft. B. M.	.03	.02½
Brick paving, 3,843 sq. yds.	.84½	.82
Totals	$5,643	$5,724

Burlington, Ia.—Bids will be received until Oct. 6 for paving with brick on portions of Main and Valley Sts. Emmett Steece, City Engr.

Canton, O.—It is stated that bids are wanted Oct. 6 for $13,000 street improvement bonds. C. C. Loyd, City Clerk.

Hammond, Ind.—Bids are wanted Sept. 30 for macadamizing Fayette St. and Sheffield Ave. W. F. Bridge, City Engr.

Mobile, Ala.—Local press reports state that the next paving project to be put before the Council will include the following work: Commerce St. with Belgian block on concrete; Water and Royal Sts. with brick on concrete; Government St. with asphalt; report of Engr. on this work not yet made.

Loveland, Colo.—The Commissioners of Larimer Co. have granted the petition to build a wagon road into Estes Park from Loveland, and have appropriated $25,000 for said purpose.

Oakland, Cal.—City Clk. R. W. Church writes that improvements contemplated for 12th St. Boulevard, include the construction of a new dam and flood gates across Estuary on 12th St. Bids for work not yet asked. F. C. Turner, City Engr. Estimated cost, $38,000.

Denver, Colo.—Bids are wanted Sept. 30 for furnishing material and constructing and reconstructing sidewalks in Sidewalk Dists. Nos. 8 and 9. R. W. Speer, Pres. Bd. Pub. Wks. The total estimated cost is placed at $101,470.

San Francisco, Cal.—City Engr. Grunsky estimates that it would cost over $100,000 to pave the central portion of steep streets with basalt block.

Portland, Ore.—The Common Council has declared its intention to pave 23d St. with vitrified brick on concrete foundation for a distance of 26 blocks.

Toronto, Ont.—The City Engr. has recommended the purchase of an asphalt plant at a cost of $23,000. The Toronto Contracting & Paving Co. has received the contracts for paving with brick on Givens St. at $17,742, and on Avenue Road at $17,556.

Contracts for paving with asphalt in three streets have been awarded to the Forest City Paving Co., amounting in all to about $15,000.

Philippine Islands.—The Washington "Star" states that on the recommendation of General Chaffee, Secy. Root has authorized an expenditure of $20,000 for immediate use in the construction of a military road in the Island of Mindanao, P. I.

POWER PLANTS, GAS AND ELECTRICITY.

Newark, N. J.—A press report states that Elisha W. Meloney, of Yardley, Pa., has purchased the Tweed Mill on the White Clay Creek, a few miles north of Newark, N. J., and will establish an electric light plant there, which will furnish light and power to Newark, Landenberg and Avondale.

Johnstown, Pa.—An ordinance has been introduced in Council granting the City Subway Co. a franchise to construct and maintain underground subways or conduits.

Altoona, Pa.—The Citizens' Electric Light, Heat & Power Co. is stated to have purchased a site for its plant on 9th Ave. and 20th St. and will soon let contracts for necessary buildings, machinery, etc. S. S. Reighard, Pres.

Middleburg, Pa.—The Council is stated to have granted A. G. Scholl and Carl F. Espenschade, representing the Middleburg Electric Co., a franchise for an electric lighting system.

Palo Alto, Pa.—The Town Council is stated to have granted a franchise to the Schuylkill Valley Gas Co. Geo. M. Roads, of Pittston, is reported interested.

West Seneca, N. Y.—The United Natural Gas Co. is reported to have commenced surveying from West Seneca to its gas wells at Lancaster and Elma, for laying pipe lines, a distance of 7 miles. Right of way has been secured from these towns.

Scranton, Pa.—The Lackawanna Light, Heat & Power Co., of Scranton, has been incorporated, with a capital of $10,000. Directors: Meyer Stern, James Gillespie and Adolph Eicholtz, Philadelphia. The company has petitioned the Council for a franchise.

Berwick, Pa.—The Berwick Light, Heat & Power Co., of Berwick, has been incorporated; capital, $5,000. Directors: Robt. C. Adams, Scranton; C. D. Eaton and Chas. C. Evans, Berwick.

Mt. Holly Springs, Pa.—The Dirs. of the Carlisle & Mt. Holly Ry. Co. are stated to have decided to take out a charter for the erection of a light, heat and power plant at Mt. Holly Springs.

Baltimore, Md.—Bids are wanted Oct. 1 for installing and maintaining a number of naphtha street lamps, using incandescent mantles. Robt. J. McCuen, Supt. of Lamps & Lighting.

Washington, D. C.—Walter C. Allen, Dist. Electrical Engr., writes that the following bids were opened Sept. 6 for lighting with naphtha lamps the public streets, alleys, avenues and roads in the Dist. of Columbia during the year ending June 30, 1903; prices are per lamp per annum: Penna. Globe Gaslight Co., Philadelphia, $20; Union Lighting Co., Washington, $19.80; American Lighting Co., Baltimore, $19.70; American Development Co., Chicago (awarded), $19.65.

Winnsboro, S. C.—It is stated that bids will be received about Oct. 15 for constructing an electric plant at Winnsboro according to plans being prepared by W. B. Smith, of Waley & Co., 1328 Main St., Columbia, S. C.

Coshocton, O.—The City Council is stated to have granted a franchise to the Coshocton Gas Co.

Manchester, O.—Bids are wanted Oct. 8 for constructing an electric light plant. S. S. Alexander, Secy.

Michigan City, Ind.—Bids will be received until Oct. 20 by Edw. J. Heise, City Clk., for lighting the city with electric arc lamps of 2,000 nominal c. p., consuming at least 450 watts per hour.

Cadillac, Mich.—See "Water."

Alexandria, Ind.—J. Thomas Roberts is stated to have petitioned the City Council for a franchise for an electric light plant.

Pontiac, Ill.—It is stated that the Pontiac Light & Water Co. is to construct a gas plant.

Colby, Wis.—Geo. Cadogan Morgan, 808 Royal Insurance Bldg., Chicago, Ill., is reported to be preparing plans for an electric light plant.

Dexter, Mich.—Thos. Muir & Son, of Detroit, are stated to have secured the contract for constructing an electric light plant for $8,100.

Blooming Prairie, Minn.—L. G. Campbell is reported interested in the establishment of an electric light plant.

Canby, Minn.—Sather & Hartle are reported interested in the construction of an electric light plant.

Lowden, Ia.—It is stated that the Cedar County Lumber & Mfg. Co. of Ia. is about to petition the City Council for an electric light franchise.

Lansing, Ia.—Plans are reported as being prepared by Geo. Cadogan Morgan, Chicago, Ill., for an electric light plant for Lansing.

Clayton, Mo.—The St. Louis Co. Comrs. are stated to have granted the West St. Louis Construction Co. a franchise to erect poles, string wires and dig conduits in St. Louis County for light and power for a period of 50 years.

Marion, O.—The City Council is stated to have granted H. E. Bradner a franchise to establish a hot water heating plant.

Defiance, O.—W. P. Engel is stated to have petitioned the Council for a franchise for a hot water heating plant.

Yellville, Ark.—The Council is stated to have granted the Yellville Electric Light & Power Co. a franchise for an electric light plant.

Long Beach, Cal.—The California Coke & Gas Co. is reported incorporated, with a capital of $1,000,000, by Thadders Lowe and Dobbins Lowe, South Pasadena, and Lynn Helm, Los Angeles, to build gas, coke, electric light, heat and power plants in Long Beach, San Pedro, Redondo and Santa Monica.

Murfreesboro, Tenn.—It is reported that about $15,000 will be expended on improvements at the electric light plant. Dr. J. H. Nelson, owner. Gromberg Jackson, Tullahoma, Tenn., Engr.

Guthrie, Okla. Ter.—A press report states that the Bd. of Regents of the Okla. Univ. want bids for an electric light plant.

Logan, Utah.—Bonds amounting to $65,000 are stated to have been sold to be used for the construction of an electric light plant.

Flagstaff, Ariz.—The Grand Canyon Electric Power Co. is reported incorporated, to utilize waters of Bright Angel Creek in Grand Canyon of the Colo. for purpose of generating electricity and its distribution for power and lighting purposes. Incorporators: David Babbitt, of Flagstaff, Ariz., and A. Barmann, of Los Angeles, Cal.

Lincoln, Neb.—Engr. Andrew Rosewater, of Omaha, is reported to have filed an amended application with the Secy. of the Irrigation Bd., Sept. 15, to establish a power plant by the appropriation of Platte River water. This amendment provides for the expenditure of $2,000,000.

Williston, N. D.—See "Water."

Santa Barbara, Cal.—The Bd. of Superv. is stated to have granted a franchise for the operation of an electric lighting and power system to W. W. Barnes and J. T. Coffman.

Hanford, Cal.—It is stated that bids are wanted by the Council until Oct. 23 for the purchase of a gas franchise.

ELECTRIC RAILWAYS.

Clarksburg, Mass.—The Hoosac Valley Street R. R. Co. is stated to have petitioned the Selectmen for the right to extend the Beaver line through the town to the Vermont line. W. F. Nary, Mgr., North Adams.

Pelham, Mass.—The Selectmen of Pelham are stated to have granted the Amherst & Sunderland St. Ry. Co. a franchise to extend its line from the Amherst line to the Orient grounds. L. N. Wheelock, Ch. Engr., Amherst.

Liverpool, N. Y.—It is stated that the Syracuse Rapid Transit Ry. Co. is to extend its line from Liverpool to Long Branch, a distance of about 2½ miles. J. E. Duffy, Supt., Syracuse.

New York, N. Y.—The Central Crosstown R. R. Co. of N. Y. City, is stated to have secured the consent of the State R. R. Comn. to issue a first consolidated mortgage for $3,000,000. The proceeds are to be applied to refund the former bond issues on the property, and for equipping 14 miles of road for underground electric trolley service.

Brooklyn, N. Y.—It is stated that the Brooklyn Rapid Transit Co. is to erect a sub-power station at 42 Sands St. The total output of the station will be 6,000 H.-P. J. C. Breckenridge, Gen. Mgr., 168 Montague St.

Troy, N. Y.—The Bennington & Hoosick Valley St. Ry. Co. is reported to have decided to construct 3 extensions: one from Troy to North Hoosick, 26 miles; another from Eagle Bridge to Greenwich, 16 miles, and the 3d from Hoosick Falls to Williamstown, about 14 miles. E. H. Libby, Supt., Hoosick Falls, N. Y.

Atlantic City, N. J.—The Atlantic City & Suburban Traction Co. is stated to have petitioned the Council for a franchise.

Newark, N. J.—The Union Township Com. is stated to have granted the North Jersey St. Ry. Co. permission to lay tracks on N. Broad St. in the Lyons Farms section of Union Township from the Newark City line to Elizabeth. D. Young, Mgr., Jersey City.

Jersey City, N. J.—The Hudson & Manhattan Ry. Co. has been incorporated, with a capital of $100,000, to build a railroad under the Hudson River from Pavonia Ferry, Jersey City, to a point near the intersection of Exchange Place and Hudson St.; also from Exchange Pl. to a point near the station of the N. J. Central R. R.; length of proposed line is 1¾ miles. It is a branch road to be constructed by the Pennsylvania R. R. Incorporators: Clarence Kelsey, Jersey City; A. C. Wall, South Orange, Francis S. Meany, Freehold, and others.

Trenton, N. J.—The Trenton, Pennington & Hopewell St. Ry. Co. has been incorporated to construct and operate the Hopewell extension of the Trenton St. Ry. Co.'s lines. The proposed road is to be 12 miles in length and extend through the townships of Hopewell and Ewing and the boroughs of Hopewell and Pennington; capital, $250,000. Incorporators: Henry C. Moore, F. W. Roebling, and others.

Chambersburg, Pa.—The Council is reported to have granted Stephen S. Emory a franchise for a street railway.

Harrisburg, Pa.—Engr. Geo. Roberts, of the Harrisburg Traction Co., is stated to have completed surveys for a trolley line from Harrisburg to Linglestown.

Springfield, Mass.—The Springfield St. Ry. Co. has petitioned the Bd. of R. R. Comrs. for authority to extend its railway into Ludlow, Wilbraham and Hampden. John Olmstead, Pres., Springfield.

Middleboro, Mass.—A press report states that the Middleboro, Wareham & Buzzards Bay St. Ry. Co. is considering the extension of its line from Bourne, through the villages of Bournedale and Sagamore to Sandwich, and later through West Barnstable, Barnstable and Yarmouth to Hyannis and thence on the Vineyard Sound shore of Cape Cod to Chatham. Chas. H. Cox, Ch. Engr., Middleboro.

Batavia, N. Y.—The Union Traction Co. is reported incorporated to operate a street surface railroad, 50 miles in length, from Batavia, to the shore of Lake Ontario, near Olcott; capital, $600,000. Principal office to be at Medina. Directors: Isidor H. Gobolle, of Medina; Jos. W. Holmes, of Batavia, and others.

New Philadelphia, Pa.—C. E. Mitchener, of Tuscarawas, is reported to have petitioned the Co. Comrs. for a franchise to construct an electric railway from New Philadelphia to Newcomerstown.

Trenton, N. J.—The Council is stated to have granted a franchise to the Camden & Trenton Traction Co. M. B. Perkins, Mgr., Beverly.

Bluefield, W. Va.—The Bluefield & Hinton Electric Ry. Co. has been incorporated to construct a line from Bluefield to Graham.

Hyattsville, Md.—A press report states that the Washington, Baltimore & Annapolis Electric R. R. Co. (Jas. Christy, Jr., Vice-Pres., Washington, D. C.), will extend the Kenilworth & Columbia electric road through East Hyattsville to Riverdale, to connect there with the City & Suburban.

Mt. Vernon, O.—The Knox Co. Comrs. are stated to have granted Dr. Shrontz, of Martinsburg, a franchise to construct an electric railway, to connect Mt. Vernon and Newark, by way of Martinsburg and Gambier.

Columbus, O.—The Columbus Ry. Co. has petitioned the Council for a franchise to construct a double track on W. Broad St. It is stated that the Ry. Co. will expend about $80,000 on this improvement. E. K. Stewart, Gen. Mgr., Columbus.

Dayton, O.—The Co. Comrs. are stated to have granted the People's Ry. Co. permission to build about 3 miles of track in Edgemont and North Dayton.

Seymour, Ind.—A company is reported to have been formed here, with L. D. Masters, of Seymour, Pres., to build, equip and operate an electric line from Columbus to French Lick and West Baden Springs.

Elkhart, Ind.—The Elkhart, South Bend & Chicago Ry. Co. is reported to be securing franchises for its line projected to connect Elkhart and Chicago. W. Osgood Orton and Sam P. Perley, of South Bend, are among the promoters of the railway.

Rockford, Ill.—The Rockford & Belvidere El. Ry. Co. is stated to have changed its name to the Rockford & Interurban Ry. Co. and has decided to issue $800,000 bonds for funding its indebtedness and to pay for proposed improvements and extensions. R. N. Baylies, Pres. H. L. Jewell, Secy.

Bay City, Mich.—The Huron & Western Ry. Co. is stated to have petitioned the Council for a franchise for a new route.

Camden, Mich.—The Village Trus. are stated to have granted John H. Roberts, of Grand Rapids, Mich., a franchise for the use of certain streets for the proposed Ft. Wayne & Jackson Electric Ry.

Grand Haven, Mich.—The City Countil is stated to have granted a franchise to the Grand Rapids, Grand Haven & Muskegon Ry. Co. It is stated that the company will construct either a swing draw bridge or a roll lift draw bridge.

Des Moines, Ia.—The City Council is stated to have granted a right of way over certain streets in East Des Moines to the Des Moines & Western Ry. Co.

Comanche, Ia.—Attorneys C. H. George and Ernest Miller, of Clinton, are reported to be here in the interest of an electric railway, a franchise for which John U. May has petitioned the Council.

Hutchinson, Kan.—Chas. T. Nolald, of St. Louis, Mo., representing the American Electric Line Ry. is reported to be investigating the feasibility of constructing an electric railway between Hutchinson, Winfield, Arkansas City, Geuda Springs and Newkirk.

Kansas City, Kan.—The Kansas City & Bonner Springs Electric R. R. Co. has been incorporated, with a capital of $500,000, to construct an electric line from Kansas City to Bonner Springs and towns in adjoining counties along the line. Directors: John W. Breidenthal and C. F. Hutchinson, of Kansas City, Kan.; M. P. Sexton, of Bonner Springs, and others.

Monroe, Mich.—The Council is stated to have granted new 30-year franchises to the Toledo & Monroe Ry. and Monroe Traction Co.

East Alton, Ill.—The Alton Ry., Gas & Electric Co. is stated to have decided to extend its E. Second St. line from Boazzatown, past Washington Garden and along Milton Road to East Alton. J. F. Porter, Pres., Alton.

Columbia, Ky.—W. K. Azhill, of Columbia, is reported interested in the construction of an electric railway between Columbia and Campbellsville.

Davis, Ind. Ter.—The Town Council is stated to have granted the Davis & Sulphur Springs Ry. Co. a franchise to construct and operate an electric line from Davis east to Sulphur and west to Turner Falls.

Los Gatos, Cal.—The Bd. of Super. are stated to have granted a franchise for the construction of an electric railroad from San Jose to Los Gatos, via Saratoga and Congress Springs, to Mr. Sage, Prop. of the Congress Springs Hotel.

Ione, Cal.—M. K. Miller, of Oakland, and F. W. Kronenberg, of San Francisco, are reported to be investigating the feasibility of constructing an electric railroad from the Southern Pacific terminus at Ione to Jackson, a distance of 12 miles.

Butte, Neb.—The Ponca Valley & Butte R. R. Co. is reported incorporated, to construct an electric railway to connect Butte and Anoka, on the extension of the Fremont, Elkhorn & Missouri Valley R. R.

Santa Monica, Cal.—W. S. Hook and associates are stated to have petitioned the City Trus. for a franchise.

RAILROADS.

Wellsville, N. Y.—The Buffalo & Susquehanna Ry. Co. has been incorporated, with a capital of $10,000,000, to construct a steam road 85 miles long, from Wellsville to Buffalo. Directors: Frank H. Goodyear, G. M. Sicard, John H. Lascelles and others, all of Buffalo.

Euclid, Pa.—Press reports state that the Allegheny & Western R. R. has awarded the contracts for the extension of its line from Euclid, on the Bessemer & Lake Erie R. R., to Pfaff's mines, as follows: Sections 1 and 2, which include the long tunnel and two 400-ft. trestles, each 75 ft. high, to Bennett & Smith; sections 3, 4, 5, 6, 7 and 8, Broadhead Contracting Co.; and sections 9, 10, 11 and 12, Hassat & Moran; total cost of the work will be about $1,500,000.

Punta Gorda, Fla.—The Engrs. of the Atlantic Coast Line R. R. are reported to be surveying for a new line from Punta Gorda to Ft. Myers. A draw bridge will probably be constructed over Caloosahatchee River. J. R. Kenly, Gen. Mgr., Wilmington, N. C.

Versailles, Mo.—A press report states that the Chicago, Rock Island & Pacific Ry. Co. has let to the W. R. Stubbs Contracting Co., of Chicago, and the Flick & Johnson Construction Co., of Davenport, Ia., contracts for constructing its new line between Versailles, Mo., and Kansas City, completing the St. Louis-Kansas City line of the Rock Island; cost will be about $3,000,000.

Madisonville, Ky.—W. L. Gordon and C. E. Morton, of Madisonville, are reported interested in the construction of a railroad from Madisonville to Dawson Springs, to intercept with the Illinois Central.

Watertown, Tenn.—It is reported that the Tennessee Central R. R. Co. is considering the construction of a branch line from Watertown to Huntsville, Ala. L. S. Miller, Gen. Mgr., Nashville.

Mena, Ark.—The Mena & Black Springs R. R. Co. has been incorporated, with a capital of $500,000, to build and operate a railroad from Mena to Black Springs, a distance of 35 miles. Incorporators: Day Mills, Pittsburg, Kan.; John F. Todd, Mena, and others.

Crowley, La.—A company is reported to have been formed here, with a capital of $10,000,000, to build a line from Crowley, La., to a connection with the Kansas City Southern and Texas & Pacific Railroads and east to New Orleans. Incorporators: W. W. Duson, M. Abbott, and others.

Grand Saline, Tex.—The Texas Short Line Ry. Co. has made application to the R. R. Comrs. for authority to register $185,000 on 10 miles of completed road from Grand Saline to Hoyt. This road is projected from Grand Saline south via Canton and Mabank to Corsicana, 65 miles, and north via Quitman to Pittsburg, 45 miles; surveys will soon be made. D. C. Earnest, Gen. Mgr., Grand Saline.

Cleburne, Tex.—R. H. Baker, of Austin, and T. W. House, of Houston, are reported interested in the construction of a railroad between Cleburne and Hubbard City, through Hillsboro to Ft. Worth.

San Antonio, Tex.—G. A. Andreon, Locating Engr. of the Mexican Central R. R., is reported to be here organizing a surveying party for the purpose of running a preliminary line out of San Antonio to the Mexican border. Lewis Kingman, Ch. Engr., Mexico City, Mex.

Danville, Ky.—It is stated that the Louisville Southern R. R. Co. will extend its line from Mercer to Danville. P. Campbell, Gen. Mgr., New Orleans, La.

Denver, Colo.—The Denver & Rio Grande Ry. Co. is reported to have commenced surveying for a new line between Denver and Colorado Springs; cost of improvement will be about $1,000,000. E. J. Yard, Ch. Engr., Denver.

Portland, Ore.—The Clatskanie & Nehalem R. R. Co., of Portland, is reported incorporated: capital, $50,000. Incorporators: S. Benson, E. E. Coover and A. S. Benson.

Oakland, Cal.—The San Francisco Terminal Ry. & Ferry Co. is stated to have petitioned the Council for a franchise for a steam road in this city.

Santa Cruz, Cal.—The Santa Cruz, Capitola & Watsonville Ry. Co. has been incorporated to construct a railroad, 20 miles in length, from Santa Cruz to Watsonville, by way of Capitola and with a branch from this latter point to Sequel: capital, $350,000. Principal office to be in Los Angeles. Directors: J. M. Gardiner, Pacific Grove; Henry Willey, Santa Cruz, and W. R. Porter, Watsonville.

Sausalito, Cal.—The North Shore R. R. Co. is about to conduct extensive improvements in Sausalito, including the building of a 2-story depot and terminal facilities at an expense of about $60,000. G. H. Fairchild, Mgr., San Francisco.

PUBLIC BUILDINGS.

Brooklyn, N. Y.—The Bd. of Estimate and Apportionment has appropriated $30,000 for a building for Engine Co. 145 at Coney Island; $30,000 for an engine house at Blissville; $23,000 for a house for Hook & Ladder Co. No. 66 at Jackson Ave., Long Island City, and also an appropriation for a house for Hook & Ladder Co. No. 65, also in Long Island City.

Bids are wanted Oct. 2 for furnishing material and making repairs to horizontal tubular boiler at Kings Co. Penitentiary, Brooklyn. Thos. W. Hynes, Comr. Dept. of Correction, N. Y. City.

Brooklyn, N. Y.—The following bids were opened Sept. 24 by J. Edw. Swanstrom, Boro. Pres., for making changea and additions, extensions, alterations and improvements to the Kings Co. Hall of Records: W. & T. Lamb, 99 Nassau St., N. Y., $427,650; P. J. Carlin & Co., ft. W. 66th St., N. Y., $415,000; Thos. Dwyer, 1st Ave. bet. 107th & 108th Sts., N. Y., $398,700; L. W. Seaman, Jr., & Son, 133 Grand Ave., $412,000; John Kennedy & Son, 175 Front St., $413,000.

Newark, N. J.—Supt. of Construction Thos. P. Clarke writea that the following bids were opened Sept. 24 for work in the new City Hall: Installing heating and ventilating apparatus—Blake & Williams, 360 W. Bway., N. Y. City, $81,484, 12 mos.; E. Rutzler, N. Y. City, $87,500, 10 mos.; Edw. Joy, Syracuse, N. Y., $92,500, 32 mos.; Gillis & Geoghegan, N. Y. City, $94,000, 15 mos.; Francis Bros. & Jellett, N. Y. City, $95,000, 12 mos.; Elias Berla, Newark, N. J., $99,202, 24 mos. All bidders except Edw. Joy state that there is no additional charge for wrought iron pipe; in the bid of Edw. Joy there is an additional $150 for wrought iron pipe.

For electric equipment and telephone tubing—Electric Motor & Equipment Co., Newark, N. J., $59,200, 30 mos.; H. R. Jackson, Newark, N. J., $64,725, 30 mos.; G. V. Flynn & Co., N. Y. City, $70,000, 40 moa.

For passenger elevators and ash lift: *a*, pull type; *b*, plunger type; *c*, time—Marine Engine & Machine Co., Harrison, N. J., *a* $20,435, *b* $21,325, *c* 4 mos.; Reedy Elevator Co., N. Y. City, *a* $21,650, *c* 3 mos.; Otis Elevator Co., N. Y. City, *a* $24,500, *b* $23,500, *c* 6 mos.

Jersey City, N. J.—Gregory Judge is stated to have secured the contract for improvements to the Insane Asylum for $46,400.

New York, N. Y.—Bids will be received by the Bd. of Health until Oct. 1 for furnishing material and completing the alterations, additions and repairs to the Department Building, 55th St. and 6th Ave. Ernst J. Lederle, Ph.D., Pres.

Bids are wanted Oct. 2 for furnishing material and repairing roofs of the buildings at Penitentiary block and at Workhouse, Blackwell's Island. Thos. W. Hynes, Comr. Dept. of Correction.

A permit has been issued for a 3-story brick and stone building for city baths to be erected at 325 and 327 30th St. Owner, Mrs. E. M. Anderson, 6 E. 38th St. Architect, Chas. A. Rich, 395 Nassau St.

The following bids were opened Sept. 23 by Homer Folks, Comr. Dept. of Pub. Charities, for the alterations and addition to the New York City Training School for Nurses at Blackwell's Island: Patrick Sullivan, $93,650; Dan'l J. Ryan, $85,629; Thos. B. Leahy, $85,000; John R. Sheehan & Co., Inc., $82,400; Thos. Dwyer, $76,510; Alfred Beinhauer, $72,150; Murphy Bros., $70,000; P. Gallagher, $66,436; Walter Reid & Co., 156 5th Ave., $65,348.

Uniontown, Pa.—Eggers & Graham, of Uniontown, are stated to have secured the contract for erecting the city hospital for $60,000.

New York, N. Y.—Bids are wanted Oct. 7 for furnishing material and making repairs and alterations to the interior of the City Hall; also at the same time for furnishing material and making alterations and repairs to hot blast and steam heating, plumbing and gas fitting and electric wiring in the City Hall, Boro. of Manhattan.

Bids will be received at the same time for furnishing material and erecting a public bath at 243-247 E. 109th St., 1 at 133-135½ Allen St., and 1 at 347 and 349 W. 41st St., all in Boro. of Manhattan. Jacob A. Cantor, Boro. Pres.

Baltimore, Md.—The Hubbard Htg. Co., of Washington, D. C., is reported to have secured the contract for heating the 5th Regt. Armory, for about $20,000.

Richmond, Va.—Joseph H. McGuire, Archt., 45 E. 42d St., N. Y. City, states that bids will be received until Oct. 10 for erecting a cathedral in Richmond. It is to be a brick and stone edifice, and will cost about $200,000.

Cleveland, O.—Bids will be received until Oct. 20 by Bd. of Trus. of Cleveland State Hospital for furnishing material and erecting an Acute Hospital building. A. B. Howard, M. D., Secy.; Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Newark, O.—Bids are wanted Oct. 15 for furnishing material and erecting a building for the Fire Dept., at North 4th and Ash Sts. F. T. Maurath, City Clk.

Stevens Point, Wis.—The plans of H. A. Foeller, of Green Bay, are stated to have been accepted for a $20,000 Carnegie Library.

Grand Rapids, Mich.—Williamson & Crow, Grand Rapids, are stated to have prepared plans for a guild house for St. Mark's Episcopal Church, to cost $15,000.

St. Louis, Mo.—The First United Presbyterian Society is reported to have decided on plans for erecting a $21,000 church.

Bids are wanted Sept. 30 for furnishing material and erecting a hospital at the City Poor House. Hiram Phillips, Pres Bd. Pub. Improv.

Eagle Grove, Ia.—Bids are wanted Oct. 3 for erecting a public library. Separate bids will be received at the same time for the heating and plumbing of same. Eugene Schaffter, Secy. Pub. Library Bd.

St. Louis, Mo.—The Com. on Bldgs. and Grounds of the St. Louis Expo. is stated to have awarded the contract for the erection of the Mines and Metallurgy Bldg. to the Hill-O'Meara Construction Co. for $498,000. The original bid submitted by the Hill-O'Meara Co. was $533,635. The changes made in the plans provide for the elimination of the south and east colonnades and the north and east entrance pavilions. The obelisks and domes, which were a feature of the structure, may yet be taken out of the plans.

Joliet, Ill.—It is stated that bids are wanted Oct. 6 for erecting a police station. Sam C. Rickson, City Clk.

Toledo, O.—Bids will be received until Oct. 4 by the Lucas Co. Infirmary Hospital at the Infirmary Farm. John G. Avery, Clk. of Bd.

Louisville, Ky.—Local press reporta state that bids will be received by the Fiscal Court until Oct. 14 for excavating and laying the foundations for the jail, according to plans prepared by D. X. Murphy & Bro., 250 5th St.

The Bd. of Trus. of the German Methodist Deaconess Home & Hospital is stated to have decided to erect a $25,000 addition. Architects, Clarke & Loomis, 502 4th St.

Texarkana, Ark.—Bids will be received by W. T. Hamilton, Co. Judge, until Oct. 13 for installing a heating plant in the Co. Court House.

Brookings, S. D.—It is stated that the M. E. Society will erect a $20,000 edifice.

Denver, Colo.—The Capitol Comn. is stated to have awarded the contract for installing a Webster heating plant at the Capitol to the Michael Htg. Co., 502 15th St., for $5,877.

Gardener, Mont.—Local press reports state that bids will be received by the Co. Comrs. until Oct. 7 for erecting a jail at Gardener. Address Co. Clk., Livingston, Mont.

Pueblo, Colo.—Local press reports state that the contract for erecting the Carnegie Library has been awarded to Richardson & Campbell, 4th and Court Sts., for $53,723. This does not include the heating plant, plumbing, fixtures or electric wiring.

Valley City, N. D.—Contractor Lenhart, of Valley City, is stated to have secured the contract for erecting a Carnegie Library for $12,300. E. J. Harrington, of Fargo, secured the contract for heating and plumbing same for $1,700.

Toronto, Ont.—Bids are wanted Sept. 30 for alterations and additions to the Post Office at Toronto. Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont.

BUSINESS BUILDINGS.

Boston, Mass.—Contractors Mack & Moore, of this city, have filed plans for a 9-story addition to the Boston Athletic Association's Bldg. to be located on Bragden St. Estimated cost, $200,000. It will be of brick with concrete floors.

Pittsfield, Mass.—The general contract for the new brick and iron building for the Stanley Electric Mfg. Co. has been awarded to Dodge & Devanney, of Pittsfield. Cost, $90,000.

Buffalo, N. Y.—Plans have been filed for a 3-story building for the Dental Mfg. Co., to be erected on Kehr and Urban Sts., to cost $35,000.

Cape May, N. J.—A press report states that J. T. Windrim, 1107 Walnut St., Philadelphia, Pa., is preparing plans for a 10-story hotel to be erected at Cape May for Anthony M. Zane, of Philadelphia, Pa.

Philadelphia, Pa.—Milligan & Webber, 520 Walnut St., are stated to have prepared plans for a new building for Lu Lu Temple, Ancient Arabic Order, Nobles of the Mystic Shrine, to be erected on Spring Garden St. east of Broad. It will be a 4-story structure, 77x146 ft., and cost about $100,000.

Buffalo, N. Y.—G. F. Bassett is about to build a $12,000 brick factory at Terrace and W. Eagle Sts.

Norfolk, Va.—E. Tatterson, Columbia Ave., is stated to have secured the contract for erecting the Virginia Club House; total cost of the building will be about $75,000.

Charleston, S. C.—Repairs and improvements to cost $24,000 are to be made to the row of 4 residences on Meeting St. off Washington Sq., which are to be converted into stores, cafe and club house for the Commercial Club. Architect, A. W. Todd, 63 Broad St.

Kansas City, Mo.—Jas. H. Beckham is stated to have purchased a site on Grand Ave. and 11th St. and will erect a business building there, to cost between $30,000 and $75,000.

Ladysmith, Wis.—Jas. Prentice is reported to be preparing to erect a 3-story brick hotel 32x100 ft. in the business part of town.

Muscatine, Ia.—It is stated that bids are wanted Oct. 1 for erecting a 3-story brick building for the Y. M. C. A. C. F. Nevins, Secy.

Memphis, Tenn.—Local press reports state that the Missouri Pacific R. R. will erect a depot on the river front at ft. of Auction St. to cost about $200,000. Geo. J. Gould, Pres., 195 Bway., New York, N. Y.

San Angelo, Tex.—It is reported that the London Hotel, recently burned, will be rebuilt at a cost of about $50,000.

Montreal, Que.—It is stated that plana are being prepared for renovating, improving and enlarging the Mount Royal Club House.

Brantford, Ont.—Bids will be received by the Cockshutt Plow Co., Ltd., of Brantford, until Oct. 6 for erecting a factory.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

115 & 117 Cannon St, br stores and tenemt; c, $40,000; o, Hershkovits, Roth & Klein; a, Bernstein & Bernstein.

171 & 173 W 4th St, br stores and flat; c, $30,000; o, Robt Friedman; a, Sass & Smallheiser.

244 & 246 7th St, br stores and flat; c, $40,000; o, Newman & Spielberger; a, Sass & Smallheiser.

Berger Ave & Rose St, br storage & stable; c, $20,000; o, Theo J Chabot; a, Albert Rothermel.

34 E 12th St, extension to br loft bldg; c, $71,700; o, Empire Realty Co; a, G Starrett.

327 and 329 W 108th St, improv to 2 br bldgs; c, $65,000 all; o, Geo W Wilder; a, Hogan & Slattery

251 5th Ave, improv to br stores and flat; c, $80,000; o, Beacon Hill Real Estate Co; a, Bruce Price; b, Chris Campbell.

1 to 13 Hancock St, 3 br stores & flats; c, $105,000; o, Freedman & Feinberg; a, Bernstein & Bernstein.

Hester & Centre Sts, br and terra cotta factory; c, $115,000; o, John L Daniels; a, De Lemos & Cordes.

343½ to 345 Water St, br stores & tement; c $40,000; o, Union Construction & Realty Co; a, Bernstein & Bernstein.

15th and 16th Sts & 9th Ave, br factory; c, $300,000; o, National Biscuit Co; a & b, Louis Weber Bldg Co.

47th St and 8th Ave, br stable; c, $125,000; o, Adams Express Co; a, Bruce Price.

58th St and 8th Ave, br and stone hotel; c, $200,000; a, Jas D Matthews; a, Ross & McNeil.

82 to 88 E 110th St, 2 br stores & tenemts; c, $80,000 all; o, W & J Bachrach; a, Bernstein & Bernstein.

117th St & 5th Ave, br stable; c, $25,000; o, Thos D Malcolm; a, Harry T Howell.

Chambers & Reade Sts and Broadway, vault and doors to 6-story office & bank bldg.; c, $30,000; o, Emigrant Industrial Savings Bank; a, J M Mossman.

Grand & Allen Sts, new store front and alterations to br loft bldg; c, $25,000; o, Goldman & Multzman; a, Bernstein & Bernstein.

DWELLINGS.

Boston, Mass.—Plans have been filed by Herbert C. Britwell, 16 State St., for a block of four 3-story 3-family brick and stone houses on Harvard Ave., Brighton Dist. Estimated cost, $65,000. Owner, Grantham Terrace Trust. Builder, Boston Const. Co. Architect, Benj. Fox, 72 Devonshire St.

Pittsburg, Pa.—Geo. N. Powell is reported as having plans prepared for a 4-story brick apartment house which he intends building on Maryland Ave. and Elmer St., 20th Ward; cost, $42,000.

Cleveland, O.—Harry L. Vail will erect a 4-story apartment building on Euclid and Willson Aves., to cost $50,000. Fenimore C. Bate, New England Bldg., Archt.

St. Louis, Mo.—It is stated that plans are being prepared by Barnett, Haynes & Barnett, 8th and Locust Sts., for an apartment house for W. F. Williamson, to be located on Hamilton and Maple Aves. It will be of red stock brick trimmed with a cream color terra cotta; cost, $125,000.

Logansport, Ind.—An apartment house to cost $25,000 is to be erected by Keller Bros.

Denver, Colo.—Adolph Zang, of the Zang Brewing Co., is reported to be having plans prepared for a dwelling to be erected on 7th Ave. and Clarkson St., to cost between $75,000 and $100,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m. mason; cr, carpenter; and b, builder.

94th St and Riverside Drive, br and stone tenemt; c, $85,000; o, Wm Rankin; a, Hy Anderson.

165th St and Bway, br tenemt; c, $22,000; o, John A Picken; a, John Hauser.

5th Ave & 79th St, br dwelg; c, $125,000; o, J C Lyons; a, McKim, Mead & White.

160th St, Amsterdam and St Nicholas Aves, br and stone flat; c $70,000; o & a, Streifler Bros.

308 5th Ave, extension and improv to br and stone dwelg; c, $20,000; o, Jaques Krakauer; a, Buchman & Fox.

SCHOOLS.

New York, N. Y.—Bids are wanted Oct. 3 for alterations in School No. 70. C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ.

Brooklyn, N. Y.—Bids will be received until Oct. 3 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., N. Y. City, for sanitary work in School No. 139 and for installing heating apparatus and electric lighting plant for Manual Training School Annex, Nos. 75 and 79, Boro. of Brooklyn.

Gloversville, N. Y.—Bids will be received by the Bd. of Educ. until Oct. 4 for erecting a brick school in the 6th Ward. C. S. Schermerhorn, Chmn. Bldg. Com.

Rochester, N. Y.—J. C. Sterns & Co., of Buffalo, are stated to have secured the contract for wiring the new east side high school for $4,970.

Woodbridge, N. J.—The Bd. of Educ. is stated to have decided to build 2 schools. One will be an 8-room addition to School No. 1. The other will have 12 rooms, and it will be located at Carteret.

South Orange, N. J.—Kellogg & Co., New York, N. Y., are stated to have secured the contract for ventilating and heating the 2 proposed new schools for about $6,000.

Buffalo, N. Y.—The Sisters of the Good Shepherd will erect a $17,000 addition to the convent at 485 Best St.

Westfield, Mass.—W. D. Mellen, 111 Dwight St., Springfield, is stated to have secured the contract for erecting a dormitory for the State Normal School; probable cost, $50,000.

Sylvester, Ga.—Bids are wanted Oct. 1 for erecting a $10,000 brick school. W. E. Grubbs, Town Clk.

Athens, O.—Bids will be received by the Bd. of Trus. of the Ohio Univ. at Athens until Oct. 7 for furnishing material and erecting the main portion of the Normal School at the Univ. L. M. Jewett, Secy.; Frank L. Packard, Archt., New Hayden Bldg., Columbus.

Chicago, Ill.—It is stated that a $40,000 school is to be erected for St. Alphonsus R. C. Church. Architect, Henry P. Beiler, 84 La Salle St.

Murphy & Camp, 632 N. Wells St., are stated to have prepared plans for a parochial school to be erected at N. Ashland and Leland Aves. for Our Lady of Lourdes R. C. Church. It will be 3 stories high, 60x122 ft., of pressed brick and stone, and cost about $50,000.

Warsaw, Ill.—The plans of W. H. Reeves, of Peoria, are stated to have been accepted for an 8-room school, to cost about $19,000.

Halstad, Minn.—Bids will be received by the Bd. of Educ. until Oct. 18 for $14,000 school bonds. H. P. Nygaard, Clk.

Milwaukee, Wis.—Competitive plans and specifications will be received until Oct. 24 by the Bd. of Pub. Wks. for a school to be erected on 5th and 6th Aves, in the 14th Ward, and for a school to be erected on Cass St., 1st Ward. Chas. J. Poetsch, Chmn.

Mobile, Ala.—The Superintendent's report to the Comrs. recommends the appropriation of $30,000 for improvements on present school building.

Greeley, Colo.—The contract for the superstructure of the State Normal School is stated to have been awarded to Knutson & Isdell for about $23,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Meadville, Pa.—City Engr. W. A. Doane writes that bids are wanted Oct. 1 for the construction of a 25-ton garbage furnace. Probable cost, $10,000.

Evansville, Ind.—Bids will be received by the Bd. of Pub. Wks. until Oct. 4 for sweeping and cleaning certain streets in the city for 1 year. W. Edw. Clarke, Clk.

Grand Marias, Mich.—This village is said to be about to purchase a garbage disposal plant.

Kansas City, Mo.—Council Committees are considering with City Physician Langsdale the question of disposing of city garbage.

Chicago, Ill.—The City Council has appropriated $50,000 for additional street cleaning.

Mobile, Ala.—The Bd. of Pub. Wks. has received a proposition from Gerald H. Kruempel, offering to clean the 17,000 yds. of asphalt now laid, each morning, for the sum of one cent per yd. per day.

Oakland, Cal.—The Bd. of Health has passed a resolution urging the Council to adopt at an early date a permanent means for the disposal of garbage.

GOVERNMENT WORK.

Portland, Me.—The following bids were opened Sept. 22 by Maj. S. W. Roessler, Corps of Engrs., U. S. A., for dredging in Lubec Channel, Me.: *a*, price per cu. yd. scow measure for about 200,000 cu. yds. of dredging; *b*, price per ton for boulders: Eastern Dredging Co., Portland, Me., *a* 24¾ cts., *b* $5; Morris & Cummings Dredging Co., New York, N. Y., *a* 26½ cts., *b* $8.

Pittsburg, Pa.—Bids were opened Sept. 18 by Capt. Wm. L. Sibert, Corps of Engrs. U. S. A., for the construction of a lock keeper's house and office at the Herr's Island dam, and the lowest bid is stated to have been from Martsolf Bros. at $6,800.

Philadelphia, Pa.—Bids will be received until Oct. 11 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a sheet steel house for locomotive crane machinery, at the Navy Yard, League Island, Pa. Bids will also be received at the same Department until Oct. 18 for constructing a steel and brick building for a foundry and coppersmith shop for steam engineering at the Navy Yard, League Island, Pa.

Philadelphia, Pa.—Bids will be received until Sept. 30 by the Bureau of Supplies & Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, League Island Pa., a quantity of railroad material, foundry cupola, blowers, hand crane, travelling crane, machine tools, etc. A. S. Kenny, Paymaster-Gen., U. S. Navy.

Boston, Mass.—Bids will be received until Oct. 18 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for dredging at the Navy Yard, Boston. Estimated cost, $22,500. Bids will also be received at the same Dept. until Oct. 18 for constructing a pile and timber wharf at the Navy Yard, Boston; estimated to cost $2,900.

Washington, D. C.—Bids are wanted Oct. 9 for safety vaults and work incidental thereto, in the Bureau of Engraving and Printing, U. S. Treas. Dept., Washington, D. C. Jas. Knox Taylor, Superv. Archt., Treas. Dept.

Tampa, Fla.—Local press reports state that the following bids were opened Sept. 15 by Capt. Herbert Deakyne, Corps of Engrs., U. S. A., for improving the channel from Hillsboro River to the deep water in Tampa Bay; the work includes 18,000 cu. yds. of rock and 370,000 yds. of earth to be removed; amount available, $150,000; National Dredging Co., of Wilmington, Del., offered to remove the rock for $112,000, and the dredging for $97,125; total, $209,625. Edwin W. Preston, of this city, offered to do the work for $157,857.

Annapolis, Md.—Press reports state that bids opened Sept. 19 at the Navy Dept., Washington, D. C., for the erection of 6 double houses and one single house, to be used as officers' quarters, were rejected, being in excess of the appropriation, which is $285,000.

Cleveland, O.—The following bids were opened Sept. 18 by Maj. Dan C. Kingman, Corps of Engrs., U. S. A., for constructing and repairing piers at Fairport Harbor: *a*, total bids if oak is to be used; *b*, total bid if other acceptable hardwood is to be used: A, W. C. Gayer, Cleveland, O., *a* $154,230, *b* $153,480; B, Donnelly Contracting Co., Buffalo, N. Y., *a* $135,881, *b* $133,911; C, L. P. & J. A. Smith Co., Cleveland, O., *a* $160,507, *b* $160,507. For detail bids see accompanying table:

Items and Quantities.	A	B	C
East pier reconstruction:			
Rem. old pier, 7,500 cu. yds.	$1.00	$.50	$1.50
Dredging, 15,000 cu. yds.	.40	.25	.40
Hemlock timber, 640 M. ft.	28.00	28.50	28.00
Old timber decking, etc., 22 M. ft.	10.00	22.50	20.00
Oak timber, 65 M. ft.	60.00	46.25	50.00
*Timber, 65 M. ft.	55.00	36.00	50.00
Tie rods and washers	.06	.04	.06
Drift bolts	.06	.04	.05
Screw bolts, etc, 180,000 lbs.	.06	.04	.06
Lag screws and washers	.06	.04	.06
Spikes	.06	.04	.05
Concrete blocks, 710 cu. yds.	14.00	11.37	15.00
Concrete in mass, 2,100 cu. yds.	8.00	7.50	8.00
Small riprap stone filling, 10,500 tons	1.50	1.33	1.60
West pier reconstruction:			
Rem. of old pier, 3,500 cu. yds.	1.00	1.00	1.50
Other excav., 1,800 cu. yds.	.40	.25	.30
Sheet piling, 170 M. ft.	55.00	50.00	50.00
Old timber decking and found., 25 M. ft.	10.00	27.50	30.00
Oak timber, 7 M. ft.	50.00	56.25	50.00
*Timber, 7 M. ft.	50.00	46.00	50.00
Hardwood piles in place, 17,500 lin. ft.	.35	.35	.35
Pile rings and shoes, 10,000 lbs.	.10	.075	.10
Tie rods and washers	.06	.04	.06
Drift bolts	.06	.04	.05
Screw bolts, etc., 50,000 lbs.	.06	.04	.06
Lag screws and washers	.06	.04	.06
Spikes	.06	.04	.06
Refilling pier and backfill. with stone from old cribs, 2,000 cu. yds.	1.50	1.31	1.60
Backfill. with sand, 1,500 cu. yds.	1.00	.44	.50
Concrete blocks, 575 cu. yds.	14.00	11.25	15.00
Concrete in mass, 1,200 cu. yds.	8.00	7.50	8.00
Sawed sandstone flagg., 6-in., 3,800 sq. ft.	.40	.44	.40
Sheathing and repairing old piers:			
3-in. white oak plank, 85 M. ft.	120.00	137.50	120.00
*3-in. plank, 85 M. ft.	115.00	123.00	120.00
Lag screws, etc., 30,000 lbs.	.06	.04	.06
Pine plank, 85 M. ft.	35.00	44.00	40.00
Pine stringers, 12 M. ft.	35.00	44.00	40.00
Hemlock timber, 30 M. ft.	28.00	29.00	30.00
Drift bolts	.06	.04	.05
Screw bolts, etc., 20,000 lbs.	.06	.04	.06
Spikes	.06	.04	.05

*Beech or other acceptable hardwood.

Chicago, Ill.—The following bids were opened Sept. 18 by Lieut.-Col. O. H. Ernst, U. S. Engr. Office, for constructing breakwater at Calumet Harbor: Gillen & Gillen, Racine, Wis., $278,939; The FitzSimons & Connell Co., Chicago, Ill., $295,636; T. J. Bennett & Co., Muskegon, Mich., $293,431; Lydon & Drews Co., Chicago Ill., $315,686; McArthur Bros. Co., Chicago, Ill., $330,475; Hausler & Lutz Towing & Dock Co., Chicago, Ill., $279,685.

Chicago, Ill.—The following bids (with dates of completion) were opened Sept. 21 at the Treasury Dept., Washington, D. C., for the interior finish and completion of the Post Office, Court House, etc., Chicago, including carpentry, fireproofing, glazing, marble, ornamented iron, painting, plastering, etc. (but not including plumbing and mechanical plants): John Peirce, N. Y. City, $1,478,500, Jan. 1, 1905; Wm. Grace Co., Chicago, $1,895,000, Sept. 1, 1904; Davidson Bros. Marble Co., $1,895,000, 27 months; Congress Const Co., $2,181,151, July 1, 1905; John Griffiths & Son, $1,930,000, Nov. 15, 1904.

Ft. Riley, Kan.—Capt. G. O. Cress, Constructing Q. M., writes that contracts for the construction of buildings, etc., at this post (bids opened Aug. 25) have been awarded as follows:

Construction proper: To Ziegler & Dalton, Junction City, Kan., 3 field officers' quarters, $39,255, and 2 double line officers' quarters, $39,800; to Moses & Holmgren, Junction City, Kan., 1 artillery barracks, $44,850, and 1 bakery, $15,900; to Jos. B. Betts, Topeka, Kan., 1 double cavalry barracks, $39,984; 1 gun shed, $21,300; 1 artillery stable, $21,600, and 1 cavalry stable, $18,600.

Plumbing and heating: To J. J. Hanighen, Omaha, Neb., *a*, plumbing; *b*, heating: double cavalry barracks, *a* $5,881, *b* $4,109; artillery barracks, *a* $3,872, *b* $3,327; gun shed, *a* $512; artillery stable, *a* $694; cavalry stable, *a* $675; field officers' quarters, *a* $2,067, *b* $2,000; double line officers' quarters, *a* $2,815, *b* $2,470; bakery, *a* $717, *b* $678.

Electric wiring several of the buildings to Riddle & Landon, St. Paul, Minn., at a total of $2,866.

Breadmaking machinery to Jas. Foley, Leavenworth, Kan., for $1,644.

Bids for the construction proper of 2 non-commissioned staff quarters being considered excessive, same were rejected, and these buildings will be readvertised for similar structures, but to be of brick instead of stone.

Des Moines, Ia.—Contracts for work at Ft. Des Moines (bids opened Aug. 25) are stated to have been awarded as follows: Construction—S. A. Robertson, of Des Moines, 3 buildings, $64,474; R. P. and Edw. O. Hamilton, Omaha, 15 buildings, $177,391.

Plumbing—L. H. Kurtz, Des Moines, 4 buildings, $3,612; Dwyer Heating & Plumbing Co., of St. Paul, 5 buildings, $12,812; H. C. Clark, Delaware City, 5 buildings, $2,681.

Steam and hot water heating—Harris & Algor, Camden, N. J., 8 buildings, $14,722.

Gas piping—Dwyer Plumbing & Heating Co., 10 buildings, $990.

Electric wiring—Riddle & Landon, St. Paul, 11 buildings, $2,845.

New Orleans, La.—The following bids were opened Sept. 8 by Lieut.-Col. Henry M. Adams, Corps of Engrs., U. S. A., for extension to and repairs to jetties at Calcasieu Pass, La., and Sabine Pass Harbor, Tex. *Contract awarded:

Bidders and Addresses.	Mattress, Est. 7,000 sq. yds.	Riprap stone, Est. 79,000 net tons.	Replacing granite blocks, Est. No. of 200 per blocs	Total.
John Short, St. Louis, Mo.	$.95	$2.50	$1.50	*$204,450
O. M. Stone, Sabine, Tex.	1.40	3.10	9.50	256,600

Bids opened Sept. 2 by Lieut.-Col. Henry M. Adams, Corps of Engrs., U. S. A., for dredging at Calcasieu Lake, La., and Sabine Pass, Tex., were as follows:

Items and Quantities.	Bowers Southern Dredg. Co. Galveston, Tex.	Atlantic, Gulf & Pacific Co., N. Y.
Sabine, 187,500 cu. yds., per cu. yd.	$.225	$.260
Calcasieu, 55,000 cu. yds., per day of 16 hours	400,000	600,000
Total Sabine Pass (approximate)	$41,250	$48,750
Total Calcasieu Lake (approximate).	$9,000	$9,000

The following bid was opened Sept. 22 by Lieut.-Col. H. M. Adams, Corps of Engrs., U. S. A., for dredging at Chefuncte and Amite Rivers, La.: Jahncke Navigation Improv. Co., New Orleans, 35,000 cu. yds. at 17½ cts. per cu. yd.; total, $6,125.

Dover, Tenn.—Bids are wanted Oct. 14 for constructing a roadway to National Cemetery at Dover. C. D. V. Hunt, Q. M., New Orleans, La.

Memphis, Tenn.—Press reports state that bids will be received until Oct. 2 by Capt. E. E. Winslow, Corps. Engrs., U. S. A., for levee enlargement in the 3d Dist. of the Mississippi River, which will involve about 315 cu. yds. of earth work.

Bremerton, Wash.—Bids will be received until Oct. 25 by Mordecai T. Endicott, Ch. Bureau of Docks and Yards, Navy Dept., Washington, D. C., for constructing an extension of the concrete wing wall, Navy Yard, Bremerton. Estimated cost, $16,000.

San Francisco, Cal.—Bids will be received until Oct. 16 by the California Debris Comn., Flood Bldg., San Francisco, for building portions of dam (known as Barrier No. 1) on Yuba River, Yuba Co., about 14 miles above Marysville, Cal. Address Lieut. R. P. Johnston, Corps Engrs., U. S. A.

Bids are wanted Oct. 20 for removing Blossom Rock, San Francisco Harbor, Cal., to a depth of 30 ft. below low water. Address Lieut.-Col. W. H. Heuer, Corps Engrs., U. S. A., San Francisco.

Sheridan, Wyo.—Bids are wanted Oct. 15 for constructing, plumbing, heating, gas piping and electric wiring 2 double sets officers' quarters, 1 double barrack and 1 bakery, all brick. Address Quartermaster.

San Francisco, Cal.—Bids are wanted Oct. 15 for constructing a brick fog-signal building, brick chimney and erection of boilers at Bonita Point Light Station, Cal. Lieut.-Col. Thos. H. Handbury, Corps Engrs., U. S. A., Light House Engr.

MISCELLANEOUS.

Boston, Mass.—Bids will be received until Oct. 9 by the Bd. of Harbor & Land Comrs. for dredging in Dorchester Bay; work to be done includes about 395,000 cu. yds. of material to be dredged from 2 areas in Dorchester Bay near City Point, Boston Harbor. Woodward Emery, Chmn.

New York, N. Y.—Bids are wanted Oct. 7 for furnishing material and building a pier with appurtenances on the westerly side of North Brother Island, Boro. of Bronx. McDougall Hawkes, Comr. of Docks, Dept. of Docks & Ferries.

Jersey City, N. J.—Ch. Engr. Van Keuren has prepared a map for the improvement, to cost about $8,000, of the property acquired for the enlargement of Columbia Park, and has been asked to prepare plans for the improvement of the new portion of River View Park; estimated cost about $20,000.

Boston, Mass.—The Mayor has signed the $25,000 loan order for park construction.

Duluth, Minn.—Local press reports state that the Duluth Dock & Dredge Co. has decided to build a new $125,000 dredge.

Escanaba, Mich.—The contract for foundation for the $1,000,000 ore docks to be built at Escanaba by the Chicago & North Western Road is stated to have been awarded to Whitney Bros., of Duluth, for $50,000.

Portland, Ore.—Engrs. Huber & Maxwell estimate the cost of preparing the selected site for the 1905 Fair, at $24,095.

Toronto, Ont.—The Bd. of Control has authorized the expenditure of $18,000 for the new cribwork at the foot of Bay St.

NEW INDUSTRIAL PLANTS.

Warlick & Whisnant, Granite Falls, N. C., are in the market for a 35 to 40-H.-P. boiler, a 25 to 30-H.-P. engine and wood-working and excelsior machinery.

The Lansing, Mich., Wheelbarrow Co. is building a 60x200-ft. addition for making steel scrapers.

The Burton D Hurd Co., Temple Block, Kansas City, Mo., will erect a 4-story, 50x70-ft. rice mill, having a daily capacity of about 1,200 bbls.; a 2-story, 100x122-ft. warehouse for rough rice, and a 2-story, 50x122-ft. warehouse for clean rice.

The Knott & Van Arnam Mfg. Co., Coldwater, Mich., makers of plumbing specialties, will erect a 50x200-ft. factory, with boiler house and dry kiln, at Fort Wayne, Ind. The capacity of the power plant will be about 100 H.-P.

The Merchants' Refrigerating Co., Kansas City, Mo., has been incorporated to erect a 5-story cold storage plant having a capacity of about 400 carloads. It is also proposed to operate a street pipe line for furnishing refrigeration. J. E. Brady, 407-11 Grand Ave., is interested.

The Atlas Co., Lincoln, N. J., miners and refiners, are adding a dry house and mechanical dryer to their plant at that place, and erecting mill buildings, 50x125 and 50x175 ft., respectively, at Mertztown, Pa., to have a power plant of about 250 H.-P.

Winfield Scott and M. E. Singleton, of Fort Worth, Tex., will be president and general manager, respectively, of a company which expects to build a cottonseed-oil mill at East St. Louis, Ill., having a daily capacity of 150 tons of seed. The company will not be ready to take up the question of machinery until about Jan. 1.

Max Lowenthal & Bro., 428-438 Main St. E., Rochester, N. Y., will erect a 3-story and basement knitting mill to have about 50,000 sq. ft. floor space. The plant will be run by electricity, and the company is in the market for motors and 60 to 80 H.-P. in boilers for heating.

The Ardmore, I. T., Coal & Power Co. is putting in a brick plant to have a daily capacity of 44,000 bricks. After the brick plant is running, a tile and pottery plant will be put in.

The Hubbard Fertilizer Co., Baltimore, Md., will soon be in the market for a complete outfit for a new plant to replace that recently burned.

The Barberton, O., Pottery Co. will build an addition, which will include several new kilns and extensive buildings.

The Marshalltown, Ia., Pottery Co. is in the market for a 75-H.-P. engine for a 4-kiln plant it proposes to erect.

The J. T. Deloach Lumber Co., Ltd., State Line, La., expects to build a mill at Homer, La., which will have a daily output of 40,000 to 50,000 ft. It is intended to install a steel tram road to handle logs.

The Virgor-O Health Food Co., Ltd., Owosso, Mich., mentioned last week, has secured a site for its factory, and is now ready to take up the matter of machinery, including engines.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., reports the following among its recent orders: Loveland, Colo., Beet Sugar Co., an engine direct-connected to a Crocker-Wheeler generator; Armour Elevator, New Orleans, an engine direct-connected to a Triumph generator; Evans, Almirall & Co., two engines direct-connected to centrifugal pumps, for the new shops of E. P. Allis & Co., Milwaukee.

The New England Structural Co., of Boston, has just shipped the steel framework for the Minneapolis General Electric Company's power station. The material was shipped complete in two weeks from receipt of the order.

The Baltimore Bridge Co., recently organized, has purchased the entire business of the Structural Iron & Steel Co., of Baltimore, Md. The plant has recently been completely remodeled, and is capable of turning out 7,000 tons annually of bridge and structural work: all tools and machinery being of the most modern character and driven by either electric or pneumatic power. Plans are now under way to more than double the capacity of the plant by the addition of a girder shop capable of turning out the heaviest type of reamed and solid-drilled work. Nathaniel Haven, Pres.; Alfred M. Mosscrop, Vice-Pres. and Mgr.

The Philadelphia Pneumatic Tool Co. reports that in the month of August it broke all previous records in the amount of goods shipped. Recent large orders have been received from the Cambria Steel Co., Pennsylvania Steel Co., New York Shipbuilding Co., Newport News Shipbuilding & Dry Dock Co. and Grand Trunk Ry. Co. Foreign orders have been received from Paris, London and Copenhagen. More orders have come in for rotary drills during the past two months than ever before. The company has just added to its machine shop equipment eight engine lathes, two automatic machines, two turret lathes, two grinding machines, one Fellows gear shaper, six drill presses, one universal milling machine, one twist drill grinder and a number of other minor machine tools.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Sept. 30. Armstrong, B. C. .... Sept. 20
Oct. 1. Nassau, N. Y. .... Sept. 20
Oct. 1. De Smet, S. D. .... Sept. 13
Oct. 3. Cleveland, O. .... Sept. 13
Oct. 3. Weiser, Idaho .... Sept. 6
Oct. 6. Webster Groves, Mo. .... Sept. 27
Oct. 7. Findlay, O. .... Sept. 27
Oct. 9. Brooklyn, N. Y. .... Sept. 27
Oct. 11. Paulsboro, N. J. .... Sept. 27
Oct. 14. Tonawanda, N. Y. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 22. El Paso, Tex. .... Sept. 6
Oct. 29. Moline, Ill.* .... Sept. 27
Adv., Eng. Record, Sept. 27.
Nov. 8. Pumping plant, Brockton, Mass. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Dec. 1. Pumps, Seguin, Tex. .... July 26
——— Fayette, Miss. .... Sept. 27
——— Cass Lake, Minn. .... Sept. 20
——— Bozeman, Mont. .... Sept. 6

SEWERAGE AND SEWAGE DISPOSAL.

Sept. 30. Davenport, Ia. .... Sept. 27
Sept. 30. Milwaukee, Wis. .... Sept. 27
Oct. 1. Elizabeth, N. J. .... Sept. 27
Oct. 1. Cincinnati, O. .... Sept. 27
Oct. 1. Douglas, Wyo. .... Sept. 27
Oct. 1. Decatur, Ind. .... Sept. 20
Oct. 1. Boston, Mass. .... Sept. 13
Adv., Eng. Record, Sept. 13.
Oct. 2. Ironton, O. .... Sept. 20
Oct. 3. Dayton, O. .... Sept. 27
Oct. 3. Roanoke, Va. .... Sept. 27
Oct. 4. Little Rock, Ark. .... Sept. 27
Oct. 4. Glenville, O. .... Sept. 20
Oct. 6. Toledo, O. .... Sept. 27
Oct. 6. Burlington, Ia. .... Sept. 27
Oct. 10. Waukegan, Ill. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 10. Ridley Park, Pa. .... Aug. 16
Adv., Eng. Record, Aug. 16.
Oct. 11. Akron, O. .... Sept. 20
Oct. 15. Cincinnati, O. .... Sept. 27
Oct. 17. Grand Rapids, Mich. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Dec. 15. Montevideo, Uruguay .... Sept. 13

BRIDGES.

Sept. 30. Carthage, Mo. .... Sept. 27
Sept. 30. Scranton, Pa. .... Sept. 27
Sept. 30. Indianapolis, Ind. .... Sept. 27
Oct. 1. Reading, Pa. .... Sept. 27
Oct. 1. Vichers Ferry, N. Y. .... Sept. 27
Oct. 1. Oregon City, Ore. .... Sept. 27
Oct. 1. St. Joseph, Mo. .... Sept. 27
Oct. 1. Castroville, Tex. .... Aug. 23
Oct. 2. New York, N. Y. .... Sept. 27
Oct. 6. Brandon, Miss. .... Sept. 27
Oct. 6. Frankfort, Ind. .... Sept. 20
Oct. 6. Ellendale, N. D. .... Sept. 13
Oct. 7. East Grand Forks, Minn. .... Sept. 20
Oct. 8. Boston, Mass. .... Sept. 20
Oct. 8. Indianapolis, Ind. .... Sept. 20
Oct. 11. Canton, O. .... Sept. 20
Oct. 13. Thomaston, Ga. .... Sept. 27
Oct. 13. Eureka, Cal. .... Sept. 27
Oct. 15. Yellowstone Park, Wyo. .... Sept. 6
Adv., Eng. Record, Sept. 6, 13.
Oct. 27. Victoria, B. C. .... Sept. 6
Adv., Eng. Record, Sept. 6 to 27.
Nov. 5. Chicago, Ill. .... Sept. 6
Dec. 1. Bigtimber, Mont. .... Sept. 27

PAVING AND ROADMAKING.

Sept. 30. Killingly, Conn. .... Sept. 27
Sept. 30. Denver, Colo. .... Sept. 27
Sept. 30. Hammond, Ind. .... Sept. 27
Sept. 30. Old Saybrook, Conn. .... Sept. 27
Sept. 30. Buffalo, N. Y. .... Sept. 20
Sept. 30. Nevada, Mo. .... Sept. 20
Sept. 30. Dunkirk, N. Y. .... Sept. 13
Oct. 1. Connersville, Ind. .... Sept. 27
Oct. 1. Chicago, Ill. .... Sept. 27
Oct. 1. Cincinnati, O. .... Sept. 27
Oct. 1. Brooklyn, N. Y. .... Sept. 20
Oct. 1. Pittsburg, Pa. .... Sept. 20
Oct. 1. Towson, Md. .... Sept. 20
Oct. 1. Decatur, Ind. .... Sept. 20
Oct. 1. Atlantic City, N. J. .... Sept. 13
Oct. 2. New York, N. Y. .... Sept. 27
Oct. 3. Troy, N. Y. .... Sept. 27
Oct. 4. Akron, O. .... Sept. 27
Oct. 4. Pittsburg, Pa. .... Sept. 20
Oct. 6. Toledo, O. .... Sept. 27
Oct. 6. Burlington, Ia. .... Sept. 27
Oct. 6. Columbus, Ind. .... Sept. 20
Oct. 6. Des Moines, Ia. .... Sept. 20
Oct. 6. Jefferson Barracks, Mo. .... Sept. 13
Oct. 7. McKeesport, Pa. .... Sept. 27
Oct. 11. San Francisco, Cal. .... Sept. 13
Oct. 13. Newark, O. .... Sept. 20
Oct. 15. Cincinnati, O. .... Sept. 27
Oct. 20. Newton, N. J. .... Sept. 27

POWER, GAS AND ELECTRICITY.

Oct. 1. Baltimore, Md. .... Sept. 27
Oct. 1. De Smet, S. D. .... Sept. 13
Oct. 3. Weiser, Idaho .... Sept. 6
Oct. 6. Winnsboro, S. C. .... Sept. 27
Oct. 7. Chattanooga, Tenn. .... Sept. 13
Adv., Eng. Record, Sept. 13 to 27.
Oct. 8. Manchester, O. .... Sept. 27
Oct. 14. San Pedro, Cal. .... Sept. 13
Oct. 15. Chicago, Ill. .... Aug. 23
Oct. 20. Michigan City, Ind. .... Sept. 27
Oct. 23. Hanford, Cal. .... Sept. 27
Nov. 1. Macon, Ga. .... Aug. 30
Nov. 15. Norfolk, Va. .... Sept. 13

GOVERNMENT WORK.

Sept. 30. Crane, etc., Philadelphia, Pa. .... Sept. 27
Sept. 30. Memphis, Tenn. .... Sept. 13
Sept. 30. Dredging, Boston, Mass. .... Sept. 6
Adv., Eng. Record, Sept. 6 to 20.
Sept. 30. Indianapolis, Ind. .... Aug. 23
Adv., Eng. Record, Aug. 23, 30.
Oct. 1. Washington, D. C. .... Sept. 6
Adv., Eng. Record, Sept. 6 to 27.
Oct. 1. San Francisco, Cal. .... Aug. 30
Oct. 2. Memphis, Tenn. .... Sept. 27
Oct. 3. Ft. Lawton, Wash. .... Sept. 13
Oct. 4. Louisville, Ky. .... Sept. 13
Oct. 6. Buffalo, N. Y. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 6. Denver, Colo. .... Sept. 20
Oct. 6. Jefferson Barracks, Mo. .... Sept. 13
Oct. 6. Johnson City, Tenn. .... Sept. 13
Adv., Eng. Record, Sept. 13 to 27.
Oct. 6. Tampa, Fla. .... Sept. 13
Oct. 6. New York, N. Y. .... Sept. 6
Adv., Eng. Record, Sept. 6 to 27.
Oct. 7. Joplin, Mo. .... Sept. 6
Adv., Eng. Record, Sept. 6, 13.
Oct. 8. Portland, Ore. .... Sept. 20
Oct. 8. Chicago, Ill. .... Sept. 13
Oct. 8. Montgomery, Ala. .... Sept. 13
Adv., Eng. Record, Sept. 13 to 27.
Oct. 8. Chattanooga, Tenn. .... Sept. 13
Oct. 9. Washington, D. C. .... Sept. 27
Oct. 9. Ft. Totten, N. D. .... Sept. 20
Oct. 9. Newport News, Va. .... Aug. 30
Adv., Eng. Record, Aug. 30, Sept. 6.
Oct. 10. Mobile, Ala. .... Sept. 13
Adv., Eng. Record, Sept. 13 to 27.
Oct. 10. Plattsburg Barracks, N. Y. .... Sept. 13
Oct. 10. Elmira, N. Y. .... Sept. 13
Oct. 11. Mach. bldg., Philadelphia, Pa. .... Sept. 27
Oct. 11. Ft. Lincoln, N. D. .... Sept. 20
Oct. 11. Ft. Snelling, Minn. .... Sept. 20
Oct. 11. San Francisco, Cal. .... Sept. 13
Oct. 11. Philadelphia, Pa. .... Sept. 13
Oct. 11. Dry dock, Charleston, S. C. .... Aug. 23
Oct. 14. Dover, Tenn. .... Sept. 27
Oct. 14. Ft. Getty, S. C. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.
Oct. 14. Aberdeen, S. Dak. .... Aug. 30
Oct. 15. Fog-signal bldg., San Francisco, Cal. .. Sept. 27
Oct. 15. Bldgs., Sheridan, Wyo. .... Sept. 27
Oct. 15. Muskegon, Mich. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.
Oct. 15. St. Louis, Mo. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.
Oct. 15. San Antonio, Tex. .... Sept. 20
Oct. 15. Yellowstone Park, Wyo. .... Sept. 6
Adv., Eng. Record, Sept. 6 to 27.
Oct. 16. San Francisco, Cal. .... Sept. 27
Oct. 16. Tampa, Fla. .... Sept. 6
Adv., Eng. Record, Sept. 6 to 27.
Oct. 18. Foundry, Philadelphia, Pa. .... Sept. 27
Oct. 18. Dredging, Boston, Mass. .... Sept. 27
Oct. 18. Wharf, Boston, Mass. .... Sept. 27
Oct. 18. Bldg., Ft. Myer, Va. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.
Oct. 20. Ft. Riley, Kan. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 20. San Francisco, Cal. .... Sept. 27
Oct. 20. New York, N. Y. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.
Oct. 21. (Conneaut Harbor), Cleveland, O. ... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 22. (Ft. Rodman), Newport, R. I. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 22. (Ludington), Grand Rapids, Mich. ... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 23. (Brunswick Harbor), Savannah, Ga. .. Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 23. (Savannah Harbor), Savannah, Ga. .. Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 23. (Chesapeake Bay), Wilmington, Del. .. Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 25. Los Angeles, Cal. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 25. Bremerton, Wash. .... Sept. 27
Oct. 29. Pier, Manistee, Mich. .... Sept. 27
Adv., Eng. Record, Sept. 27.
Oct. 30. Dredging, Boston, Mass. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.
Nov. 1. West Point, N. Y. .... Sept. 20
Adv., Eng. Record, Sept. 20, 27.

BUILDINGS.

Sept. 30. Post Office, Toronto, Ont. .... Sept. 27
Sept. 30. Hospital, St. Louis, Mo. .... Sept. 27
Sept. 30. Library, Canastota, N. Y. .... Sept. 20
Sept. 30. Hospital, Raybrook, N. Y. .... Sept. 13
Adv., Eng. Record, Sept. 13, 20.
Sept. 30. School, Lancaster, O. .... Sept. 13
Oct. 1. Pub. bldg., New York, N. Y. .... Sept. 27
Oct. 1. School, Sylvester, Ga. .... Sept. 27
Oct. 1. Bus. bldgs., Muscatine, Ia. .... Sept. 27
Oct. 1. Library, El Paso, Tex. .... Sept. 20
Oct. 1. School, Milwaukee, Wis. .... Sept. 13
Oct. 2. Penitentiary, Brooklyn, N. Y. .... Sept. 27
Oct. 2. Workhouse, New York, N. Y. .... Sept. 27
Oct. 2. School, Norfolk, Va. .... Sept. 20
Oct. 3. School, New York, N. Y. .... Sept. 27
Oct. 3. School, Brooklyn, N. Y. .... Sept. 27
Oct. 3. Library, Eagle Grove, Ia. .... Sept. 27
Oct. 3. Htg. court house, Bryan, O. .... Sept. 20
Oct. 4. School, Gloversville, N. Y. .... Sept. 27
Oct. 4. Hospital, Toledo, O. .... Sept. 27
Oct. 6. Pub. bldg., Joliet, Ill. .... Sept. 27
Oct. 6. Factory, Brantford, Ont. .... Sept. 27
Oct. 6. Jail, Hazlehurst, Miss. .... Sept. 13
Oct. 6. City Hall plans, Houston, Tex. .... Aug. [illegible]
Oct. 7. School, Athens, O. .... Sept. 27
Oct. 7. Jail, Gardener, Me. .... Sept. 27
Oct. 7. City Hall improv., New York, N. Y. . Sept. 27
Oct. 7. Bath, New York, N. Y. .... Sept. 27
Oct. 7. Court House, Miami, Fla. .... Aug. [illegible]
Oct. 10. Cathedral, Richmond, Va. .... Sept. 27
Oct. 10. Pub. bldg., Springfield, O. .... Sept. 20
Oct. 10. Police station plans, Milwaukee, Wis. Sept. 20
Oct. 13. Htg. Court House, Texarkana, Ark. .. Sept. 27
Oct. 14. Jail, Louisville, Ky. .... Sept. 27
Oct. 14. Hospital, Springfield, O. .... Sept. 20
Oct. 15. Pub. bldg., Newark, O. .... Sept. 27
Oct. 15. Hospital, Willard, N. Y. .... Sept. 13
Adv., Eng. Record, Sept. 27.
Oct. 20. Hospital, Cleveland, O. .... Sept. 27
Oct. 21. Jail, Jefferson, Ga. .... Sept. 13
Oct. 24. School plans, Milwaukee, Wis. .... Sept. 27
Dec. 2. Capitol work, St. Paul, Minn. .... Aug. 16
Dec. 8. Municipal bldg. plans, Wash'gt'n, D. C. Aug. 30

MISCELLANEOUS.

Sept. 30. Harbor, Port Adelaide, S. A. .... July 5
Oct. 1. Garbage, Meadville, Pa. .... Sept. 27
Oct. 1. Levee work, Pointe-a-la-Hache, La. .. Sept. 6
Oct. 2. Montreal, Que. .... Sept. 20
Oct. 4. Street cleaning, Evansville, Ind. .... Sept. 27
Oct. 7. Pier, New York, N. Y. .... Sept. 27
Oct. 8. R. R., Portuguese East Africa. .... Aug. 30
Oct. 9. Dredging, Boston, Mass. .... Sept. 27
Oct. 9. Dry dock machinery, Portland, Ore. .. Sept. 6
Oct. 10. Garb. disposal, Atlanta, Ga. .... Sept. 13
Oct. 13. Garb. disposal, Brooklyn, N. Y. .... Sept. 13

THE ENGINEERING RECORD.

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Unreasonable Contract Requirements by the Government.—III.

The technical details of engineering specifications should be sufficiently full and explicit to secure beyond question the desired quality of both material and workmanship, but more than that is not only redundant but almost certain to be seriously prejudicial. It is rare that superfluous matter can be introduced into specifications without carrying with it conflicting conditions and, what is worse, requirements not capable of being met or positively injurious if enforced. The Charleston Dry Dock specifications in regard to the Portland cement to be used impress a careful reader as belonging preeminently to this class. Paragraph 53 states "All cement used shall be of the best quality, of an established brand of Portland cement which has been made by the same mill and satisfactorily used in important structures under similar climatic conditions and in sea water for a period of not less than three years. It must be finely ground and free from lumps." Probably few civil engineers would care to compress cement specifications into the limits of a single short paragraph, but any cement fulfilling the requirements of that quoted would be eminently well adapted to the dry dock work at Charleston. The Bureau of Yards and Docks, however, as if distrusting such a concise and well-defined prescription proceeds to impose an extended and elaborate set of exactions, some of which are matters of indifference, some of doubtful value, some harmful and some harmless, but nearly all of them thoroughly superfluous.

A requirement that "All cement shall be of uniform bluish-gray color," strictly speaking, means essentially nothing as to exact color determination, but it would have little or no value if it did. The specifications as to chemical constitution is one of little wisdom in a general application. It is doubtless well enough to express one or two limits in an approximate way as affecting durability in sea water, yet even that is of questionable value except when employed in a reasonable manner, and with the qualifying element of good judgment. What is needed is a cement possessing durability in sea water and if, as prescribed in another paragraph, a given brand has satisfactorily withstood the action of sea water for at least three years that is as near the proof of its capacity as a chemical analysis at this time without comparison with any other.

Paragraph 58 specifies that "No cement shall be used that contains more than 2 per cent. of magnesia, unless positive and satisfactory evidence is furnished that a larger per cent. is not detrimental to the brand of cement used, in which case the amount shall not exceed 3 per cent." If it is conclusively shown that "a larger per cent." than two "is not detrimental," it is natural to inquire why the limit should be three. Again paragraph 59 states "Cement containing an excess of free lime shall not be used," but "an excess" is not defined.

There are other paragraphs in abundance similar in nature to those named and equally indicative of the weak if not worse character of these cement specifications. The checking and cracking tests render superfluous some of the chemical requirements and there are others either aimless or overlapping. The boiling of cement pats in sea water for twenty-four hours is worthless torture, whereas a well-considered accelerated test is sound and reasonable.

The requirements of paragraphs 78 and 79 that in the making of concrete the cement shall be measured "packed in the original package," is a straining after some advantage, apparently, not plainly evident. It might easily result in distinct inconvenience and constitute a marked disadvantage to the progress of the work. It is one of those things which without good sense and judgment based on experience may easily result prejudicially and in no event can result in any real advantage.

The manner of taking samples of cement for testing is "from the interior of bags or barrels." It is not an infrequent experience after exposure of barrels or bags of cement to find the material at and near the exterior of the package partially set from the surrounding moisture while the interior is in perfect condition. The manner of taking the sample prescribed would completely defeat its purpose by avoiding the injured material.

Much of the specifications for making and depositing the concrete is perhaps well enough, but there are other provisions so erratic that one is forced to the thought that scissors and paste rather than experience and judgment have been the ruling instrumentalities in the preparation of these specifications. In paragraph 81 the instructions for depositing concrete in layers so that the top of each shall be a horizontal plane, are such as to induce to the greatest possible extent the lamination of the material. Again in paragraph 83 there occurs the sentence "Concrete shall be tamped at the rate of not more than 72 square feet of concrete 9 inches thick per man per hour." The same paragraph further prescribes that the number of blows and height of fall are to be regulated by the civil engineer in charge. Any such minute and finical regulation in connection with the tamping of concrete is whimsical and ridiculous. If concrete is laid in such condition as to require tamping the latter operation should be so conducted as to accomplish the desired purpose, and that result is the only rational limit of the number and height of blows. Any arbitrary regulation which requires a nice apportionment of the number of blows "per man per hour" without regard to results is calculated to do more harm than good, especially when it is prescribed that such a requirement "shall be rigidly adhered to."

That part of the specifications devoted to the pile work presents features of the same general unsatisfactory class. The following sentences occur in paragraph 95: "The hammer used on the work shall weigh not less than 3,000 pounds nor more than 4,000 pounds. A steam hammer may be used by the contractor if he so desires, but in such event only such dimensions, weight and construction shall be used as shall meet with the approval of the civil engineer in charge." These provisions are apparently based upon lack of experience and unfamiliarity with the class of work to which they apply. Some of the most effective pile driving ever done around New York City, certainly, has been accomplished with a hammer weighing 4,500 pounds and materially heavier hammers have been employed with excellent results. Indeed as a general principle the heaviest hammers including those of the steam hammer class with small falls do much better work in every way than lighter hammers with high falls.

Another characteristic feature of these specifications will be found in paragraph 133 in the following language: "Whatever design be employed the entire responsibility for the sufficiency for the cofferdam shall rest upon the contractor, but the right is reserved to the Government to require that it be perfected in any respect considered necessary by the civil engineer in charge." In other words, under the plea of perfecting it the civil engineer in charge may modify the plan of the cofferdam to any extent whatever, but the contractor must bear all the consequences.

Other citations might be made, but enough has been shown to demonstrate conclusively the absolute unfitness of these specifications for such a great work as the Charleston Dry Dock. They are unworthy of a competent engineering administration of the Bureau of Yards and Docks, and they are not creditable to the Navy Department. They should be recalled, radically recast and put in such shape as to gain to the Government an opportunity to secure the performance of the work on an efficient and businesslike basis.

EXTRACTS FROM SPECIFICATIONS REFERRED TO ABOVE.

38. Tests of Ground.—After the excavation has been completed, the bearing power of the material at the bottom of the same shall be ascertained by tests made by the contractor at his own expense. Not more than five tests will be required under this provision. The location for same will be fixed by the civil engineer in charge. The area loaded for any one test shall be not less than 3 feet square. The method of making the tests shall be as required by the civil engineer in charge, and, if directed, the ground shall be loaded up to 12 tons per square foot. In addition to the above tests in the dry dock proper, the contractor shall, at his own expense, drive in positions shown on plans four test piles, 70 feet long, of the quality and diameter specified in paragraphs 93 and 94, with a hammer weighing not less than 3,000 pounds nor more than 4,000 pounds. During the driving of each test pile the contractor shall afford the Government every facility for keeping a complete and accurate record of the fall of hammer and penetration for each blow. In addition to the above driving tests, the piles shall each be fitted with a platform, and three days after being driven a test load of pig iron, or equivalent, not exceeding 40 tons, shall be applied as may be required by the civil engineer in charge, and facilities shall be afforded for keeping a record of levels during the application of the test load. The test piles shall be left in position and will constitute a portion of the permanent structures. If the tests show that piles will be necessary in the dry dock proper, any test in connection with such test piles will be paid for by the Government, as resulting from a change in contract.

78. Mortar.—All mortar used shall be made with Portland cement, measured packed in the original package, and in the proportions elsewhere specified herein. The volume of cement shall be taken to be that actually filled by the cement itself upon delivery, and shall be ascertained by careful measurement. The sand and cement shall first be thoroughly mixed dry so that when cut down with a shovel the mixture shall show a uniform color without streaks. Water shall then be added slowly, in the form of spray, and the entire mass worked with shovels and hoes to a uniform plastic condition. When thoroughly mixed, very little mortar should adhere to the steel when the hoe is drawn out of it. Only such quantity of mortar as can be used before it begins to set shall be mixed at one time. Sand and cement shall not be mixed dry and allowed to remain for any considerable time before being used.

79. Proportions of Concrete.—Concrete shall be of the following proportions, used in locations specified hereinafter:

	Cement.	Sand.	B'k'n Stone.
Class 1.........	1 part	3 parts	6 parts
Class 2.........	1 part	2 parts	4 parts
Class 3.........	1 part	1 part	2 parts*

*Finely crushed granite.

All shall be by measure. The cement shall be measured packed in the original package, and the actual volume occupied shall be ascertained by careful measurement. Sand and broken stone or gravel shall not be measured in the small wheelbarrows, as is sometimes done, but it will be permissible to use large square wheelbarrows which are of a uniform size and can be filled with a uniform quantity each time. Barrels without heads and boxes without tops and bottoms may also be used; these to be filled only level full with the material to be measured, after which they shall be lifted away. In the side walls of the dry dock structure proper and in the approaches, hard, sound granite blocks or boulders, not exceeding 3 feet in largest dimension, may be embedded in concrete as directed by the civil engineer in charge. No block shall be placed within 2 feet of the limits of the 1 to 3 to 6 concrete or within 1 foot of another one or within 10 feet of the vertical plane of the inner face of the lowest altar of the dry dock. Special care must be taken to entirely surround all such blocks with ½ inch of 1 to 3 mortar so there shall be no voids, and so as to secure a proper bond with the concrete. No boulders shall be placed in the concrete forming the floor of dry dock.

81. Depositing Concrete.—Before any concrete is laid in a trench, or on the site of any foundation, all mud, slush, soft ground, etc., must be removed and refilled with suitable material until a satisfactory bearing is obtained, without extra compensation. Concrete shall be dumped as closely as possible to the place required, so as to avoid, in as great a degree as is practicable, handling or turning it over within the excavation or forms. Concrete shall be deposited in place in homogeneous layers not exceeding 9 inches in thickness. It is not required that one layer be completed before the succeeding layer is started, but layers may be carried along one after the other as closely as practicable consistent with good work as decided by the civil engineer in charge, subject to other requirements of this specification. Where it is impracticable to entirely complete one layer before a second one is started, a plank 9 or more inches in width shall be securely fastened, against which the end of the layer of concrete shall be rammed, thereby securing a vertical joint in this layer. If a second layer has to be stopped before the full length of the work is reached, another cross plank shall be securely fastened at least 3 feet back from the end of the first layer, as shown on sheet 7, and the concrete shall be rammed against it. Layers of concrete must not be tapered off in wedge-shaped slopes, but shall have vertical ends by being built by the above described process. The surface of each projecting layer shall be finished hard and regular, leaving no cavities or loose stones. Layers of concrete shall be kept truly horizontal, and if it is necessary to stop work for an indefinite time the top of the concrete shall be properly finished so that it is a horizontal plane. No concrete shall, under any circumstances, be deposited in place after it has commenced to set, nor shall it be mixed with succeeding batches. When in place and rammed all disturbances must be prevented until at least twelve hours have elapsed. No wheeling or heavy work shall be carried on upon any concrete without first laying down planks for the protection of the concrete. The surface of all concrete masonry shall be kept thoroughly moistened for at least three days after being deposited, and shall be protected in the summer from the direct rays of the sun for a like period. No concrete shall be deposited except by special permission of the civil engineer in charge in writing, during freezing weather or at such times that it is likely to be subjected to freezing within forty-eight hours after being deposited; and then depositing shall proceed only under such conditions and with such precautions as may be directed by the civil engineer in charge. If concrete is likely to be subjected to freezing before it has been allowed to set for forty-eight hours, proper care shall be taken to protect it from the action of frost. The surface of each layer shall be thoroughly moistened before the succeeding layer is deposited upon it, and if it has been exposed more than twelve hours it must be covered with a layer of neat cement ¼ of an inch thick after moistening. The concrete adjacent to the granite facing shall be deposited and tamped in place so as to bond the stone securely to the mass of concrete backing, to the entire satisfaction of the civil engineer in charge. The granite blocks shall first be thoroughly moistened and covered with ¼ inch of 1 to 2, 1 to 1 cement mortar, or neat cement paste, according to the material required for the joints in masonry contiguous to same, in order to obtain a thorough bond between granite and concrete.

83. Tamping Concrete.—The proper tamping of concrete is a matter that shall be given careful attention in order to secure the greatest strength possible, and the requirements stated herein shall be rigidly adhered to. As specified hereinbefore, the amount of water used in mixing concrete shall be such as will permit of tamping being carried on for the period hereinafter specified before a film of water appears on the surface and before concrete begins to quake. Concrete shall be tamped at the rate of not more than 72 square feet of concrete 9 inches thick per man per hour. The number of blows and height of fall shall be regulated by the civil engineer in charge. Each batch shall be thoroughly spread and tamped before another is dumped. Rammers shall weigh not less than 30 pounds, with bases having an area of about 36 square inches.

95. Penetration of Piles.—All piles shall be driven full length, if it is possible to do so without injury, unless otherwise directed by the civil engineer in charge. It is intended that the maximum load per pile shall be 15 tons. The minimum satisfactory length of all piles shall be such as will permit the driving of same to proceed until the average penetration per blow for the last five blows shall not exceed 1½ inches with a 3,000-pound hammer falling freely 20 feet, or the equivalent, unless a modification is authorized by the Chief of the Bureau of Yards and Docks after the excavation has been completed and tests made, as specified in paragraph 38. The hammer used on the work shall weigh not less than 3,000 pounds nor more than 4,000 pounds. A steam hammer may be used by the contractor, if he so desires, but in such event only such dimensions, weight and construction shall be used as shall meet with the approval of the civil engineer in charge. The results obtained by using the steam hammer shall be carefully compared with the results obtained by driving with a drop hammer under the conditions imposed above, and the penetration of the last blow or any number of blows shall be determined by the civil engineer in charge. If required by the civil engineer in charge, in order to sink piles to the required depth, a water jet shall be used, without extra charge. The driving of a pile shall be continuous from the time of starting until the required penetration is obtained. The heads of all piles shall be hooped with iron rings during driving. If it is found necessary to furnish piles with metal shoes, the shoes will be furnished by the Government without extra cost to the contractor.

Heavy Swinging Dampers should be avoided in mechanical draft work, according to Mr. F. R. Still, of Detroit, in a recent paper in the "Journal" of the Western Engineers' Club. They should, he said, be cut up into small ones, as in a floor register, only not so small, say 12 to 20-inch louvers, with a rod connecting the louvers outside, so that they will all operate simultaneously.

The Failure of the Supply of Water in the Edison station supplying electricity for lighting and traction purposes for the City of Paterson, N. J., on Saturday evening, Sept. 6, caused the failure of three out of six boilers, resulting in the injury of two men and the interruption for an hour or more of the supply of electricity at a time of the week when it was, perhaps, most needed. Ordinarily the condensers draw water from a canal forming part of a hydraulic system that operates a number of mills in the city. Provision is also made for drawing water from the Passaic River, which is at a lower level than the power house and the boiler feed pumps may in addition to the two sources of supply already named be connected to the city mains. Owing to the closing of the head gates in the canal, it was empty and water was being drawn from the river at the time the accident occurred. The water was unusually low and, it seems, falling at the time. Before this was noticed the water got so low that the condensers and pumps failed to work and while investigation was being made as to the cause of their inaction the water became so low in the boilers that three of them failed. This experience would point to the desirability of providing, in places where the condensing water is lifted from a river or other source at a lower level, some automatic means of giving sufficient warning to prevent such accidents from occurring.

The New Power Plant for the Assabet Mills, Maynard, Mass.

The Assabet Mills at Maynard, Mass., which are owned by the American Woolen Company, have recently been enlarged by the construction of a new mill building for which power had to be provided. When this was planned it was decided to replace an old boiler plant with a new one, so that steam for the entire plant could be generated as economically as possible. The work was given to the company's consulting engineers, Messrs. Dean & Main, of Boston, and it has been constructed under their supervision. The Engineering Record is indebted to Mr. W. N. Wood, treasurer of the American Woolen Company, for permission to print the following description prepared from data furnished by Messrs. Dean & Main:

The new building measures 690 feet in length and 106 feet in width and is of five stories for half its length and six stories for the remainder. It is of the usual mill construction. Because of the fact that power could not be transmitted conveniently by belts from the engines to the shafting, the electric drive was adopted, and that made it possible to locate the engine room where most convenient. Steam for the old mill was generated in a battery of 12 horizontal return tubular boilers, each of 200 horse-power capacity located in a boiler house about 45x127 feet in plan. The chimney connected to these boilers was of good construction, 9 feet in diameter and 200 feet high, ample in size for a larger boiler plant. It was found upon investigation that these boilers could be removed, and, by raising the roof of the building, substitute for them 21 vertical fire-tube boilers, so that 4,725 horse-power could be obtained from them on their normal rating. Room remains for the installation of still another boiler, if necessary, so that the same building now accommodates 4,950 horse-power of vertical boilers instead of 2,400 horse-power in horizontal boilers as formerly used.

A plan of the boiler room as remodeled is shown in Figure 1. As the work had to be done without interruption to the operation of the mill, the method of making the change is quite interesting. The old battery of boilers occupied the space now taken by the new boilers indicated by even numbers. Vertical boilers numbered 1, 3, 5, 7 and 9 were installed while the older ones were in operation. The smoke flue for the new boilers was at a higher elevation than that for the old ones so that the new flue was put in without inconvenience. The new steam main was installed and connected and then six of the old boilers, in front of the new battery, were removed through an opening in the building wall. New boilers 2 to 10, which were more than sufficient in capacity to furnish all the steam needed, were then put in and the remainder of the old boilers in the north end of the building were removed through on opening made in the wall for the purpose. Afterwards new boilers 12, 14, 16 and 18 and 13, 15 and 17 were installed to supply power for the new mill. Room is left for boilers 11, 19, 21, 20 and 22.

The vertical boilers are a modification of the Manning type. They are of the same general design as those illustrated in The Engineering Record of July 2, 1898. They are internally fired with a fire box 5 feet high above the grates. The shells are about 8 feet outside the largest ring and the grates, 7 feet in diameter. The lower tube sheet is 5 feet above the grates, and there are 348-2¼-inch tubes in each boiler, each tube 15 feet long. An annular space of 15 inches exists between the tubes and the shell, so that a ladder, suspended by rollers at the top, can be run around a circular track riveted to the inner surface of the top of the shell, to permit a man to inspect and clean the tubes and shell. A manhole is placed in the boiler just above the lower tube sheet.

The total heating surface in each boiler is 2,965 square feet including 2,363 square feet of steam heating surface. The grate surface is 38.48 square feet and the ratio of the heating to the grate surface is 77 to 1. The boilers are intended to burn bituminous coal. The products of combustion pass to the chimney through a rectangular flue 10x5 feet in size and of uniform cross section. At a height of about 14 feet above the floor a continuous gallery extends along the fronts of each battery of boilers. The steam is delivered to two mains in the boiler room supported by stands opposite each boiler. The steam connection is carried around from the front of the boiler, then up into the bottom of the main, so that the triple bend this arrangement makes will provide sufficient elasticity to take care of expansion. A safety valve and a Chapman gate valve are placed in each of these feeders. The two mains are connected at the south end of the building by a cross-over pipe, from which a 15-inch main leads to the new power house. The old 10-inch main supplying the old engines is shown in the rear of one of the batteries in the longitudinal section. Before the old boilers were disconnected, a 10-inch connection with a Watts reducing valve was run from the new main to the old one as shown in the same drawing. The old system operates under a pressure of 100 pounds and the new one, 140 pounds. In case the reducing valve should become deranged, means are provided for relieving the pressure, should it become greater than desired, through a safety valve on the low pressure side of the reducing valve. A 4-inch blow-off main is connected to each boiler through a 2-inch globe angle valve and 2-inch straightway globe valve. It discharges into a tail race.

The new engine room is a brick structure 81 feet 6 inches by 44 feet 6 inches in size and is lighted by a double tier of windows on three sides. It is shown in plan and sectional elevation in Figure 2. It is equipped with a 15-ton hand operated traveling crane. Power is supplied by two McIntosh & Seymour, vertical cross-compound, condensing engines and one Ames engine, driving General Electric three-phase generators. The vertical engines are of different sizes, the larger one having cylinders 32 and 64x48 inches in size and a rotative speed of 120 revolutions per minute, while the smaller one has cylinders 20 and 40x36 inches in size with a speed of 133 revolutions. The economi-

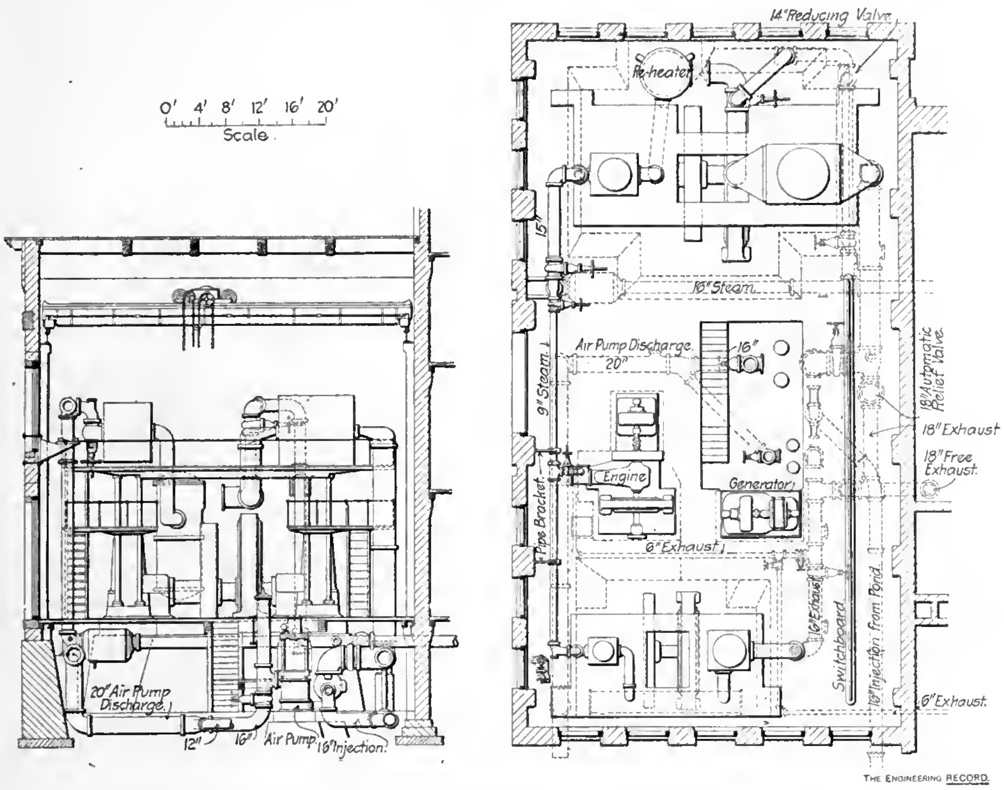


FIGURE 2.—PLAN AND SECTIONAL ELEVATION OF THE ENGINE ROOM.

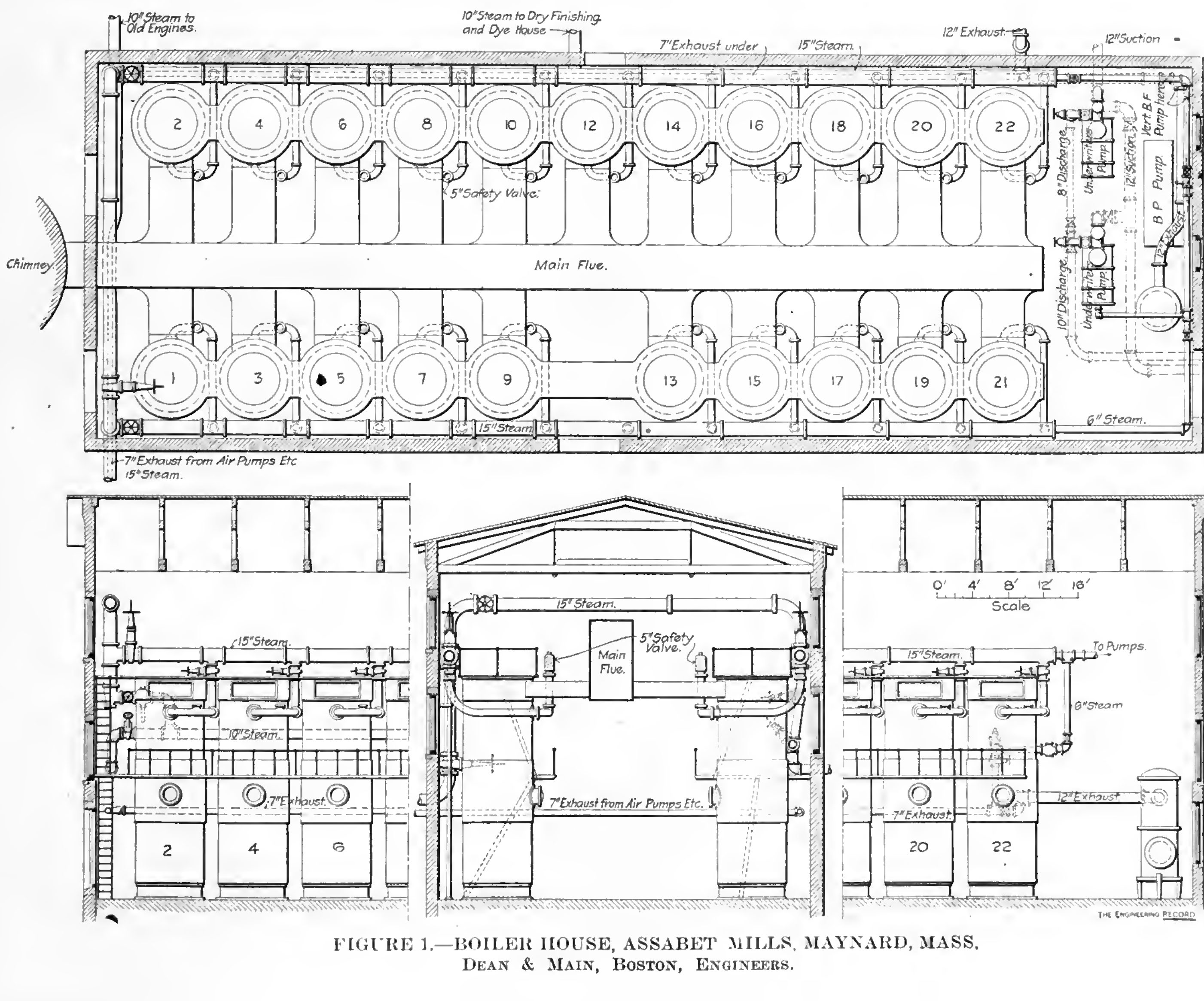


FIGURE 1.—BOILER HOUSE, ASSABET MILLS, MAYNARD, MASS.
DEAN & MAIN, BOSTON, ENGINEERS.

cal load of the former engine is about 2,230 horse-power, and of the latter engine, 760 horse-power. The large engine has bearings 23x48 inches, and the smaller engine 13x22 inches, with shafts 25 inches and 16 inches in diameter in the body, respectively. The steam pressure is 140 pounds. The two engines are provided with reheating receivers. The high-pressure side of the large engine and the reheater may be cut off at any time and the low-pressure side run with steam at reduced pressure, a connection with a Foster reducing valve being led directly to the low-pressure cylinder.

The larger engine drives a 2,000-kilowatt 40-cycle three-phase General Electric generator; the smaller one, a 500-kilowatt machine of the same frequency and type. When the main generators are in operation, the exciting current is supplied by a motor generator, operated by alternating current and delivering direct current. When this cannot be used through the main generators being shut down, or from any other cause, the exciting current may be obtained from a direct-current motor that may be directly coupled to a 14x14-inch engine made by the Ames Iron Works. This engine is of the center-crank type and is directly connected to a

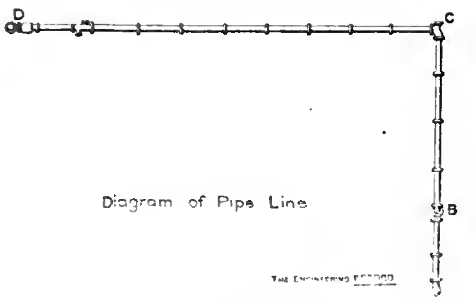


FIGURE 3.

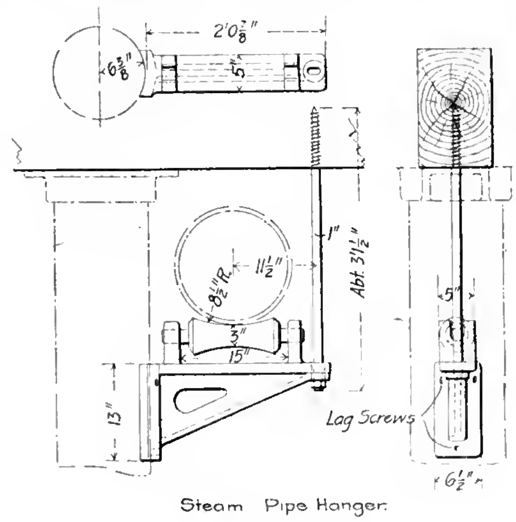


FIGURE 4.

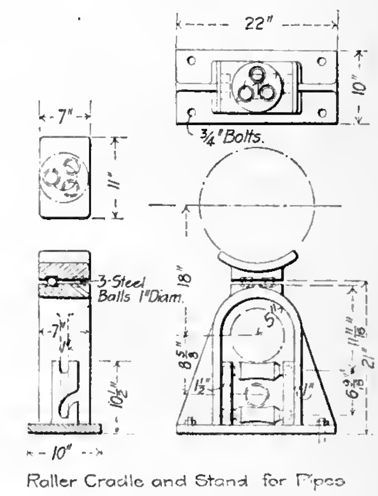


FIGURE 5.

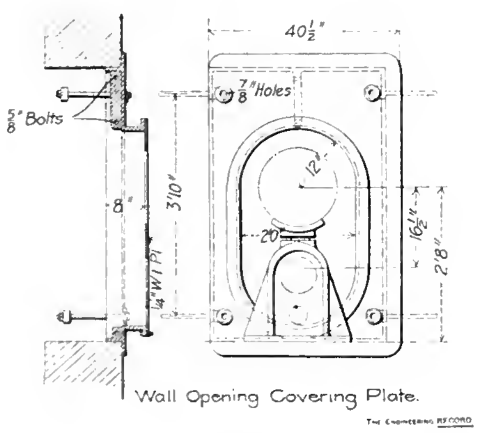


FIGURE 6.

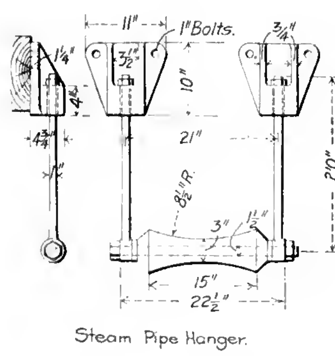


FIGURE 7.

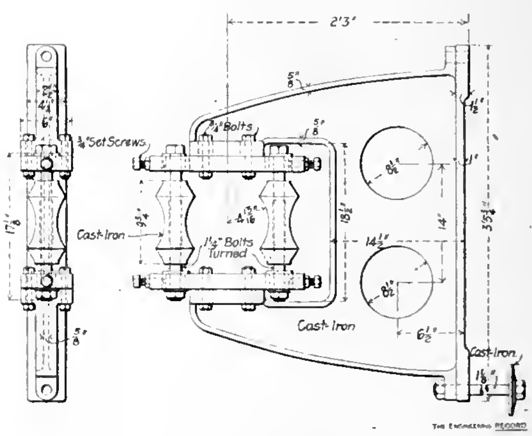


FIGURE 8.

DETAILS OF SUPPORTS AND HANGERS FOR PIPING.

100-kilowatt 40-cycle alternating-current generator used to supply the mill with small power during the night when the main plant is shut down. The exciting current for this is obtained from a small generator belted to a pulley on the out-board end of the engine shaft.

The main engines are intended to operate condensing and each exhausts into a jet condenser connected to a Warren vertical twin air-pump. The exhaust pipe from each engine is connected through a Blake relief valve to a common 18-inch free exhaust pipe. The injection water from the condensers is drawn from a pond through cast-iron pipes with bell and spigot joints. The pipe divides into two short horizontal branches leading to the condensers, and to provide for expansion, Wainwright expansion joints are placed in each branch. It will be noticed from the plans of the engine room that the air pumps discharge into a tee with an upward branch connected to a large vertical air chamber, this being necessary to reduce the shock, as the air pumps deliver the hot water under pressure to the dye tubs. Incidentally, there is saved by this utilization of the condenser discharge the large amount of steam that would be required were the usual practice followed of heating fresh cold water by means of live or exhaust steam. The air pump discharge passes through a 17-inch pipe to a large tank on the roof of the dye house. This pipe has a 6-inch branch leading to the boiler-feed pumps.

The exhaust steam from the air pumps and from the Ames engines in the new engine room is carried back through a 7-inch pipe to the boiler room, and there connects with a 12-inch exhaust from several non-condensing engines in the old mill. The 12-inch low-pressure pipe is connected with a 4,000 horse-power vertical feed-water heater, made by the Taunton Locomotive Manufacturing Company. Thus there is a low-pressure system, steadily maintained at a maximum by live steam through reducing valves, for use in the dye house and feed-water heater. A 2½-inch drain from the steam space in the heater is connected to a Geipel trap, which discharges into the blow-off from the water space of the heater. The steam that condenses in the heater is pumped into the boilers. There is a single steam connection to the heater, it being arranged on the induction principle, and an automatic air valve is connected to the top of the steam space of the heater to prevent it from becoming filled with air. A branch from the 12-inch exhaust mentioned supplies steam for heating and in case the supply of exhaust steam for these purposes is insufficient, for instance at nights when the engines are shut down, a 6-inch live steam connection is provided to meet this demand. The live-steam pipe has a reducing valve and a back-pressure valve, the latter to relieve the low-pressure system in case the pressure in it becomes too great.

There are two 1,000-gallon Underwriter fire pumps each capable of drawing water from the pond or city supply and discharging into the fire protection system, which consists of fire hydrants and the usual sprinkler equipment. There are two boiler-feed pumps, one a 14x8x18-inch Warren horizontal duplex outside packed plunger pump and a 12x7x12-inch Warren duplex vertical piston pump. One of the fire pumps is also connected to the bolier feeding system. Either of the boiler feed pumps may, independently of the other, draw water from three sources; the town supply, the pond or the air pump discharge. An American Steam Gage Company's Underwriter relief valve is placed on the pump discharge. The water is forced through the heater, which may be by-passed if desired, and thence to two 5-inch brass feed mains, one carried along the rear of each row of boilers, gradually reducing in size. A 2-inch branch, of brass, supplies each boiler, the water passing through a Chapman gate valve, a check valve, a union and plug cock in the order named. All high-pressure drips in the engine room, from steam pipes, jackets and reheating receivers, are collected into an automatic pump and receiver and returned by it to the boiler room, where it is delivered to both feed mains between the heater and the boilers.

An amount of attention that is unusual in steam plant construction has been paid to the steam piping and a description of its details will doubtless be of interest. The 15-inch mains in the boiler room are supported opposite each boiler by stands made of 6-inch pipes capped with cast-iron saddles. Each stand is bound by a 2½x⅜-inch strap bolted to the wall. Steam is carried almost 300 feet from the boilers to the engine room, and as there is a change in the direction of the pipe, the method of supporting it and taking care of the expansion is quite interesting. As shown by diagram, Figure 3, the pipe drops at the boiler room, then runs horizontally to the point B, where it rises about 8 feet. At C it changes its direction and extends about 190 feet to a separator in the engine room, at the point D. From A to B the pipe is supported by four roller cradles. At the bottom of the riser at B is a tee resting upon a brick pier. From B to C the pipe is suspended by five hangers each consisting of a roller turning upon a shaft suspended by two hangers 2½ feet long from a pair of 4-inch channels fastened at each end by angle clips to the floor beams. From C to D the pipe is supported by the building columns, by means of a bracket shown in Figure 4. The expansion of the pipe from A to C is taken up partly by the change in direction at the riser and by the flexible suspenders. The combined roller cradle and stand used between the points A and B to support the 15-inch main, the 6-inch exhaust pipe from the air pumps and the 2-inch high pressure drip return is shown in Figure 5. The two lower pipes are supported upon rollers and the upper one upon a stand resting upon three balls, the latter permitting a slight lateral movement as well as one in a longitudinal direction. At the opening where these pipes pass through the wall a covering plate is provided. This and an elevation of the support of the pipes is shown in Figure 6. Beneath the engine room floor the pipe is supported on hangers, shown in Figure 7.

At several points in the engine room the horizontal steam main is supported by a bracket of unusual design, shown in Figure 8. This is intended to allow motion in the direction of the axis of the pipe and vertical motion, but to prevent lateral motion or vibration. It will be noticed that the rollers may be brought to a firm bearing by means of the set screws at either end of the bracket, and while the pipe can move, there is considerable resistance thereto. The entire piping contract was executed by the Walworth Construction & Supply Company, of Boston. The specifications required that the exhaust piping should be equal to the Walworth standard for 100 pounds pressure, and that all flanges and fittings for the 100 and 140-pound work should be equivalent to the Walworth standard for 250 pounds. The "Walmanco" steam joint, made by the Walworth company, was used for connecting pipes in the high-pressure work. Corrugated copper gaskets washed with a thin layer of Dixon's plumbago paste were placed between the flanges, inside of the bolts, on the piping subjected to 140 pounds pressure and rubber gaskets on the exhaust lines. The gate valves with by-passes used on the high-pressure lines are of Chapman make with Crosby globe valves. The exhaust valves are Fairbanks.

The discharge from the condensers, as before stated, is partly used in the dye house and for boiler feeding. The pipe conveying the water is of cast iron with caulked lead joints. At the dye house the pipe reduces to 16 inches and from the tank the distributing pipes are of steel. To insure a constant head for the air pumps to work against, which was deemed necessary for their proper action, a discharge and overflow head was fitted to the top of the riser supplying the tank on the dye house roof. It is shown in Figure 9. The water rises through the central opening and overflows into the annular chamber A which is connected to the tank supplying the dye tubs. In case the tank is full and the demand of the dye tubs should be less than the discharge of the air pumps the water level in the chamber A rises and overflows into B which is connected to an overflow or waste pipe.

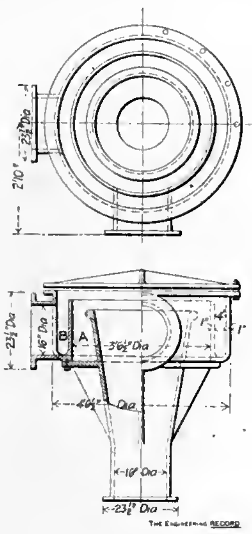


Figure 9.—Overflow Head.

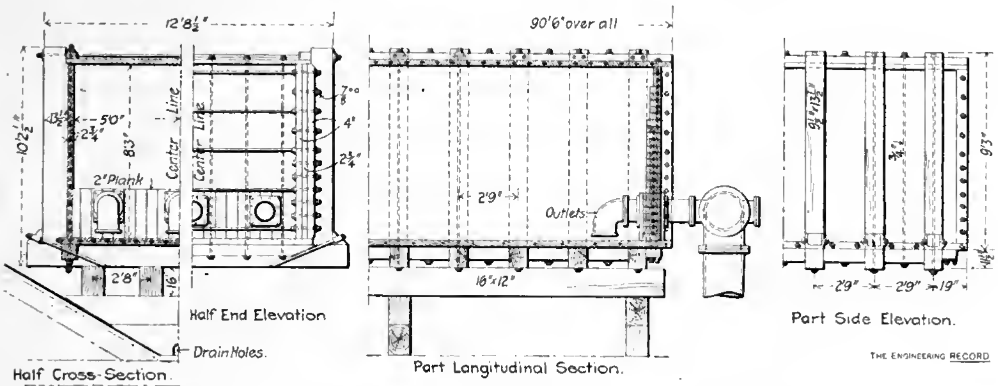


Figure 10.—The Water Storage Tank for the Dye Tubs.

The construction of the storage tank is shown in Figure 10. It is placed in the valley of the roof, as shown in the cross section. It has three 10-inch outlets connected to a header provided with a 20-inch supply to the dye tubs. The tank is 90 feet 6 inches in length over all, 8 feet 3 inches deep and 10 feet wide inside measurements. The bottom, top and sides of the tank are of Cypress with the joints spliced and laid in white lead. The sills are of 9½x11½-inch plain southern pine. The posts are of 9½x13½-inch pine, and each is tied in at the top by a pair of ⅞-inch bolts extending from one post to the opposite one. Straps hold them in place at the bottom. Other details are shown in the drawing.

The Cross Arms on the redwood poles commonly used for the electric transmission lines of the Pacific Slope are of 6x6-inch kiln dried Oregon pine, subjected to a temperature of 220 degrees Fahr. for several hours in a bath of asphaltum oil. The redwood poles are cut from young trees, not more than four from the one tree, and are counted on to last 25 to 35 years.

Submerged Pipe.

Abstract of a paper by A. L. Holmes before the Central States Water-Works Association.

In the larger cities along the navigable waters care must be taken that the pipe lines are beyond the reach of keels or propeller wheels and the pipe protected at the docks and landings. Then we must provide for the deepening of the harbors in the future, for the government is arranging for about twenty feet of water in all the principal lake ports, and pipes must go well out of the way of dredge dippers. About the only safe way for laying pressure pipes across navigable streams is to place them in a trench well below the bottom of the river and in this trench pipe carefully laid will give no trouble.

If the bottom is soft there is little trouble in dredging a trench, and if rock it can be drilled and blasted from the surface and the loose rock cleaned out of the trench, the most of it from above, but it will pay to send a diver down to be sure of a clean channel before sinking the pipe. In some localities with soft bottoms it has been a custom to lay the pipe on the mud with the upper ends disconnected, and then by a sand pump working along the line of pipe gradually work it down to place. It is obvious that where this can be done in sand or mud the pipe will keep in the bottom of the trench and save the handling of some material. Eternal vigilance is necessary in all this class of work.

At Michigan City, Ind., a 20-inch force main across the harbor was lowered from a depth of 16 feet 5 inches to a depth of 20 feet by the use of a sand pump and without any repairs whatever. This pipe was 160 feet long and was fitted with five ball joints, and together with 1,200 feet of other pipe on shore showed a leakage under 100 pounds of water pressure of only 168 gallons in 24 hours. A 16-inch riveted pipe across the stream at Hammond, Ind., was lowered in this way and by the use of a water jet and was perfectly tight when down. Of course this way of doing the work is not advocated where it is practicable to get and to maintain a trench otherwise, but some streams are so swift and carry so much fine sand or silt that the trench would fill as fast as dug.

The writer's preference for submerged pipe is cast iron hub and spigot with lead joints and every 36 or 48 feet a flexible joint that will allow of considerable movement. The Ward joint is perhaps as well known in this country as any of the various forms and was for quite a number of years the only one. During the last twenty years a half dozen others have come on the market and the price has been largely reduced. Originally in using the Ward joint, which is made in the end of 12-foot lengths of cast-iron pipe, it was the custom to use the whole line of submerged pipe of this kind, but this was not necessary and incurred a needless expense.

Wrought pipe is used to a large extent by private concerns, and there is a sufficient spring to a 6-inch wrought pipe with several joints to conform to a surface that is quite uneven. A flanged cast-iron pipe for this work will be expensive to lay and probably cause trouble from leaks.

With medium-size pipe, say up to 12 inches, the work of jointing and getting in place can be done from above water. In one case under the writer's charge a line about 200 feet long was sunk in 20 feet of water lowered from the sides of scows by ropes and showed no leaks at the time, neither has it in the eighteen years since placed.

Of course many, or the most of these lines, do leak unknown to the water works managers, and the best way to ascertain the amount of the leakage is by placing a valve at each side of a river crossing with a by-pass around it in which to place a meter. With the valves closed and a pressure on the meter the leak can be measured quickly. To locate the leak the writer has found the use of an air pump the most efficient and the quickest means. With the valves closed and the air under pressure introduced into the submerged pipe the air bubbles coming to the surface will locate the leaky joints very quickly.

In many streams where not interfered with by boats, pipes are jointed on a frame of timbers sloping toward the stream, and as each length is added the pipe is launched into the water, the outer end supported by floats, and as the pipe goes out floats are added about every 24 feet until the whole line is put together and it is then gradually lowered by long screws or ropes to the bottom. Twelve-inch cast iron pipe can be handled in this manner for about $1 per foot including the lead used for joints and it will cost about as much for the smaller pipes, and but little more for the 16-inch.

In some small streams and moderate depth of water the writer has used benches built of 2 by 6 and 4 by 4-inch timber set in the ground or bottom of the stream and putting the pipe together on these platforms easily lowered it to the bottom.

The placing of coffer dams and laying of pipe in them where practicable offers no objections to doing good work, but it is generally very expensive in operation, and the work at Ft. Wayne last year, where a 24-inch cast-iron pipe was laid across the St. Mary's River, is a fair sample of how long it may take to get in a few hundred feet of pipe in this manner.

In laying 24, 30 and 36-inch pipe in deep water the writer has connected 40 feet with lead joints in the usual manner, placing on each end of this section a half of a bolted ball joint and lowering this into the trench prepared for it, holding one end off the bottom with a piece of wood 8 by 8 inches placed under the hub as the pipe was lowered to place. The next section prepared in the same way is lowered to place and while in the slings and held just clear of the bottom the diver enters the ball into the bell and bolts it up and so the process is continued.

The pipe can all be put in shape to lower to the bottom in a harbor or where the work can be handled most economically, and it is often the case that 500 feet of large pipe is laid in this manner daily, which means that the work can be done cheaply and well. Bulkheads are placed over the ends of the pipes before they are placed in the water to exclude fish and rubbish while lowering and are removed by the diver and sent up for use again.

The writer does not advise an attempt to get pipe very closely in line. If it zig-zags a little it may keep tighter if it settles any. In river crossings a curve up stream is generally desirable, so that as the current washes out under it and it works down stream it will become tighter.

In suction pipes in lakes the writer advocates the submerged crib or intake and in most cases wood is cheaper and preferable for this purpose. In the great lakes, where there is navigation the outer end of the intake should be placed in 40 or preferably 50 feet of water. Ice drifts on to shore and piles up and sinks until it is 30 feet deep, and this must be watched and guarded against if possible. There is much less danger of obstruction to the water supply if a submerged crib is used than if it reaches above the surface. A crib of timber 24 feet square and 8 feet high, with a timber bottom and pockets loaded with stone, if no piles are necessary, can be placed for about $1,200.

Just as efficient protection is furnished by an upturned elbow on the end of the pipe in which is inserted a tee of the same size, the ends of which are barred, leaving openings about 3 inches wide. Around this drive 12 piles 10 feet in the bottom and cut them off 2 feet above the top of elbow, rip-rap about this to top of casting and it is as safe as if a lot more money was invested.

All intakes and suction pipes for large plants should terminate in a reservoir or pump well on shore, to which the water should flow, and while pipes should be so planned that the pumps can operate directly on the intake, yet it is better that the pump well or reservoir have screens to shut out all foreign matter and that they be large enough to allow sedimentation to take place if there is anything in the water.

All intake pipes should have valves placed at the outer ends and near the well with provision for closing both and testing, under pressure through a meter, for leaks and with air to locate them. Leaky suctions, whether on shore or under water, are the terror of the pump engineer and reduce the efficiency of his machinery and ruin his engines. A little care and persistency will find and stop the leaky pipes and save annoyance and coal bills. All suction and intake pipes should, of course, be laid to a grade that air pockets may be avoided.

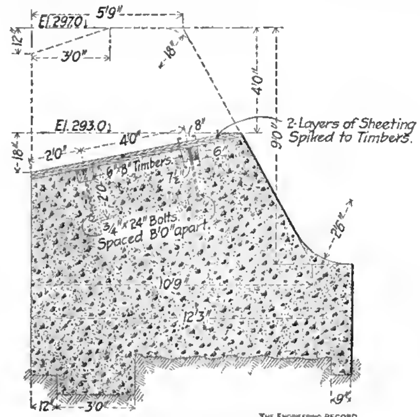
The writer would always insist on an efficient and easy way to test every pipe of this kind in use, and he considers that all submerged pipe should be looked upon with suspicion. He once removed an intake at Negaunee, Mich., laid in the bed of a muddy lake, the outer end in 30 feet of water, which, when laid ten years before, had been broken into five pieces, and which had sucked in the disease-breeding filth about 100 feet from shore and sent it through the town instead of getting the pure water through the 1,200 feet of pipe as intended. The experience at Duluth a few years ago where the intake was discovered broken in several places, and where typhoid was rampant evidently from this cause, is another instance. Neither could have happened if provision had been made for the test mentioned and it had been enforced as it should be.

A plant taking water from wells across a small pond from their pumping station sunk a line of spiral riveted pipe for a suction and could not lower the wells at all, but an outbreak of typhoid and an investigation and analysis of the water disclosed the fact that the water in town was identical with that in the filthy pond and entirely unlike the well water. Upon taking up this pipe, a connection was not only found through a tee with a check valve a few feet from shore, but some lengths of the pipe had let go or unwound, and the reason for the sickness and deaths was discovered.

"Out of sight out of mind," is apt to be the rule with submerged pipe, but if the water works managers will look after these under-water force mains they will in many cases find where a lot of the water they pump goes to, and if they will test their suction pipes going out to good water they will find them sucking in the filth and dangerous poisons in the mud near the shore and will find the reason for a good many disease germs found in water taken from the faucets when an analysis of the water at the intake shows nothing of the sort.

A Concrete Power Dam at Middle Falls, N. Y.

A water-power property at Middle Falls, N. Y., near Greenwich, Washington County, on the Batten Kill, was improved a short time ago by the erection of a concrete dam. The work was undertaken to replace a timber dam that leaked badly, but incidentally the opportunity presented itself of raising the level of the impounded water 4 feet with a corresponding increase of the working head and the advantages of added storage capacity. The enlarged flooded area that would result from the extra height of dam, however, gave promise of numerous legal complications, and these rendered it unadvisable to continue the construction as originally intended. The dam having in the meantime been partially completed, the work was continued on the original lines, stopping at the height of the former dam; the structure has thus been left so that it can easily be completed at such time as is found expedient. For its height the dam is consequently a very substantial one. The improvement was planned by Mr. Henry Floy, of New York City, in an interesting manner, as shown in the accompanying drawings.



SECTION OF THE DAM.

The water is diverted to each side of the stream for a pulp mill on one bank and various mills and an electric lighting and power station on the other, the owner of the latter, the Consolidated Electric Company, controlling the entire water power. Two waterways had thus to be maintained, and a dam was built across the stream with gate structures or abutments at each end, with a rollway in the center 114 feet long and two wing dams running downstream from each end of the rollway portion separating each waterway from the stream proper. The wing dams are somewhat similar to the rollway portion of the main dam and are designed to afford 165 feet additional rollway in times of high water. As shown in the accompanying plan of the dam, the abutments are not in a straight line with the main rollway section, but all parts, including the wing dams, are arranged to have a mutual bracing effect. The main dam is curved upstream on a 450-foot radius.

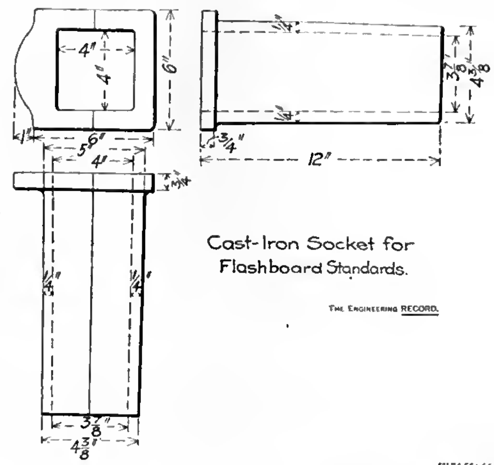
A section of the rollway is shown herewith. The design of the full-size dam contemplated an upward inclined approach to the dam crest, at an angle of about 18½ degrees with the horizontal to prevent the lodgment of debris and a downstream face with curved top and bottom, as shown. As completed, a double layer of sheeting spiked to longitudinal timbers fixed to the top of the dam, was used, giving an approach angle of about 11½ degrees with the horizontal. A cut-off is provided at the toe of the dam and a larger one at the heel, these cut-offs being in both wing dams as well as in the main rollway dam and the abutments. The wing dams differ from the main rollway section in that there is no inclined approach to the crest, as racks in front of the gates keep out large floating bodies, such as ice and logs. The area of the cross-section of the dam is about 90 sq. ft., so that allowing 145 pounds per cu. ft. for the concrete, the weight of the dam is 6.5

tons per lineal foot; when carried to its full height it would weigh 8.7 tons per foot. In connection with the full-height dam, it is intended to use flashboards by which 4 feet additional head can be obtained. The flashboard structure is to be set in sockets imbedded in the dam crest, 3 feet 3 inches from the upstream face of the dam and on 5-foot centers.

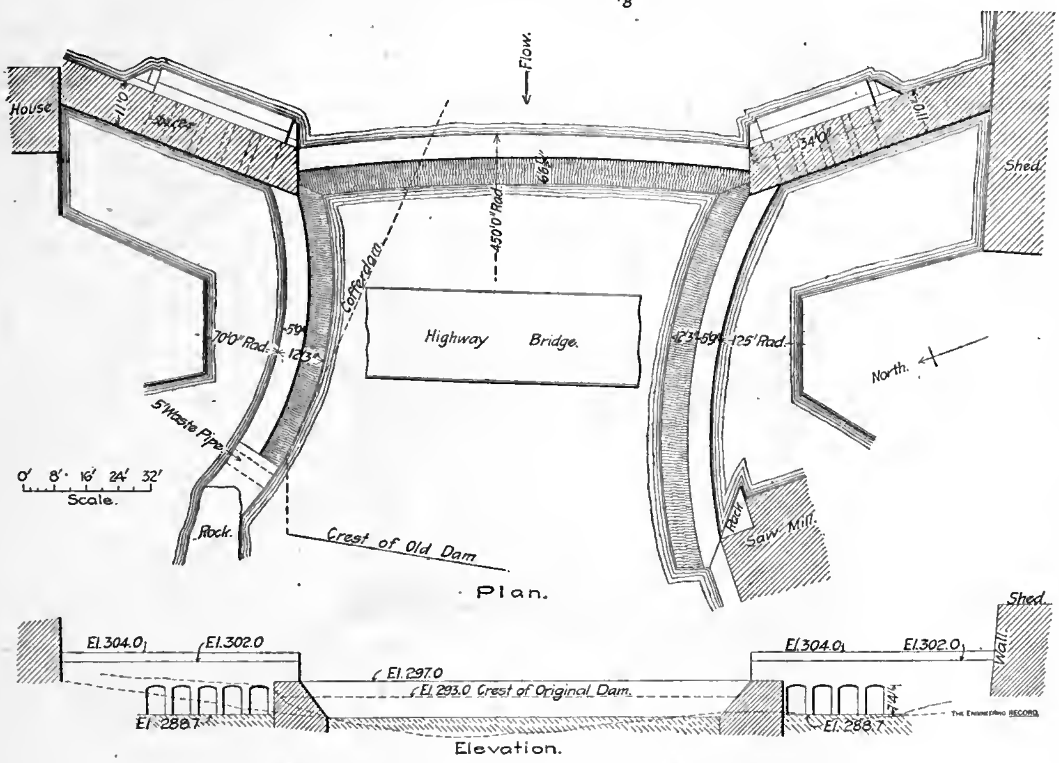
The gate structures or abutments are not as thick through as the bottom part of the dam, being 11 feet, but are heavier, having vertical up and down-stream surfaces and carried to an elevation 11 feet above the present dam crest, or 7 feet above the desired dam height. The gate structures in each case run to the stone foundations of a building on the river bank. In one case there are four openings and in the other five, each 5 feet wide and 7 feet 4 inches high and each provided with the usual protection rack of iron bars to keep out debris. These are of ¼x3-inch iron mounted in a usual way on an inclined I-beam framework. Each opening has a lift gate of 4x12-inch timbers, one gate in each side operated with geared crabs for opening against heavy pressure, as when first admitting water, the rest lifted by simple crabs. The water in each case flows through the waterways, which is a basin confined between the wing dam and the corresponding shore. One of the difficulties of the work was encountered in this connection, in providing sufficient area of waterway, which, indeed, partially accounts for the curvature of the wing dams. Between the old dam, the location of which is indicated, and the new dam, are located the abutments of a highway bridge. The flow of diverted water had on both sides of the stream to be taken around these abutments, and to secure the maximum possible area, the rock was cut away as far as safe around the abutment foundations. The bottom of the gate openings is at elevation 288.7, so that with water at elevation 293, that is, at the height of the rollways, the total wet area of the openings on the right bank of the stream is 107.5 square feet and on the other, 86 square feet. The large size of openings was made to provide for handling high water over the wing dams. The section of the waterways between abutment and wing dam was taken large enough so that the maximum rate of flow of water is 5 feet per minute. Attention should be called to the fact that the rock sides of the abutment foundations were smoothed with concrete; while, of course, the other side is the smooth wall of the wing dam. Each basin has a 5-foot drain pipe for emptying it.

To build the dam, cofferdams consisting of timber cribs filled with stones, were run from the old dam upstream, and the main rollway portion and one gate structure and its corresponding wing dam were first built. The water was then allowed to pass through the completed gate structure and basin and over a portion of the completed dam, while the gate structure and the wing dam on the other side of the stream was constructed behind cofferdams. As already stated, the dam throughout is built entirely of concrete, in the following proportions: one part of Atlas Portland cement, three parts sand and four parts of gravel in varying sizes, being taken from a convenient bank. Some Glens Falls cement was employed toward the end of the work. A hand and gravity concrete mixer was used and the material was carried to place in wheelbarrows. The dams are built on the trap rock of the stream bed. The total cost of the work was about $20,000.

The electric plant is supplied with McCormick turbines built by the Rodney Hunt Machine Company. They drive two two-phase Stanley generators, one of 120 kilowatts capacity, at 1,000 volts, and 66 cycles, installed in 1898, and the other of 330 kilowatts capacity, at 2,500 volts and 60 cycles, erected in 1901.



Cast-Iron Socket for Flashboard Standards.



Plan of the Water Power Improvement at Middle Falls, N. Y.

Sewage Disposal Works at Nuneaton, England.

For many years the system of sewage purification adopted at Nuneaton, England, was chemical precipitation and artificial filtration, but the results were not altogether satisfactory, and the working expenses very high; so that it was decided several years ago to make a trial of the bacterial system with septic tanks and contact beds. Although the sewage was particularly difficult to deal with on account of the waste matters discharged into it from the works of wool scourers, fellmongers and hat factories, this trial proved so satisfactory that the treatment was applied to the whole of the sewage, resulting in a very considerable saving in working expenses.

These works having become inadequate to properly deal with the increasing quantity of sewage, an entirely new arrangement of the works was undertaken last year by the engineer, Mr. J. S. Pickering, Assoc. M. Inst. C. E. Both the old and the new plans were described in detail by him at the meeting of the Association of Municipal and County Engineers at Nuneaton last fall.

In the first arrangement of the bacterial system the sewage was passed through a screening chamber to a pump well 50 feet deep. From this it was pumped into two roughing tanks, each 20 feet in diameter and 13 feet deep, where the heaviest part of the suspended matter was deposited and lifted automatically to within 2 feet of the surface by the pressure of the sewage. This sludge was dealt with in two Johnson's sludge presses.

The sewage then flowed into septic tanks or coarse contact beds. There were three open septic tanks and one closed one, each of a capacity of 120,000 imperial gallons. An area of 1,708 square yards of coarse contact beds was provided, and in order to test the qualities of the various materials, these beds were filled with coke, macadam, broken pots, ashes and broken bricks. The sewage remained in the contact beds about two hours. From the tanks and coarse beds the sewage passes into the fine contact beds, of which there is an area of 3,564 yards, varying from 3 to 5 feet in depth and composed of coke dust, coke breeze, small coal, and fine granite chippings. From these beds the effluent passes directly into the river. It is stated that the coke beds gave the greatest capacity, but there seemed to be no appreciable difference in the results obtained from the various materials used, as regards their purifying power.

The closed septic tank was in use for over two years without being emptied, and it had liquefied during that time about 95 per cent. of the suspended matters passed through it. It was found necessary to empty the open septic tanks after 7 to 9 months' working, when the sludge from the three tanks produced about 320 tons of pressed cake. It is stated, however, that while the flow through the closed tank was only about 50 per cent. of its capacity, the open tanks had to deal with a quantity equal to 150 per cent. of their capacity. A coating of scum was not found to be a necessity for the proper working of the tanks.

As regards the odors arising from sewage treatment, Mr. Pickering is of the opinion that a system of open septic tanks cannot be carried on without a considerable nuisance, and that the least offensive method is by the Dibdin system of coarse and fine contact beds. He does not agree with some authorities that after reaching a certain stage the capacity of contact beds will remain undiminished, believing that sooner or later the beds must become choked to a considerable extent.

As an illustration of the saving in sludge pressing resulting from the introduction of bacterial treatment, the amount of pressed cake in tons per million imperial gallons was for the years beginning with 1897 and ending with the first eight months of 1901, 18.1, 16.8, 10.7, 5.4, 3.3. The average quantity of sewage treated was in October, 1901, about 750,000 imperial gallons per day, having nearly doubled in a period of eight years.

In the new plan the works just described are utilized as a pumping station and for the treatment of storm water. The sewage is pumped about 2½ miles to the new site, where, after screening, it passes through detritus tanks, through coarse and fine bacteria beds and is finally passed over an irrigation area. By this arrangement the use of sludge presses was entirely dispensed with. The estimated cost of these works was about $219,000. They are designed to treat 1,500,000 imperial gallons of sewage per day, about three times the dry weather flow. When the pressure in the pumping main reaches that due to the delivery of this volume, a relief valve is automatically opened at the pumping station and the excess up to six times the dry weather flow is taken care of in the old beds.

Upon reaching the new site the sewage passes through two revolving wire screens 5 feet wide, having ¼-inch meshes and driven by a water wheel propelled by the sewage. It then flows through three covered tanks built on the Dortmund principle, 34 feet deep and 24 feet in diameter, with a combined capacity of 150,000 imperial gallons. The matter intercepted in these tanks is automatically discharged by the pressure of the sewage and is delivered into furrows on the irrigation area, and incorporated with the soil.

The site chosen for the bacteria beds is 20 acres in extent and has a natural slope of about 40 feet, thus enabling the tanks to be built in terraces. Fourteen concrete tanks were constructed—seven for the coarse material and seven for the fine. Each bed has an area of 1,000 square yards, and the depth of material averages 4 feet. Assuming the material to occupy two-thirds of the space in the beds, the remaining one-third gives a capacity of 75,000 imperial gallons to each. As they may be filled and emptied three times daily, they are capable of dealing with a total quantity of 1,575,000 gallons per day.

Each of the coarse beds is provided with three inlets, and at each of these a fine screen is placed. This special screening is rendered necessary by the large quantity of wool fiber contained in the sewage. The sewage is distributed over the beds by means of open-jointed socketed pipes laid over the material. The material for the coarse beds is broken granite, about 2½-inch gauge. The beds are drained by means of U-shaped, butt-ended tiles, laid 4 feet apart. After contact in the coarse beds the effluent is conveyed to the fine grain beds, which are composed of screened coke dust. This material, although somewhat finer than that generaly used, has been found to answer admirably.

From the fine grain beds the effluent is discharged on to the land, an area of 60 acres having been acquired for this purpose. The carriers consist of 18-inch stoneware pipes, laid below the ground, the effluent rising in chambers at intervals of 30 to 40 yards, for distribution over the land. These pipes work under a head of 4 or 5 feet. The land, which is mostly of a gravelly nature, is under-drained to a depth of about 5 feet. The upper half of the sockets of the main drains are made with a cement joint, the lower portions only being left open. The drains were placed in the first instance about 40 yards apart, with a view, if found necessary, of laying intermediate drains.

The Strength of Concrete-Steel.

In a recent communication to the Paris Académie des Sciences, M. Considère describes a series of valuable experiments carried out by a commission appointed by the Ministre des Travaux Publiques, with a view to ascertaining the precise role played by the metal in ferro-concrete constructions. According to an abstract of the report in "Engineering," the specimens tested by the commission were generally 6.56 feet long, and had a cross-section 3.94 inches square. Each of these concrete bars was reinforced at the corners by four steel rods, having a total section of 0.177 square inches. The concrete employed was made by mixing 661 pounds of Portland cement with 1.04 cubic yards of gravel, passing a 0.98-inch screen, and 0.52 cubic yard of sand, passing a 0.19-inch screen. It was found that in setting, the contraction of the concrete gave rise to an initial compression in the steel reinforcement amounting to 2.86 tons per square inch of the metal. The corresponding tensile forces simultaneously called forth on the concrete amounted to 74 pounds per square inch. Tested in tension, it was found that the specimens stretched rapidly until the stress on the concrete was practically equal to the ordinary tensile strength of this material. From this point the tested bar stretched much less rapidly, and throughout this period the tensile stresses in the concrete remained constant, the whole increase of load being taken by the iron bars. It follows, therefore, that during this period the elastic modulus of the concrete was zero. In one case the test-bar was subjected to a stress of 292 pounds per square inch of cross-section, under which the total extension of the specimen was 0.024 inch. The reinforcing rods were then cut out, and the +-shaped bar left was then tested in cross-breaking, and in spite of being somewhat injured in the cutting out of the reinforcing bars, only failed under a calculated stress of 128 pounds per square inch. Summing up, M. Considère states that concrete-steel submitted to tension acts precisely as ordinary concrete, so long as the tensile stress does not exceed the usual breaking stress of ordinary concrete. Under higher stresses it will support without breaking extensions which, in the case of specimens hardened under water, have been as great as 1/500th the total length; and, in the case of air-hardened concrete, have ranged between 1/2000th and 1/850th of the total length. When the concrete-steel is stretched beyond the usual elastic range of ordinary concrete, the tensile stress on the concrete remains constant up to the ultimate breaking-point, the whole of the additional load being taken up by the metal. When subjected to repeated tensile stresses, however, the fraction of the load carried by the metal tends to augment, and that of the concrete to fall, until ultimately the working stress on the concrete is only 70 per cent. of its original value. If finally, after a series of loadings and unloadings, the maximum load is raised 30 per cent., the concrete again exerts a tensile resistance equal to its primitive value. It may be added that the modulus of elasticity in compression of a concrete-steel bar is reduced on stretching the latter.

Repairs to Asphalt Pavements in Toronto, Can., according to the 1901 report of city engineer, C. H. Rust, were carried out under contract at $1.23 per square yard for 2½-inch surface, $1.09 per square yard for 2-inch surface, and $4.75 per cubic yard for concrete foundations.

The Philadelphia Company's Building, Pittsburg.

The Philadelphia Company is a corporation owning, operating and supplying natural (fuel) gas for heat and power, artificial gas for light, electricity for light and power, and street cars for transportation in the cities of Pittsburg and Allegheny and surrounding territory. It is now erecting in Pittsburg a steel cage office building designed exclusively for its own occupation. It has a front of about 35 feet on Sixth Avenue, a depth of about 150 feet on Garland Alley and is designed for an ultimate height of fifteen stories although it is to be roofed at present just above the ninth story floorbeams. The general features of design and the details and connections of the steel work conform to the standard practice for such structures which have been frequently illustrated in The Engineering Record, but there are some special features of foundations, columns and roof construction which will be described in this article.

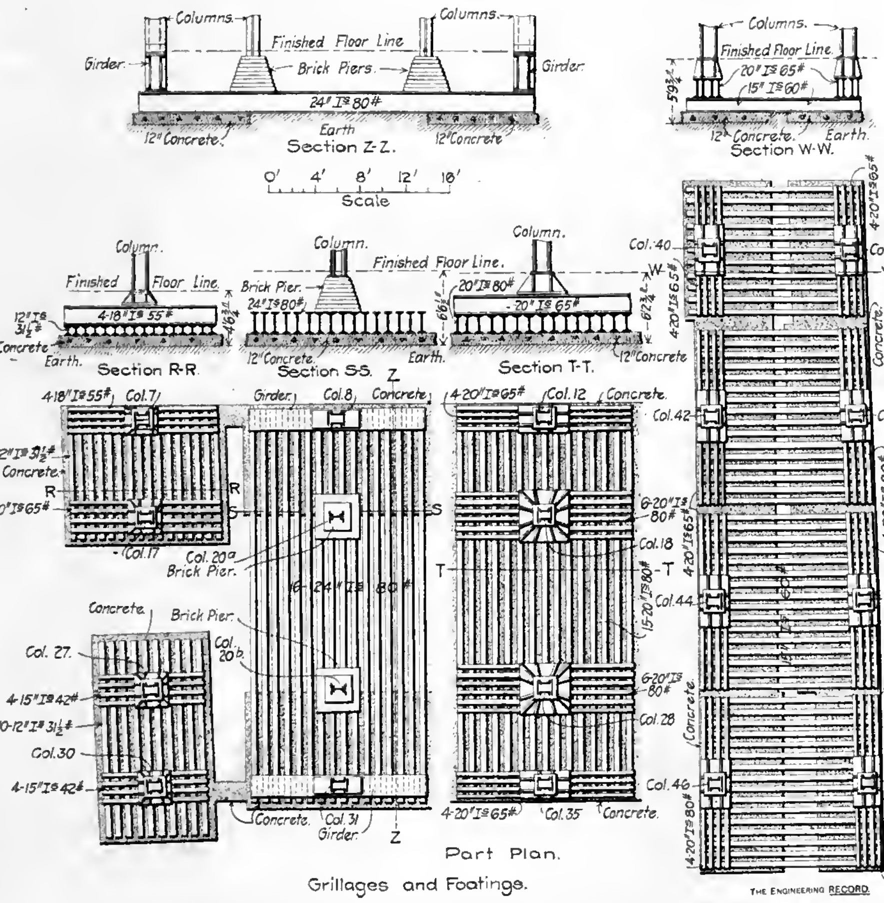
A horizontal wind pressure of 20 pounds per square foot on the whole surface of the outer walls of the building is assumed, and it is calculated that this will be resisted by solid-web knee braces between the wall girders and columns and by the stiffness of floors and partitions, the rigidity of the beam and column connections, and by the inertia of the heavy completed structure. The total weight of the eight-story building and contents is estimated at about 10,000 tons and that of the building and contents if extended to a height of thirteen stories at 15,000 tons. These amounts are distributed as uniformly as possible over a large percentage of the total area of the lot and on portions of the adjacent street areas beyond the building lines. The foundations have concrete footings laid on the bottom of the general excavation for the basement, and covered with steel grillage beams which receive the column loads through distributing beams or girders below the basement floor level.

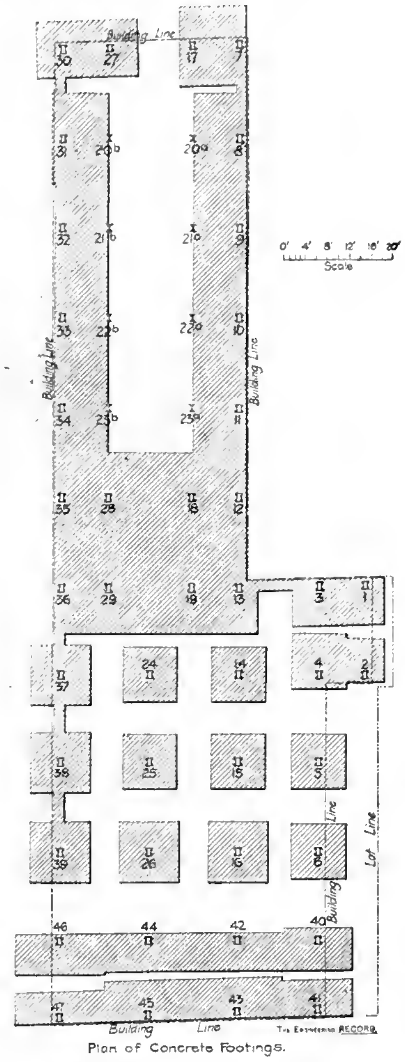
The finished basement floor level is 12 feet below the curb and it was originally intended to carry the excavation only about 6½ feet deeper and make the concrete footings of a uniform thickness of 1 foot. It was found, however, as the work progressed, that the surface mould was underlaid by muck which was not suitable to receive the footings and the excavation was continued through it to the earth and gravel below. The excavation did not extend to ground water level, and was not deep enough to require unusual provision for retaining walls. It was, however, made after the materials had been ordered for the columns and it was impossible to carry their bases to a lower level, therefore the whole excavation, up to the grillage beams, was levelled up with a solid mass of concrete not originally contemplated nor needed as a footing, which acts merely as a filler and reaches in some places, not shown on the accompanying drawings, to a depth of over 6 feet.

The arrangement of the concrete footings varies in different parts of the building, as shown in the general plan, but in general there is a continuous strip of concrete 27 inches wide and 1 foot thick under the outside walls which connects the adjacent footings, although this is omitted in some places. At the rear a footing from 6 to 8 feet wide and about 62 feet long extends across the lot and 5 or 6 feet beyond it at both ends and distributes on the earth the loads from the wall columns. Parallel to it and from 1 to 3 feet away in the clear, is a corresponding footing of similar dimensions for the first row of interior columns. These two footings are entirely separate except that they are connected by the grillage which they support. This is composed of 15-inch 60-pound transverse I-beams 12 inches apart on centers and about 16 feet long which are divided in three groups of 16 and one of 11 beams, separated 18 inches. Each group carries 80-pound longitudinal I-beams across it at each end to distribute on it the column load received through a cast iron pedestal 20 inches high with its base extended to rest across the flanges of all four longitudinal beams. By this arrangement each grillage beam becomes a double cantilever, unsupported and unloaded, in the center, between the two footings, and having the distributed loads of the footing reactions applied to the lower side and the concentrated loads from the distributing beams applied in the opposite direction to the upper side. The distributing beams are figured for a loading which consists of the reaction from the grillage beams distributed over the whole of their lower sides and the concentrated column load in an opposite direction in the middle of the upper side.

The next three transverse rows of interior columns have separate footings 10 feet square, on each of which is set a grillage of nine 12-inch 31½-pound transverse I-beams 9 feet long and 13 inches apart on centers. Across the centers of these beams there are four 15-inch 42-pound longitudinal distributing beams, 9 feet long and 10 inches apart on centers. The columns have cast iron pedestals 3 feet square and 14 inches high seated on the centers of these upper beams. Columns 1, 2, 3, and 4 have footings, grillages and distributing beams corresponding to those already described in the rear of the building for columns 40 to 47; the remainder of the footings are in the narrower front part of the building. Columns 7 and 17 are supported on the same 12x14½-foot footing which has grillage beams carrying distributing girders at both ends so as to provide for uniform and symmetrical loading from columns located at the opposite edges of the footing. The 10½x18½-foot footing for columns 27 and 30 has the centers of the sets of distributing girders set back 5 feet from the ends of the grillage beams but otherwise corresponds to the foundation last described.

The remaining twenty-four columns, 8 to 36, have their grillages supported on a continuous bed of concrete which forms a single U-shaped footing extending nearly the full length of the narrow front part of the building and having a width equal to the distance between building lines. The two branches of the U are 10 feet wide and 64 feet long with a clear space of nearly 16 feet between them. At one end they unite to form a solid rectangle 33 feet long and nearly 36 feet wide. It was under this footing that the excavation had to be made deeper than was originally intended, to reach soil of a satisfactory bearing capacity, and the space below the basement floor between the footings is backfilled with sand and earth thoroughly rammed in 12-inch layers. The surface of this footing is entirely covered by 94 24-inch 80-pound transverse grillage beams about 37 feet long and 12 inches apart on centers. They are divided into four groups of 16 beams each and two groups of 15 beams each. The 16-beam groups have double-web distributing girders across each end and the 15-beam groups have sets of longitudinal distributing beams across them at both ends and at two intermediate positions. In both cases the wall columns are supported over the extremities of the grillage beams and their loads are uniformly distributed over the concrete footings.





FOUNDATIONS OF THE PHILADELPHIA COMPANY'S BUILDING, PITTSBURG.

In each of the transverse rows which include wall columns 8, 9, 10 and 11, there are two light interior columns which extend only to the first floor and have their bases seated on brick piers which rest directly on the grillage beams. The corresponding interior columns 18, 19, 28 and 29, are of full size, extend to the top of the building and are seated on longitudinal beams which distribute their loads to all the grillage beams in their respective groups. All the grillage beams are thoroughly painted and carefully bedded in concrete or Portland cement mortar and are connected by cast iron separators and ¾-inch tie rods about 5 feet apart. Concrete is filled in solid in the spaces between all beam and girder webs and extends 4 inches beyond all their sides, ends and flanges so as to thoroughly enclose and protect them. Selected moist earth and sand was rammed around and above all groups of beams and all girders, and levelled at sub-grade where 6 inches of concrete was laid on it for the basement floor. All cast iron column bases are below the basement floor level and are enclosed in concrete like the beams and girders.

The building has 47 main columns reaching from foundation to roof, and eight short columns, which, as already mentioned, reach only to the first floor and have I-shaped cross sections made with a web plate and four flange angles. The main columns are all made with closed rectangular sections having two channels and two cover plates. They are made in three sizes, with 12-inch channels and 16-inch plates, with 15-inch channels and 16-inch plates and with 15-inch channels and 22-inch plates. Each column reaches from the basement to the ninth tier of beams in three sections, spliced 21 inches above the finished floor lines of the third and sixth stories with milled butt joints and two opposite plates 2½ feet long on top of the cover plates. These plates are shop-riveted to the lower and field-riveted to the upper sections of the columns. At the third floor splice where the sizes of the upper and lower column sections do not change, the milled ends of the column channels and plates are in direct contact, but at the sixth floor where the channels change from 15 to 12 inches there is a horizontal diaphragm plate ¾ inch thick interposed between the abutting ends to give bearing and distribute the pressure uniformly and the flanges of the smaller channels are fillered out to the width of the wider channel flanges.

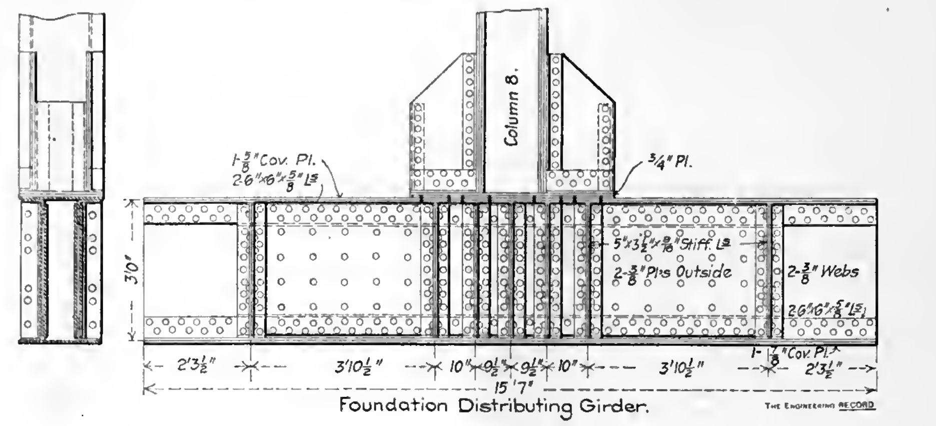
Columns 18, 19, 28 and 29 are designed for maximum loads and have 92½ square inches cross sectional area, made up with two 15-inch 40-pound channels, two 16x1-inch plates and two 14x¾-inch plates. In the lighter columns of the upper tiers the cover plates are omitted and the channels are latticed together, thus reducing the cross sectional areas to a minimum of 17.6 square inches. The columns are proportioned for a unit stress of 16,000 pounds per square inch, reduced by column formula, and the foundations are calculated for a maximum pressure of about 6,000 pounds per square foot on the earth.

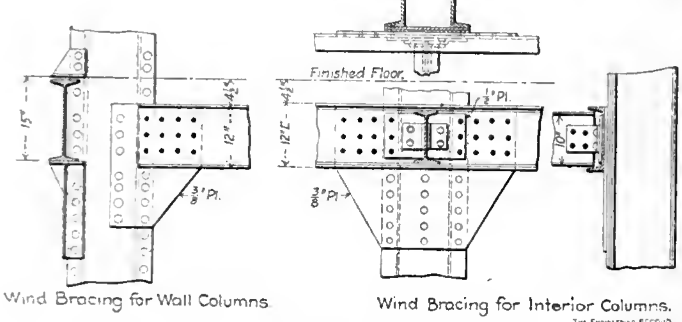
Columns 8, 9, 10, 11, 31, 32, 33 and 34 are seated on double-web distributing girders and are connected to their top flanges with vertical field rivets through long narrow base plates, as shown in the detail drawing. They distribute the column load by means of wide reinforced gusset plates on each side which extend the column base and practically increase the depth of the distributing girder. All other columns have base plates like that shown for column 7, which extend a few inches each side of the column face, and are seated on the cast iron pedestals below cellar floor level.

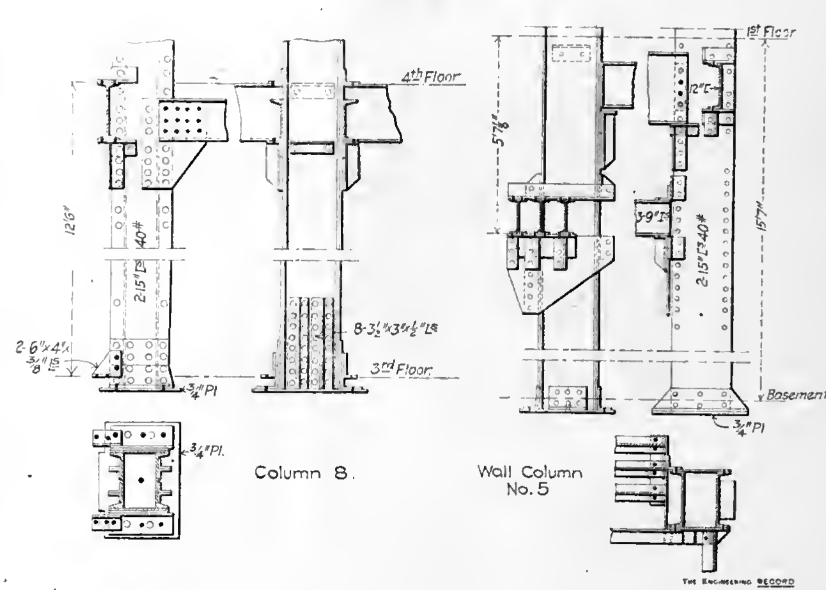
The location of the first tier of columns is shown on the footing plan. In the first and second stories the eight columns, 20, 21, 22 and 23 A and B, are omitted and the wall columns carry the whole superstructure and leave the full width of the building unobstructed in the narrow portion. Above the second story there are four columns, 20, 21, 22 and 23, midway between the pairs of wall columns 8-31, 9-32, 10-33 and 11-34 respectively. Except where the girders are used as wind braces the beams and girders are connected to the sides and faces of the columns in the usual way with horizontal angles across the upper and lower flanges and with the lower angles reinforced by vertical flange bearing and distributing angles, as shown on the column details.

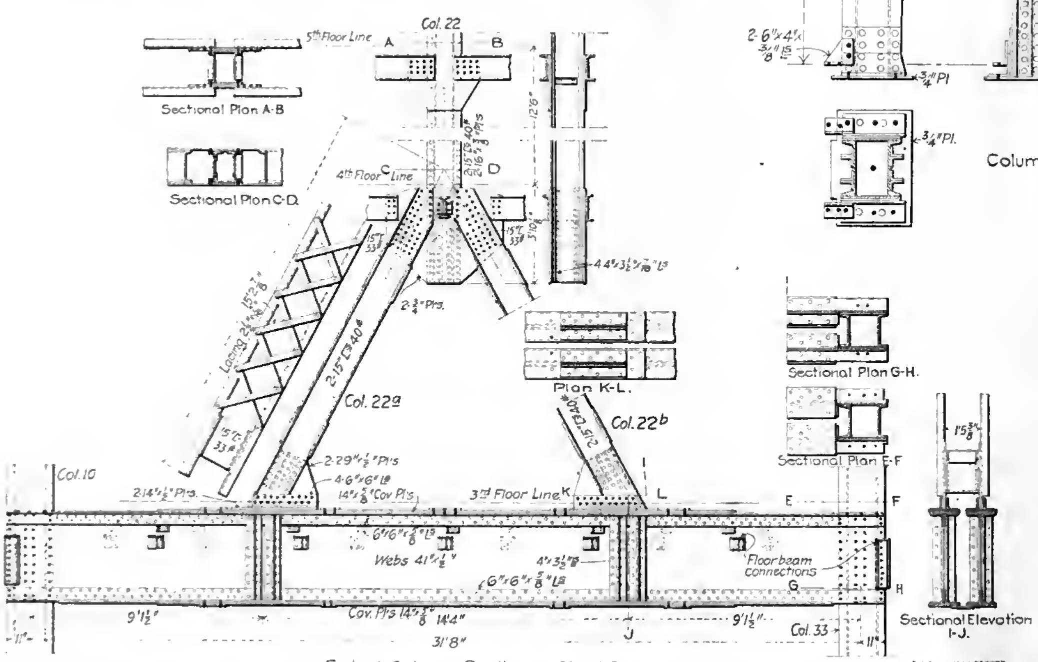
In each story, except a part of the third, the transverse floor girders, parallel to the short sides of the building are made double and have their column connections designed to resist lateral wind pressure and deformation of the transverse vertical panels of the columns and beams. This construction terminates at columns 13, 14, 15, 16, 42 and 43 and does not extend to the row of columns from 3 to 41. The special girders are in all cases 12-inch 30-pound channels with the backs of their webs riveted to gusset plates on opposite sides of the columns as shown in the wind bracing details. The channels are continuous across the interior columns; at the wall columns they are cut only long enough to take the regular rivets through the column channel flange. All the floors are of hollow brick proportioned for a load of 150 pounds per square foot except in the first story where it is 200 pounds and the beams are 12-inch 31½-pound I-beams about 5 feet apart and of about 16 feet span. The beams in the other floors are the same except that they are generally 10-inch 25-pound I-beams. The wall girders are 12 and 15-inch I-beams bracketed out from the faces of the columns as shown in the details.

In the basement there extends nearly from column 9 to 19 a fireproof vault with its axis coincident with the center line of the building. It is about 59 feet long and 16 feet wide and to insure its protection from falling bodies in case of a possible fire in the upper stories of the building it is covered, just below the first floor, by a series of 101 transverse horizontal 12-inch 31½-pound I-beams set 7 inches apart on centers and connected by tie bolts and separators, with the spaces between their webs filled with concrete to make a solid massive slab. Between columns 18, 19, 28 and 29 the vault wall construction is carried up to the roof, and independent fireproof vaults about 16 feet square are formed with special floors at every story.









Structural Details of the Philadelphia Company's Building.

A hall about 32 feet wide and 80 feet long and 24 feet high is provided free of obstructions in the front of the building by removing all interior first and second story columns opposite wall columns 8, 9, 10 and 11. The intermediate pairs of wall columns 8-31, 9-32, 10-33 and 11-34 carry the whole weight of the six upper stories which are now built over the hall and are proportioned to carry that of the seven additional future stories planned for. They are connected in the third floor tier by double plate girders which support the row of center columns 20, 21, 22 and 23 which, if the building is extended to the proposed height of fifteen stories will have maximum loads of 242 tons each. Carried in the center of a 32½-foot span these loads would produce heavy moments and it would be desirable to support them on trusses; these would require to be the depth of a story and would involve at least the obstruction of a full partition entirely across that story. This was architecturally undesirable and it was calculated that a plate girder shallow enough to be contained in the floor space without too deep a projection beyond the ceiling below would weigh about 20 tons. This was considered an extravagant use of metal and involved difficult and expensive erection work.

The problem was finally solved by terminating the columns at the fourth floor and carrying their loads from that point to the third floor girders by double inclined lower sections like pairs of batter posts or braces resembling an inverted V, as shown in the drawing of the assembled columns and girder. The distance between the feet of the inclined posts was made about 15½ feet from out to out so as to be as wide as possible and still clear the corridors in the sides of the building. The inclined posts are concealed in a partition through the center of the story so that no serious obstruction is occasioned, and the moments are very much reduced so as to effect a great saving of the metal employed to transmit the loads to the wall columns and permits the advantageous use of shallow plate girders. These girders are 3½ feet deep with solid webs and the usual I-shaped cross sections. The top flanges are flush with the third floor tier of beams and the bottom flanges project about 24 inches below the ceiling line and are enclosed in mouldings which divide the ceiling of the large hall into panels.

The girders are in pairs about 3 inches apart in the clear and are not connected by their flanges, which have entirely independent 14-inch reinforcement plates for each piece. The upper parts of the lower story wall columns extend up between the girder webs and terminate at the top flange where they have cap plates extending across the girder flanges to receive the bases of the third story sections of the columns. Each girder is connected to the wall columns by 40 single-shear rivets through each end of the web and through the column cover plate. The inner edges of the lower flanges of each pair of girders are connected by small tie plates and the upper flanges are connected by the inclined column sections. Separate base plates are shop-riveted on the top flange of each girder and have jaws made with pairs of wide connection angles which receive between their vertical flanges the connection plates which are shop-riveted to the webs of the inclined posts. The upper ends of the inclined columns are field-riveted to wide and thick jaw plates on the feet of the fourth story column sections. Each girder in the pair weighs about 6 tons and was easily hoisted about 30 feet and connected in place.

Although the present height of the building is only eight stories the upper tier of columns is three stories high like the rest and terminates at the standard height of 18½ inches above the ninth floor line. The ninth floor tier of beams corresponds with the other upper tiers and this floor and the ceiling below are built on it in readiness for the future extension of the building. The tops of the columns are covered by horizontal diaphragm plates and the upper tier columns can be readily connected to them by removing the diaphragms, cutting out the upper rivets in the cover plates and driving regular splice plate rivets in their holes.

An ordinary steel-frame roof house is built on the ninth story floor-beams in the front of the building; elsewhere there is a flat-pitched roof sloping transversely about 1: 24. The highest part of this roof is about 2 feet 9 inches clear above the finished ninth floor and it is supported by single 3½x3½-inch vertical angles set about 5½ feet apart on the transverse beams of the ninth floor tier. Seven longitudinal horizontal lines of 6-inch channels and I-beams are seated on top of these vertical angles. They have spans of about 16½ feet, are about 5½ feet apart and are spliced by double web plates close to each vertical. They are connected by tie rods about 2½ feet apart and support a hollow brick arch and tile roof. The tops of the vertical angles are braced transversely by single lines of 6-inch channels riveted across them just below the longitudinal I-beams and pitched to correspond with the slope of the roof.

Messrs. MacClure & Spahr, of Pittsburg, are the architects of the building and Mr. S. C. Weiskopf, New York, is the consulting engineer. The Thompson-Starrett Company, of New York, are the general contractors and the detail drawings for the steel superstructure were made under the supervision of Mr. George Simpson, assistant engineer, of their staff. The structural steel for the first eight stories weighs about 1,200 tons and was rolled by Carnegie Steel Company and fabricated by the American Bridge Company, Mr. Paul L. Wolfel, chief engineer.

The Central States Water Works Association Convention.

The sixth annual convention of the Central States Water Works Association, held in Indianapolis, was called to order September 23, by Joseph J. Pater, President, of Hamilton, O. Hon. Chas. A. Bookwalter, mayor of the city, welcomed the visitors. President Pater, after a brief response, referred to the objects of the Association, the necessity for constant vigilance in maintenance of a pure water supply, and the desirability for some measures being taken to remedy the growing evil of pollution of streams, which must always remain the principal sources of supply for towns and cities.

The convention was in session three days, and although there was considerable transpiring to distract attention, in the fact of the reunion of the Spanish-American war veterans and the reception to President Roosevelt, considerable business was done. A large number of new members were received and a new departure taken in admitting associate members to the same privilege of voting and holding office as enjoyed by the active members. It is expected that this liberal action will tend to greatly benefit the Association, which is already indebted to the associate members for many courtesies. A resolution was also adopted that the members so far as possible give preference to associate members in the purchase of supplies, other things being equal. The reports of the Secretary and Treasurer showed the finances of the Association in healthy condition. Mr. A. J. Pray, of the Pittsburg Meter Co., located at Columbus, O., reported upon a design for a button and certificate, both of which were approved and adopted. Mr. Fred Baker, of Evansville, Ind., offered some valuable suggestions looking to increase of membership, including the establishment of a bureau of statistics to be in charge of the Secretary. The suggestion was adopted and will be at once carried into effect.

Officers for the ensuing year were elected as follows: Joseph J. Pater, Hamilton, O., President; Frank J. Kelley, Cincinnati, O., Vice-President; Frederick Baker, Evansville, Ind., W. H. Glore, Covington, Ky., T. H. Morton, Nashville, Tenn., A. L. Holmes, Grand Rapids, Mich., S. F. Tompkins, Joliet, Ills., and O. G. Guyton, Sistersville, W. Va., State Vice-Presidents; Wm. Allen Veach, Newark, O., Secretary; Chas. E. Rowe, Dayton, O., Treasurer; C. H. Wiles, Delaware, O., Geo. F. Cooper, Xenia, O., Jerry O'Shaughnessey, Columbus, O., Executive Committee; T. R. Cook, Toledo, O., John Langan, Tipton, Ind., A. W. Inman, Massillon, O., Finance Committee. Dayton, O., was selected as the convention city for 1903.

Among the papers presented was one by Mr. John Langan, Tipton, Ind., on "Flushing the Mains." He places at the lowest point of his system 150 feet of 8-inch sewer pipe leading to the bluffs of an adjoining water-course; by opening a valve here and closing certain valves in the central portion of the city the current is changed through any desired line, and thus better results are obtained in flushing mains than through hydrants. Mr. Charles, of Lexington, agreed with the writer; he uses "wash-outs" and condemns flushing through hydrants.

Mr. C. E. Inman, Warren, O., presented a paper on "Automatic Sprinklers," discussing the proper charge for such service; users claim the sprinklers are not employed except in case of fire and should not be charged for any more than the general use of hydrants on streets is charged for in fires; also that the installing of sprinklers saves greater expenditure of water and labor of firemen by preventing progress of fires; and therefore no charge should be made. Manufacturers who take water for other purposes want this sprinkler service free because they pay for other water used; insurance people require a much larger main to supply sprinkler services, and object to meters as obstructing passage of water through services. The writer commented on the disadvantages attending sprinklers in the temptation afforded to surreptitious use of water, and thought on account of the large reduction in insurance rates users should pay for this protection. The discussion following indicated great diversity in practice as to charges for this class of service, some cities deriving no revenue at all from it. Messrs. McIlhenny, Cooper, Cook, Kelley, and Davis gave their experiences. The Indianapolis Water Company was charging $50 for 4-inch, $35 for 3-inch, $25 for 2-inch, and other cities were charging from $25 to $300 for such protection. Users in Indianapolis had acknowledged a saving of from $1,800 to $3,000 in individual cases. Care should be taken in putting in sprinkler systems that street mains are of sufficient size, and that in case of fires where walls fall the surrounding property shall not be cut off from water supply. As a result of this discussion a resolution was adopted that an equitable charge should be made by cities or private companies for such protection; and a similar resolution was carried calling for an equitable charge to be made for standpipes, private fire services, etc. It was conceded that in this latter case the unauthorized or surreptitious use of water was more likely to occur than with sprinklers.

Mr. J. R. Maxwell, C. E., of Hyde Park, Cincinnati, O., presented a paper on "A Method of Testing Wells Connected to the same Suction or Supply Pipe," describing a propeller wheel with spiral openings similar to those of the small electric fans in common use, with a solid rim made nearly the diameter of the pipe to be tested, leaving room enough to revolve freely without touching the inside of the pipe. A light steel rod is connected with the spiral wheel and carried up through cap to top of pipe; a meter is attached to register the revolutions of the spiral wheel.

Mr. S. A. Charles, of Lexington, Ky., read a paper on "Eighteen Years Experience in the Purification of Water," explaining his method of regulating mechanical filters applicable to smaller cities where because of the cost other systems are objectionable. He uses an auxiliary pump, driven by the main pump and maintaining a certain known ratio of velocity to the main pump, to inject a solution of sulphate of alumina of any required strength. He also employs æration to remove odor due to algæ or decomposing vegetable matter, his water supply being from a pond of still water. The water is delivered to the filters through a pipe or tube perforated with about 1,600 minute holes, through which it falls in spray on the filter below. One-third of a grain of sulphate of alumina per gallon was used on an average the year around; the cost per 1,000 gallons being one cent, covering all expenses. The bacterial efficiency was 98 to 99 per cent. He used only the very best grade of sulphate of alumina, the cheaper quality being useless.

Mr. F. A. W. Davis, vice-president of the Indianapolis Water Co., submitted a paper on "Fire Streams," prefacing it with the explanation that he had had his attention especially invited to this subject by reason of the bringing of suits against cities and private companies in event of fire losses on the ground of insufficient pressure and water supply. He gave figures showing amount of pressure required at hydrant to deliver through hose of a given length and throwing a stream a certain distance. He demonstrated the importance of using the least possible length of hose, and having nozzles the requisite size. Too small nozzles were often used, and hose improperly laid so as to increase friction. Firemen must also understand the proper use of fire hydrants, which were sometimes not fully opened. He suggested the feasibility of constructing larger fire engines of greater capacity to be placed on cars to run on street-car tracks, using motors to run the car and drive the pumps; such pumps to throw a stream of at least 3 inches. In the discussion following Superintendent Bosch criticized the employment by firemen of nozzles of ¾ to ⅞-inch, and the laying out of too much hose. Superintendent Cook, of Toledo, called attention to the improper handling of hydrant valves, and said he had exhibited a section of a fire hydrant in the fire headquarters at Toledo, accompanying it with an explanation to firemen how to use hydrants properly. Superintendent Pater commented on the mistake made by many cities in laying too small mains.

Mr. Marshall Leighton, Hydrographer, U. S. Geological Survey, Washington, D. C., presented a paper on "Stream Pollution and its Pecuniary Damage to Natural Water Resources," in which he reviewed the subject and invited the cooperation of all water works men in certain efforts the Government is now making which will tend to remedy the evil complained of. The following paragraph gives the kernel of the paper:

"It will be my endeavor as the official in charge of this new branch of the survey work to establish a system of co-operation with every chemical laboratory in the United States, wherever the analysis of water is conducted. It is desired to bring together the results of water examinations for study and comparison, such examinations to be made according to standard method, so that there may be uniformity of data. Coincident with this work the areas of special interest throughout the country will be taken up and studied. This has already been accomplished in the metropolitan district around New York. Similar work is now being carried on in the anthracite coal regions of Pennsylvania, and during the coming winter the drainage area of the Wabash river will receive attention. In the performance of this work I shall be glad to take counsel of the members of this Association and shall be grateful for any and all assistance."

The paper by Mr. C. W. Wiles, of Delaware, O., on "Street Sprinkling Wagons" was brief but very much to the point. He favorably mentioned the attachment of a meter to these wagons. A law has recently been adopted in Ohio placing street sprinkling in the hands of the city authorities and providing that by petition of 35 per cent. of the voters such streets may be ordered sprinkled as they desire, the cost for maintenance to be assessed on the tax duplicate.

Mr. A. L. Holmes, of Grand Rapids, Mich., gave a paper on "Submerged Pipe," most of which is reprinted elsewhere.

Appreciating the importance of the subject of electrolysis, at the suggestion of President Pater a motion was adopted to republish the papers contained in last year's proceedings of this Association on Electrolysis by Mr. Edwin P. Matthews, city solicitor, of Dayton, O., and Mr. L. Clifford Anderson, of Franklin, O. The latter gentleman gave a short address upon the general subject of electrolysis as affecting underground structures, and gave valuable advice to those who might be called upon to dictate terms of franchises to street railway companies looking to the protection of water pipe.

The Max Joseph Bridge in Munich, which is now rapidly approaching completion, is a three-hinge masonry structure with a clear span of 210 feet, a thickness of 3.45 feet at the crown, a rise of 19.7 feet from the springing to the crown and a rise of 26.2 feet from the abutments to the crown. It carries a 39.3-foot roadway with a 9.8-foot sidewalk on either side and has a total length, with approaches, of 298½ feet. Limestone has been used for all parts save the bearing stones of the steel hinges, which are granite. About 6,500 cubic yards of

concrete were employed. The foundations required 15,500 bags of Marienstein cement, and the arches 2,700 bags of Dyckerhoff cement. About 1,800 cubic yards of limestone were used in the arch. According to the "Centralblatt der Bauverwaltung," the bridge was finished, outside of the decorative features, in about 200 working days, and 600 men were employed during the work. Columns designed by Professor Fischer, of Stuttgart, will be erected at each end and provided with bronze bas-reliefs. The builders are Sager & Wörner; the engineer's name is not given.

The Sewage Disposal Works of Salford, England, deal with 2,000,000 imperial gallons of sewage daily. Chemical precipitation followed by filtration through clinkers is the purification process in use. The precipitants used are lime and sulphate of iron, each in the proportion of 550 pounds per million imperial gallons of sewage treated. From the sludge tanks 600 tons of sludge daily is forced by Tangye sludge pumps into a sludge steamer which carries it out to sea beyond the mouth of the Mersey. After passing through the roughing tanks and settling tanks, the settled liquid is distributed over the filters by means of brass sprinklers fixed at intervals on top of horizontal pipes crossing from side to side of each section of the filter beds at intervals of 8 or 10 feet. There are 4,500 of these sprinklers for the whole area of 26,000 square yards. They throw up the liquid in a hollow cone, the drops falling in a fine rain over a circle 4 or 5 feet in diameter. The upper stratum of the filter bed is composed of clinker which has passed through a ⅜-inch screen. At present it has a depth of 5 feet, but it can be raised to 7 feet. Below this is a bed of coarse clinker 1 foot thick, resting on concrete. Although the sewage of Salford contains much foul trade refuse, the results of the treatment just described are considered, according to "The Builder," to be very satisfactory, the effluent being odorless and clear, and averaging well within the standard of the Joint Board of the Irwell & Mersey watershed. Mr. J. Arnold is the engineer in charge.

The New Westinghouse Foundry at Trafford City, Pa.

The rapid growth of the affiliated Westinghouse industries was recently signalized by the creation of a new city and the building of another Westinghouse manufacturing plant. The new industrial center is located about 17 miles east of Pittsburg on the Pennsylvania Railroad and is to be known as Trafford City. Extensive factory sites have been laid out here to provide for the overflow of the several Westinghouse industries, a number of which have already used up all the available building room at their present locations and are still pressed for space. The first of the corporations to erect buildings in the new city is the Westinghouse Foundry Company, which is at present putting up the extensive foundry plant and pattern shop described in this article. This addition is necessitated by the rapidly increasing business of the Westinghouse Machine Company especially in connection with very large steam and gas engines and steam turbines. Before taking up the foundry itself, a short account will be given of Trafford City.

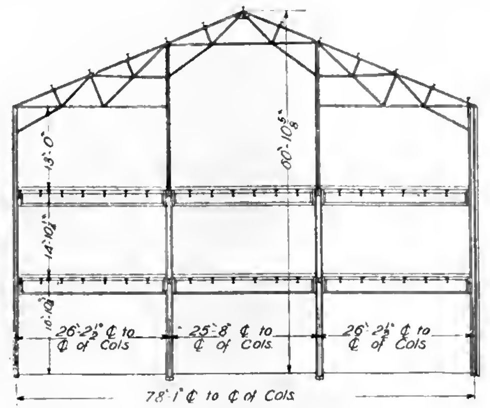
In laying out this city, provision has been made, not only for the factories that are to be erected there, but also for homes and all modern improvements and comforts for the men who are to work in the factories. The latter will be located on a fairly level area between the Pennsylvania Railroad and the residence portion of the city, which will be reached from the railway station by a steel viaduct 1,100 feet long. The residence district has been laid out upon hillsides and a generally level plateau, high enough above the factory sites to render it free from smoke and dirt. The city consists of two oblong areas, one of which is about ½ mile by 1/5 mile and the other ½ mile by 1/7 mile, the two areas meeting in such a way as to form a reversed letter L, the corner of which is the most northerly part. The town has been laid off into about 800 building lots, each with an average frontage of about 30 feet and a depth of 100 feet. In addition to this, space has been left for six parks. The entire town has been provided with waterworks and a sewerage system, the latter including separate storm water and sanitary sewers. This work, as well as the paving of the streets, was completed before the city was thrown open to settlement. The latter event, which took place on June 7, 1902, recalled in many ways the famous booms of the far West. Many of the intending purchasers of the lots came to the site of the future city a day before the sale was to commence and "squatted" on the ground which they wished to possess.

The new town is connected with Pittsburg by the Pennsylvania Railroad, over which there are 46 local passenger trains going each way daily and reaching the center of the city in from 25 to 35 minutes. In addition a street railway line has been built, connecting with the Pittsburg Railways Company's line at Wilmerding, 2½ miles distant. This street railway passes over the steel viaduct into Trafford City and forms a loop through the principal streets.

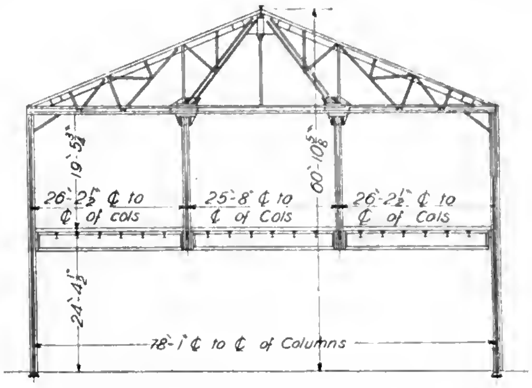
The factory site, located in a bend of Turtle Creek, provides room for nine factory buildings, each about 200x800 feet. A system of railway yards and tracks serving this area has been laid out in a very thorough manner, providing a track alongside of each building and transversely through each end. The storage tracks, in connection with this, occupy an area of about 300x200 feet. This system of tracks is connected with the main line of the Pennsylvania Railroad by the Turtle Creek Valley branch of the latter. It is, also, to be connected with the towns of Wilmerding and East Pittsburg, where the works of the Westinghouse Air Brake Company, the Westinghouse Electric & Manufacturing Company, and the Westinghouse Machine Co. are located, by an interworks railway which will be operated by the Westinghouse interests.

The new foundry and pattern shop of the Westinghouse Foundry Company, which, as stated above, are at present being erected, are located at the extreme southern portion of the factory site and near the steel viaduct mentioned above. The pattern shop and storage building, which has already progressed well toward completion, is a steel and brick structure 605 feet long and 80 feet wide, with a height to the eaves of the roof of 47 feet. The pattern shop occupies 160 feet at one end of this building. It is divided into two floors, the second floor being suspended from the roof trusses in order that the first story may be entirely free from columns, thus providing ample space for handling the largest patterns. The remaining 447 feet of the building is to be used for the storage of patterns and has three floors, the two upper floors being supported on steel columns and the entire space being divided by interior fire walls into three separate compartments. The foundations are of concrete and the superstructure of steel and brick. The foundation of the ground floor is made up of 8 inches of concrete into which the floor sleepers are bedded and on top of these is a layer of 2-inch maple flooring. The upper floors in both the pattern shop and storage building are supported on steel beams and steel girders, and are made up of 3-inch yellow pine flooring covered by one thickness of maple flooring. The roof purlins are steel I-beams spaced 8 feet center to center, and covered with 3-inch roof sheeting which is covered with slate.

The foundry building is 611 feet 8 inches long and 184 feet 3 inches wide outside of the brick walls, which are 36 feet high at the eaves and 80 feet at the peak. As in the case of the pattern shop, the foundations are built of concrete and the superstructure of steel and brick. The foundry is divided transversely into three bays, the center bay being 80 feet 3 inches wide between centers of columns, runways being provided for travelling cranes of 80-foot span and 150 tons lifting capacity. The cranes will be electrically driven. The two side bays are each 50 feet 6 inches wide from center to center of columns and are provided with runways for traveling cranes of 47-foot 2½-inch span and 50 tons lifting capacity. At one side of the foundry building runways are provided for yard traveling cranes of 100-foot span and a lifting capacity of 75 tons. The I-beam purlins are spaced 8 feet center to center and are covered with 3-inch yellow pine roof sheeting. The roof is covered with slate.

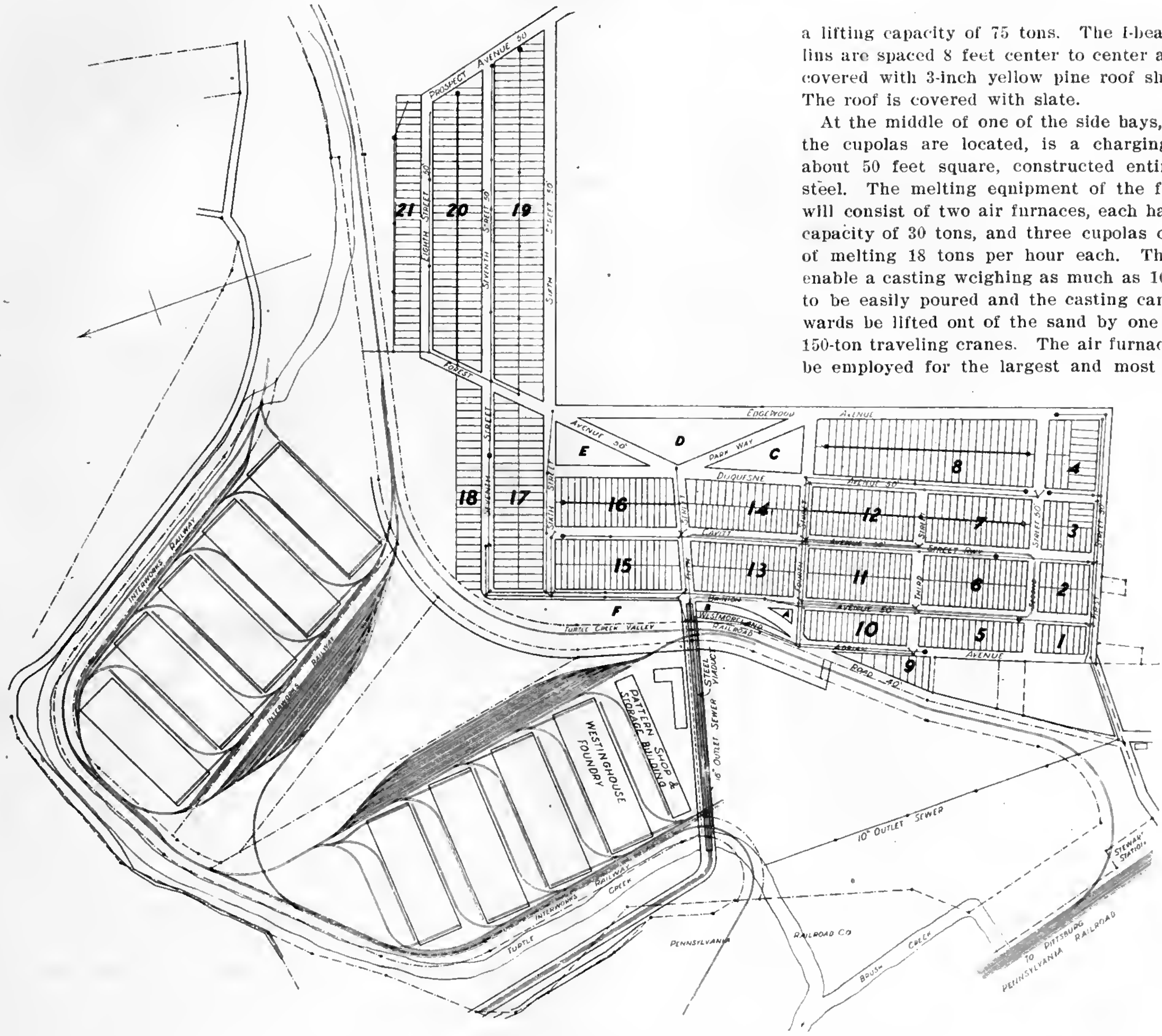


Pattern Storage.



Pattern Shop.

At the middle of one of the side bays, where the cupolas are located, is a charging floor about 50 feet square, constructed entirely of steel. The melting equipment of the foundry will consist of two air furnaces, each having a capacity of 30 tons, and three cupolas capable of melting 18 tons per hour each. This will enable a casting weighing as much as 100 tons to be easily poured and the casting can afterwards be lifted out of the sand by one of the 150-ton traveling cranes. The air furnaces will be employed for the largest and most important castings, owing to the fact that they yield a superior quality of iron, and the cupolas will be employed for the ordinary classes of castings, and particularly small castings. The building will contain every modern convenience known to the art, making possible the easy and economical handling of all materials, and it is expected to produce such castings as those re-



GENERAL PLAN OF THE SHOP PROPERTY AND RESIDENCE TRACT, TRAFFORD CITY, PA.

quired for the largest size of steam engines now in existence, with provision for possible increase in sizes for the future. Both buildings will be provided with automatic sprinklers for fire protection.

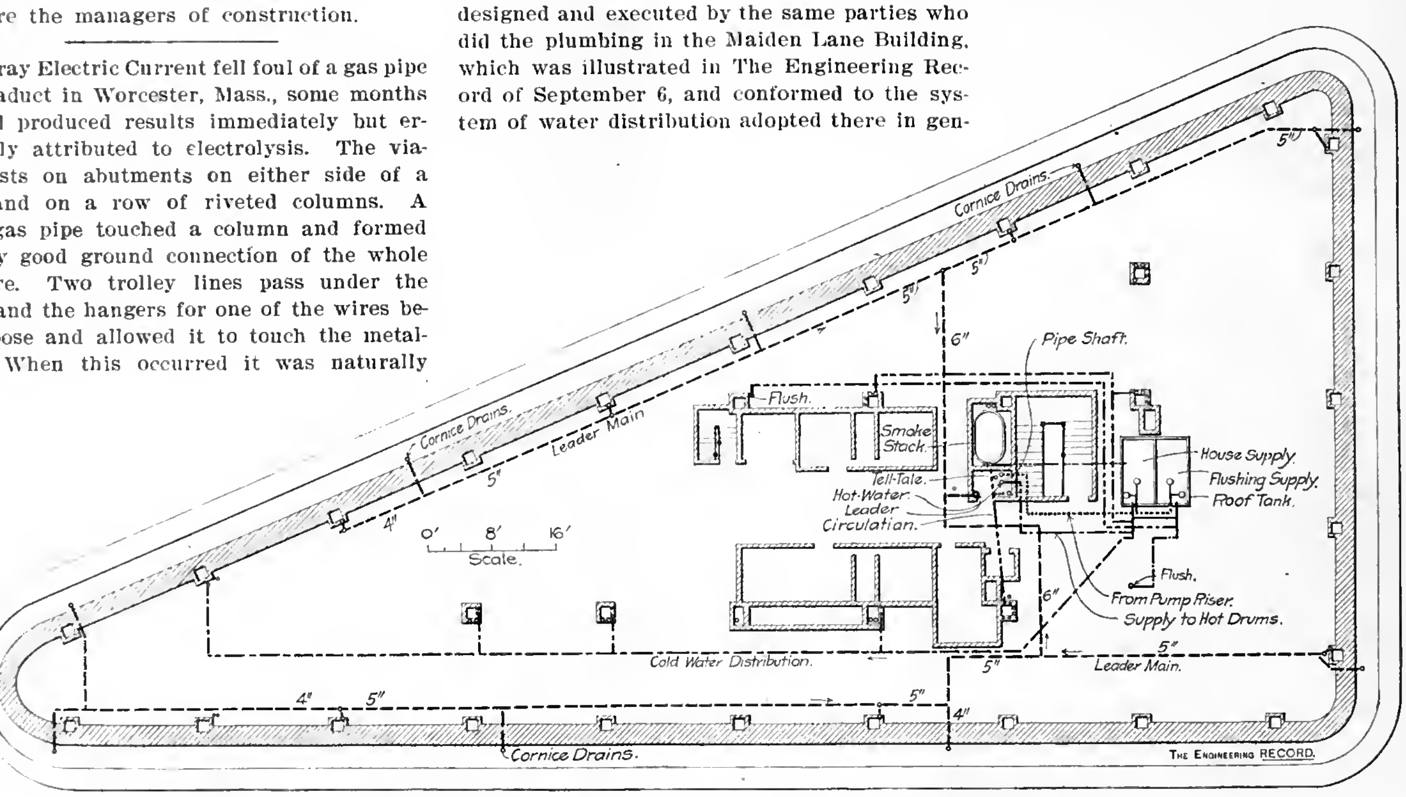
The buildings will be equipped throughout with modern lavatories and conveniences for the comfort of workmen and will be in every respect up-to-date. They will be heated by hot air, the foundry, pattern shop and pattern storage rooms to have minimum temperature of 50, 60 and 35 degrees Fahrenheit, respectively, in zero weather. Artificial light will be furnished by both arc and incandescent lamps. In order to insure plenty of light during the day, the windows are large and both the foundry building and pattern shop are provided with skylights of large area. The plans for the buildings were prepared under the supervision of the Westinghouse Machine Company. The Security Investment Company of Pittsburg is the financial agent and general contractor for the entire works, and Messrs. James Stewart & Company, of St. Louis, Mo., and Pittsburg, are the managers of construction.

A Stray Electric Current fell foul of a gas pipe on a viaduct in Worcester, Mass., some months ago and produced results immediately but erroneously attributed to electrolysis. The viaduct rests on abutments on either side of a street and on a row of riveted columns. A 2-inch gas pipe touched a column and formed the only good ground connection of the whole structure. Two trolley lines pass under the bridge and the hangers for one of the wires became loose and allowed it to touch the metalwork. When this occurred it was naturally troublesome to keep the circuit breaker in place in the power house, for a large part of the current was passing into the earth through the pipe. An investigation was started which showed that about 3 feet of the gas pipe was practically burned out and the cement in one of the joints was fused into glass.

Hand Sweeping Machines were used in Washington with marked success during 1901-02, according to the annual report of Mr. Warner Stutler, superintendent of the street cleaning department. Previous to the adoption of the machines, 210 men cleaned with hand brooms 1,565,800 square yards of street daily; with the machines the same force cleaned 1,920,400 square yards. The extra cost of cleaning this larger area was $3,265, but if the work had been done by hand it would have been about $18,910. The cost of cleaning per 1,000 square yards has been reduced from 18.6 to 15.8 cents. The machines were obtained from the Sanitary Street Cleaning Company of Washington at $6.25 per month for a year, after which period they passed into the possession of the District. The company kept them in good repair during the rental period.

Plumbing in the Flat-Iron Building, New York.

The Flat-Iron Building is so called from the peculiar shape of the lot it occupies at Broadway, Fifth Avenue and Twenty-second Street, New York. It covers all the space enclosed by their intersections, which is in the shape of a triangle with base and perpendicular of 86 and 171 feet. Each of the corners is rounded off to a radius of 8 or 10 feet, and the prominence of its location and the peculiar appearance of the wedge-shaped walls rising nearly 285 feet above the pavement in an isolated position, have given it much notoriety. It is a modern steel-cage office building and a perspective view and structural details of the framework were published in The Engineering Record of March 29. The plumbing requirements are the same as for other metropolitan office buildings, but as rentals in it will be very valuable pains were taken to reduce the space occupied by the water and sewage installation, and to simplify it, and some special features and details were introduced. This work was designed and executed by the same parties who did the plumbing in the Maiden Lane Building, which was illustrated in The Engineering Record of September 6, and conformed to the system of water distribution adopted there in general, but varied from it in arrangement and detail as well as in some essential features which will be described here.



PLAN OF COLD WATER DISTRIBUTION AND ARRANGEMENT OF LEADERS IN THE ATTIC.

In general, water for the upper stories is supplied downwards under tank pressure from distribution mains in the attic, and for the lower stories is supplied upwards under street pressure from a distribution main on the basement ceiling. These two systems are not cross connected and are both entirely independent of the fire system, differing in these respects and in the absence of distribution drums and individual waste and emptying pipes for the separate lines, from most office building systems in this city. Water is received from the street main through a 3-inch connection which is immediately enlarged to 4 inches and has two 3-inch branches, each of which is separately metered and valved to a 4-inch pipe discharging through two Ford ball cocks to the 4,000-gallon steel suction tank in the cellar.

From the suction tank a 5-inch pipe is run with branches to four Fairbanks pumps and is by-passed so that the supply can be taken direct from the meters without passing through the tank. One pump is for emergency use and has two 4-inch branches from its discharge; one of them connects with the stand pipe for fire purposes, exclusively, and the other discharges into the sewer from the rain water leader just beyond its main trap. It is used in connection with a special suction from the catch basin to empty it in case the automatic ejector is out of service. The other three pumps each have two 3-inch branches from their outlets. One of each pair is connected to the tank supply riser and the other to the boiler feed main. This arrangement makes the three pumps interchangeable and provides one for continuous house service, one for continuous boiler service and leaves the third in reserve. Each is controlled by a Utility governor connected to the steam valve so as to open and close it when the level of the water in the tank falls or rises beyond fixed limits.

The stand pipe has a 2½-inch outlet and 50 feet of hose in the corridor of every story and on the roof. It is exceptional in that it has no connection whatever with the house supply or boiler systems but has a branch to the street which terminates above the sidewalk in a Siamese connection for fire engines so that they can augment the supply or pressure if necessary. Check valves are set at the pump and inside the Siamese connection to prevent the escape of pressure into the street or through the pump.

The house pumps deliver through a 3-inch riser and four Ford ball cocks into a 4,000-gallon attic tank from which there are two 3-inch outlets, one to supply water for flushing the water closets and the other to supply all other fixtures above the second story. A separate supply is run to the hot water tank in the cellar and horizontal mains are run on the attic floor with vertical pipes down to the different groups of fixtures, each line being valved at the top and terminating at the bottom in the third story with a reverse bend which forms an air chamber about 2 feet high. These lines can be emptied through the lowest fixtures but are not connected or valved at the bottoms. The great height of the building produces a maximum tank pressure of nearly 150 pounds in the cellar and this is regulated to some extent by throttling the valves controlling the wash basins and slop sinks. Each of the two pipes supplying the flushing water for the water closets in the men's and women's toilet rooms has a pressure reducing valve set in a short vertical section of the pipe, offset from the main line to facilitate connections as indicated in the general diagram.

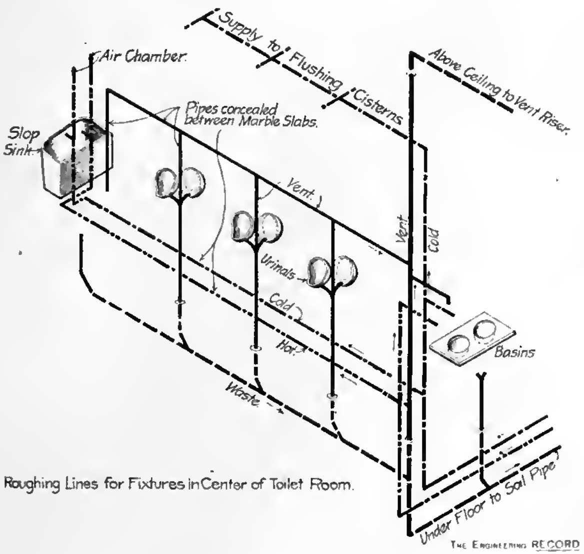
The cold water is supplied to the Mott heater with automatic steam regulating device, through a 2-inch pipe and the hot water is delivered from it through a single 1½-inch vertical pipe which has a branch at every story connecting with the different slop sinks, and the wash basins in the men's toilet room. As the riser is about 300 feet high provision for temperature expansion and contraction is made between floors by four equi-distant horizontal loops about 2 feet long and the pipe is rigidly supported in the middle of each section between loops. This is intended to limit the vertical displacement at any fixture to ⅛ inch. The diameter of the pipe decreases upwards and at the top it makes a return bend and runs parallel with itself back to the hot water tank where it is connected with the inlet and serves for return circulation. The upper end of the riser is vented over the attic tank and the return leg has four expansion loops corresponding to those on the riser, and has at the bottom a loosely swinging angle check valve set to stand open when no water is being drawn from the riser. Circulation in the return leg is promoted by taking from it branches to supply the fixtures in the women's toilet room, the barber shop and in the engineer's toilet room. A supply is taken from the basement main between the meter and the suction tank and run on the basement ceiling to connect with branches to all cold water fixtures below the third story.

All water, soil, waste and vent pipes are screw jointed galvanized iron except the short connecting lead waste branches and the exposed pipes at public fixtures which are of brass, nickel plated. All water pipes, brass work and valves below the seventh floor are extra heavy. All soil, waste and vent pipes were tested by being filled with water to above the roof level. All exposed pipes in the basement and cellar and all hot water pipes are jacketed with woolen felt, lap jointed, covered with insulated paper, waterproofed and enclosed in painted canvas. The hot and cold water risers are run behind the fireproofing of the columns and partitions and are supported by clamp collars, made in two flanged halves bolted tightly together to grip the pipe firmly just below a coupling sleeve, and having their extended flanges resting across the tops of the floorbeams. The 6 and 8-inch risers for the fire line and the leader system are supported at every floor by U-shaped collars with flanges bent out at right angles at both ends. The depth of the U is nearly as great as the diameter of the pipe and the flanges are drawn up close to the edge of a floorbeam by horizontal bolts with nuts on the flanges and hooks which engage the opposite edges of the upper flanges of the floorbeams. All valves have direction arrows on their hand wheels and are tested to 250 pounds pressure. Up to 2½ inches the body is of brass, above that diameter it is of iron.

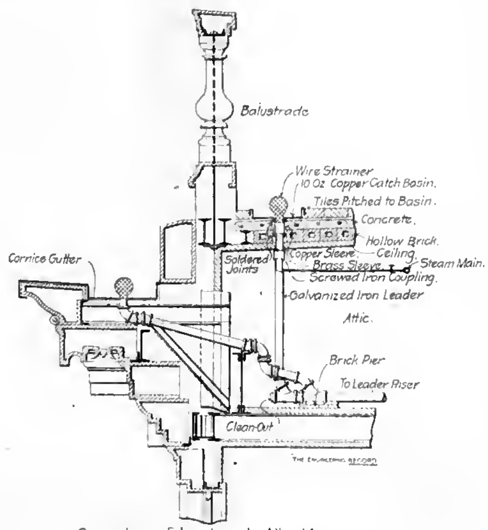
The roof tank is seated in a steel safe pan 4 inches deep, and has a wooden cover with hinged doors. It is made of ¼-inch steel and has a central partition dividing it into independent parts for the flushing service and for the general supply. Each portion of the tank is supplied through two 2-inch Ford ball cocks, and has a single 3-inch outlet, both outlets being connected outside the tank with a by-pass and valve which is usually closed. The centers of the 5-inch overflow pipes are set 3½ inches below the upper edges of the tanks, and they discharge into the top of the 8-inch leader pipe. There are no floats nor high and low water alarms or height gauge, but there is a pressure pipe to the pump governors and a ¾-inch tell tale pipe emptying in the engineer's sink. The tell tale, the pump riser and the down supply to the hot water tank are located accessibly in a pipe shaft reaching from cellar to attic and containing also the 6-inch fire line, the 8-inch leader pipe and steam, vent and soil pipes.

The supply from the street main is through a 4-inch cast iron pipe outside the building where it is buried in the earth. This connects with a screwed steel pipe which enters through an arched opening in the basement wall where the main sewer emerges. Inside the wall the pipe has two branches to 3-inch Worthington meters seated on a solid brick pier. From their outlets 3-inch branches are carried down to the floor at both ends of the pier and unite in a 4-inch main which passes under the floor to the suction tank. By this arrangement either meter can be thrown out of service without interfering with the supply.

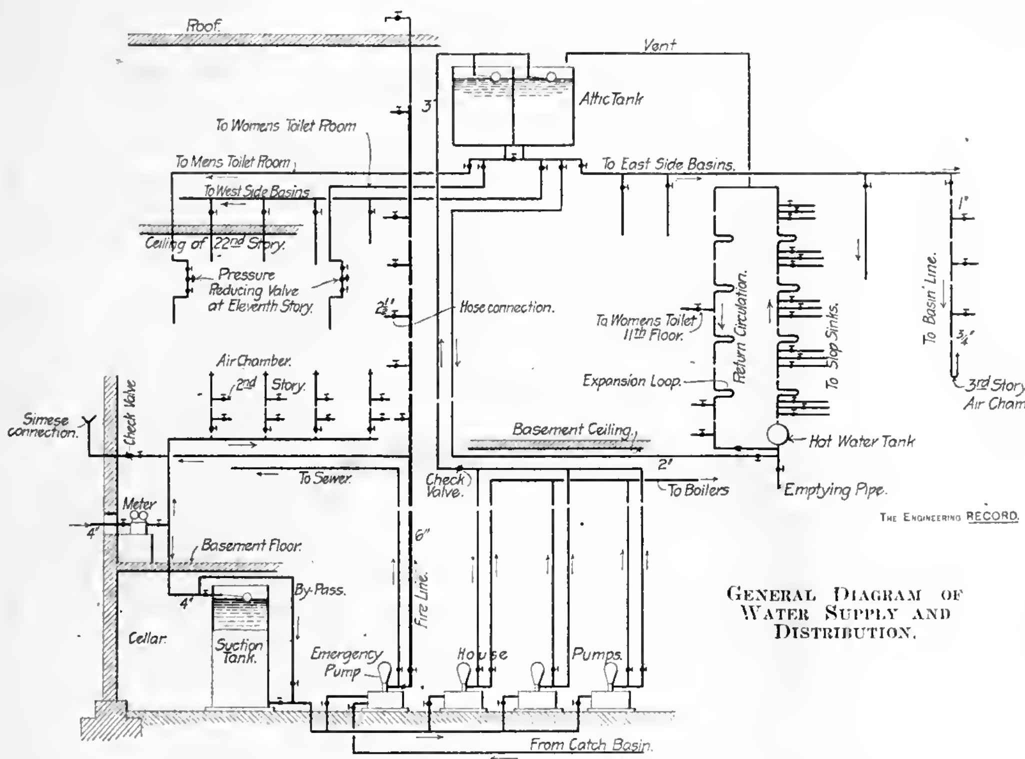
The toilet rooms are on the 11th floor, midway from top to bottom of building; the men's room has 32 water closets, six urinals, two wash basins and a slop sink, the women's has eight water closets and two wash basins. Each



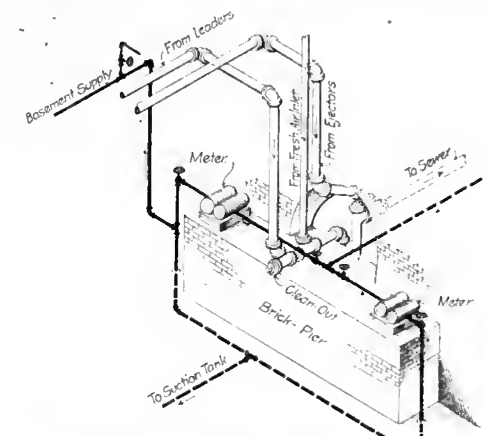
Roughing Lines for Fixtures in Center of Toilet Room.



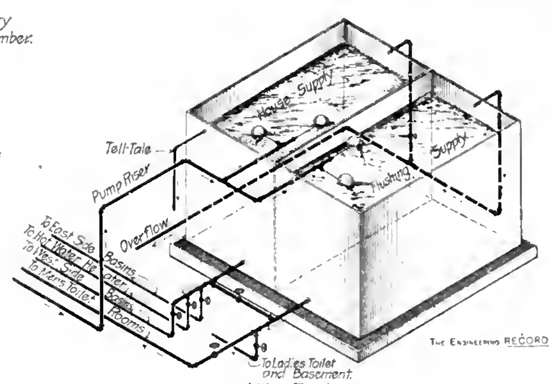
Connection of Leaders to Attic Main.



General Diagram of Water Supply and Distribution.



Arrangement of Meters and Running Trap for Leaders.



Attic Tank.

other floor has only a urinal and a slop sink, except in the basement where there is an engineer's toilet room with water closet, wash basin and shower bath. Each office floor has about a dozen wash-basins with provision for several additional ones if necessitated by subdivision of rooms or change of partitions. The toilet rooms are wainscoted and paneled with Italian marble and the wash basins, slop sinks and urinals on all floors have marble floor and wall slabs and marble tables with nickel plated legs. The total present number of fixtures includes about 49 water closets, 26 urinals, 20 slop sinks, 2 iron sinks and 275 wash basins.

The flat tiled roof is arranged with a number of summits from which the surface slopes in both directions to shallow copper lined basins in the center of each of which there is an outlet with a 4-inch soldered copper sleeve which connects with a brass ferrule and a sleeve coupling with a vertical branch. The vertical branch discharges through a Y into a collecting pipe which is supported on brick piers on the concrete floor of the attic. This pipe parallels the two long walls of the building and receives ten branches from the roof and nine from the cornice and connects with an 8-inch vertical pipe to the basement which enters the house sewer outside its main trap as shown in the drawings of the attic floor plan and of the meter connections. Just below the roof each pipe has a steam connection to use in thawing it out in case it should be stopped by ice. The drains from the gutter outside the balustrade, have to be made with offsets, as shown in the detail, to clear the roof and cornice girders. They are connected up similarly to those from the roof drains and their feet are accessible from clean outs. All soil and vent pipes are enclosed above the roof with pieces of lead soil pipes ⅛ inch thick. The upper end of the lead pipe projects above the top of the iron pipe and turns down 1 inch inside it. The lower end is soldered to a lead flashing 20 inches or more square.

All soil pipe branches from water closets and slop sinks are run between floor and ceiling and all their horizontal vent pipes are run between the ceiling and floor next above the fixture to the vertical pipe. In the eleventh story toilet rooms the soil and vent lines were set before the walls were plastered or the floors finished, and being arranged for so many fixtures made an attractive appearance on account of their symmetry and regular arrangement. The group of pipes in the center of the floor for the urinals, wash basins and slop sink were completely isolated from the rest which were arranged along the walls and are concealed between the marble back slabs of the urinal stalls. The waste and water supply pipes are run from the fixtures to the risers under the floor and the vent pipe is run to its riser above the ceiling. In every story extra openings are provided in the soil and waste lines and are plugged so as to allow for future connections if necessary. Corresponding plugged outlets are left in the hot and cold water lines.

The areas and cellar floor are provided with cast brass cesspools, having bell traps and 9x9-inch hinged strainer covers. These discharge to the ejector tank which also receives the soil and waste from the engineer's toilet room and the drip sink, etc. The cellar excavation was made in rock and considerable ground water was encountered which is collected in open jointed glazed tile drains which lead to a number of small brick catch basins below the cellar floor. These basins all discharge into a larger central basin about 30 inches in diameter and 5 feet deep which normally overflows to the ejector tank. The contents of the main catch basin can be discharged by the emergency pump into the leader waste outside its trap, but normally they overflow into the ejector tank and are automatically discharged into the same pipe between the sewer and the pump.

Messrs. D. H. Burnham & Company, Chicago, are the architects of the building and the George A. Fuller Company is the general contractor. The plumbing work was done by the Wells & Newton Company, Mr. John Mooring, foreman.

Tests of the Glasgow Tramways Engines.

In 1899, as may be remembered, The Engineering Record made a brief reference to the excitement that was aroused in Great Britain when it was recommended that the contract for the steam engine equipment for the new power-house of the Glasgow tramways be placed with an American firm and on a design based on American practice in power machinery for street railway service. The controversy over those transactions is now again brought to mind by a recently published report of tests of the completed engines, which by their extraordinary performance go far toward justifying the American design. It will first, however, be well to review briefly the early history of the subject.

At the initial letting, four firms tendered bids, and on the advice of the consulting engineer, Mr. H. F. Parshall, M. Inst. C. E., the Edward P. Allis Company, of Milwaukee, now of the Allis-Chalmers Company, was given the contract. When the matter came up for confirmation, however, so strong was the feeling that the work should not go out of the country, that finally it was given to Messrs. John Musgrave & Sons, Limited, of Bolton, Eng., on a specification similar to that under which the American bid was made. It was then found that they could not promise delivery within the required time, and eventually the work was divided between them and the Allis Company, as regards the large engines, and another contract was awarded to Messrs. D. Stewart & Company, of Glasgow, for two smaller engines.

Four main engines, each of 4,000 indicated horse-power at normal load, and two engines of 750 horse-power, were required. With regard to the main engines great surprise was manifested at the dimensions recommended by Mr. Parshall, and with which the Allis engine accorded, one of the bidders asserting that their design had only about 70 per cent. of the weight of the Allis engine. The Musgrave engines were modified, however, according to the American ideas, including enlarged bearings to reduce friction by lessened bearing pressure. Each engine has one high-pressure cylinder, 42 inches in diameter and two low-pressure cylinders, each 62 inches in diameter; the common stroke is 60 inches. The steam pressure is 150 pounds and the speed 75 revolutions per minute.

The tests were conducted by Prof. Barr, of Glasgow University, and are reported in "Engineering." He found that the Allis engines operated under a mechanical efficiency of 96 per cent., and at the remarkable steam consumption of 12.2 pounds of steam per indicated horse-power per hour. Incidentally it may be mentioned they were delivered a month before the specified time. They were guaranteed to work with 14 pounds of steam per indicated horse-power, while the Musgrave engines were restricted to 14.5 pounds per indicated horse-power hour. These engines, however, also exceeded their guarantee, using 13.4 pounds of steam per indicated horse-power hour in one case, and 13.2 pounds in the other; the steam consumption per brake-horse-power per hour was 13.9 and 13.6 pounds. The combined efficiency of both engine and generator was 93 per cent. and the mechanical efficiency of the engines, 96 and 97 per cent.

The Stewart engines are of the two-cylinder vertical cross-compound type and drive 500-kilowatt direct-current dynamos. They have a normal working load of 800 horse-power, but are capable of working continuously at 1,000 horse-power and for short periods at 1,200 horse-power. The cylinders are 22 and 44 inches in diameter by 42 inches stroke and the speed 90 revolutions per minute. The guaranteed steam consumption was 14.5 pounds per brake-horse-power hour and the combined efficiency, 92 per cent. According to two trials early in the year, one engine used 14.2 pounds of steam per indicated horse-power per hour, and the other 14.8 pounds. The combined efficiencies were 88.3 and 88.5 per cent. and the mechanical efficiencies of the engines, taking the efficiency of the dynamo as 94.6 per cent., were 93.4 and 93.7, respectively.

The By-Product Coke Oven continues to grow in favor in the United States, according to figures collected by Mr. Edward D. Parker. There were 1,165 such ovens in use at the close of 1901 and 1,553 under construction. The average production was a little over 1,000 tons per oven, about three times that of the beehive ovens during the same period. A little over half of the number in operation were run in connection with iron and steel plants, and a larger proportion of those under construction will be so operated. The total output of these ovens during 1901 is valued as follows: Coke, \$2,894,077; tar, sulphate of ammonia and ammoniacal liquor, \$1,029,876. The market for the by-products is stated to be good, and to show no signs of over-supply, a condition that opponents of this class of oven assert will surely follow their introduction.

The Filter Beds for purifying the water supply of Nuneaton, Eng., were described by Mr. J. S. Pickering, the waterworks engineer, at the meeting of the Association of Municipal and County Engineers held at that place last fall, substantially as follows: The water when pumped from the wells contains iron in solution, which oxidizes on exposure and produces a turbid appearance. The four filters by which this iron is removed have each an area of 200 square yards. They are composed of a depth of 3 feet of sand, under which is laid a 12-inch layer of granite chippings, the whole being supported on a false floor composed of special perforated tiles. The tiles are 16 inches square, and are laid loosely on rows of bricks so formed as to thoroughly drain the beds. The outlets from the beds are movable iron arms, which can be raised and lowered at will in order to regulate the head of water on the filters. When a filter requires cleansing the filtered water from another bed can be delivered into the bottom and utilized for upward washing, the dirt being discharged with the water through a swivel elbow pipe fixed immediately below the surface of the sand. The water from the filter-beds is conveyed through a 15-inch main, by gravitation, to the covered service reservoirs, which have a capacity of 800,000 imperial gallons. The walls of the reservoirs are built of brickwork and the floors are of concrete. The roof consists of a series of brick arches springing from brick arched walls. The floors and walls are rendered ¾ inch thick with cement mortar.

Insulators for Long-Distance Power Transmission Lines.

The following note relating to insulators for electric power transmission lines is taken from an interesting paper on the problems and difficulties of the transmission of power long distances, read by Dr. F. A. C. Perrine before the Massachusetts Institute of Technology and printed in the "Technology Quarterly" for June.

For potentials up to about 25,000 volts, where an insulator of 7-inch diameter is sufficient, there seems not much reason for the employment of anything except glass, unless the lines reach a size above half an inch in diameter, when its strength is deficient. For these lower potentials and lighter lines the good properties of glass are easily summarized. In the first place, it is cheaper by far; while not so strong as porcelain, it is, as has already been said, sufficiently strong for the purpose; its inspection is easier and surer, since it requires only a visual examination and a few taps of a hammer to ascertain its soundness in place of the tedious hign potential test necessary in the examination of porcelain. But having said this much, all has been said that is possible in favor of glass.

It is not true that glass is a better insulator than sound porcelain, nor is its surfaee so good in damp weather against surface leakage. The mechanical strength does not equal one-half that of porcelain, as has been proved by a long series of mechanical tests performed by dropping a steel ball from a height upon insulators of the two materials; temperature also affects it much more than porcelain and it is often found to crack simply from the effect of extreme changes of temperature.

The insulators for high voltage lines must be very large, for the reason that with a striking distance through the air of from 4 to 6 inches, great gaps must be provided in the path of the current. But above all a great creeping distance is essential. Insulators that are a perfect protection in the hardest rains fail utterly in clear weather when covered by smoke and soot, which allow small amounts of currents to escape and char away the pins or cross-arms. The compound insulator is very attractive, for the reason that it is easier and cheaper to make and handle two or three small parts rather than one large one, and in some cases the additional advantage has been sought of securing the good properties of both glass and porcelain by making parts of an insulator of each; but there is both a theoretical and practical fallacy in this type of design. In the first place, no dielectric is so strong as one entirely homogeneous. As the stress is passed from glass to porcelain, or vice versa, at the two surfaces the stress piles up as it were, and it is better if one believes in glass to rely upon it; or, on the other hand, to show faith in the porcelain used by employing it entirely.

From the pure standpoint of practice the insulator which must be cemented together is troublesome. The shrinking of the mastic leaves voids and produces strains; if cement be used, its slowness in hardening delays the work and requires large areas for setting out to harden any considerable number of insulators. The one other mastic in use is molten sulphur, which, while better as a mastic than cement, is still more liable to crack the insulators while they are being joined, and finally when exposed to light and air, frequently decomposes on the surface, producing sulphuric acid; and, finally, when current creeps over its surface following the acid, perhaps, catches fire and often results in the rupture and fall of the insulator. The insulator which will be entirely satisfactory for this use has not yet been found, but the diligent search made for it by some of our best engineers is resulting in its definition and will probably soon result in its production, not as an inspiration for a patent, but as a careful engineering conception.

Trade Publications.

A number of additions have recently been made to the useful series of bulletins issued by the Bullock Electric Mfg. Co., Cincinnati, as follows: No. 1,006, railway generators of 100 to 2,500 kilowatts capacity; No. 1,007, variable speed motors, a discussion of the different methods of securing variable speeds and of the motors best suited for various classes of machine tools; No. 1,009, multiple voltage, a full explanation of the Bullock system of control for variable-speed motors; No. 1,010, the electrical equipment of the shipyard of the Fore River Ship & Engine Co.; No. 1,014, Bullock motors applied to cold storage plants; No. 19, alternating current engineering, an account of its development. All these pamphlets are well illustrated.

The highly developed hydraulic ram known as the Foster impact engine, an improvement of the Rife ram, is described in a circular of the Power Specialty Co., 126 Liberty St., New York. It is guaranteed to have 60 to 80 per cent. efficiency, to work under a head of 2 feet, and to pump clear water from one source with a muddy supply from another without mixing the two.

The S. K. C. inductor alternator is described in Bulletin 128 of the Stanley Electric Mfg. Co., Pittsfield, Mass. Bulletin 123, previously published, explains the electrical technicalities of this machine, while the new pamphlet is a general explanation of its advantages and construction. It is well illustrated.

The Chapman Valve Mfg. Co., Indian Orchard, Mass., has issued a special catalogue of its electrically operated valves for steam and water power plants, water and sewerage systems, dry-docks and other works large enough to use power-driven gates. The catalogue is profusely illustrated.

Perrin, Seamans & Co., 57 Oliver St., Boston, have just issued a new catalogue showing their large line of tools and supplies for sewer, water-works and electric railway construction. The book contains over 300 illustrations, most of which are accompanied by short descriptive articles. As a reference book for contractors this catalogue will doubtless prove of much value.

The American Graphite Co., Cleveland, has issued a preliminary circular concerning a new paint for wood and metal called "Graphault." It is not claimed to be quick-drying, the merits claimed being elasticity and permanence.

The development of the Jeanesville pump is sketched in a 20-page pamphlet forming advance sheets of the general catalogue of the Jeanesville, Pa., Iron Works Co. The leading types now made are explained, with illustrations and tables of dimensions, and there are a number of illustrations of typical arrangements of pumping plants for underground stations. Other advance sheets describe the jet and surface condensers made by the company.

The Reynold silent chain gear, described in a new bulletin of the Link-Belt Engineering Co., Philadelphia, consists of a link chain made with teeth in six pitches and many widths, and cut sprocket wheels with teeth having straight sides. Every tooth in mesh in this gear is doing useful work, and the effect of wear in the chain is to change the point of contact of the teeth of the wheel and chain and not to decrease the number of teeth in contact. Numerous applications of the gear to motor-driven tools are illustrated.

The Ridgway system of belt conveyors is explained in a well-illustrated pamphlet issued by the John A. Mead Mfg. Co., 11 Broadway, New York. In this system there is a special belt designed to curve readily into a trough section, and an arrangement of idlers having a large horizontal pulley and smaller troughing pulleys some inches back of the former in order to curve the belt without any tendency to produce an angle bend.

The General Electric Company's latest bulletins are the following: No. 4,295, oil switches; No. 4,296, a switch for a system of remote control; No. 4,297, high-voltage, type H transformers; No. 4,298, the Thomson high torque induction meter. All are fully illustrated, and the last-named contains an interesting description of a new measuring device on which the attention of some eminent electricians has been long directed. The company has also issued a special volume of excellent engravings of electric hoists, covering all types for which steam has been used hitherto. The advantages of such apparatus have been recognized for many stationary purposes, but its usefulness in erecting buildings and other branches of contracting has not yet been appreciated.

A folder containing some illustrations of belt conveyors in large salt works has just been prepared by the Robins Conveying Belt Co., 21 Park Row, New York. These installations are particularly noteworthy, as the action of salt on most conveying apparatus is very destructive.

The Laidlaw-Dunn-Gordon Co., Cincinnati, has prepared a 120-page catalogue of air and gas compressors which, in addition to descriptions of the company's machines, contains a chapter on two-stage and multi-stage compression and many pages of useful tables for users of compressed air, some of them covering subjects on which it is hard to find tabular data, such as the sizes of air-driven pumps for different conditions, the air required for different numbers of drills at various altitudes, and the best ratios of steam and air cylinders to satisfy various requirements. The company has also issued a new catalogue of deep-well pumping machinery, and a bulletin on small two-stage straight-line compressors.

The John A. Roebling's Sons Co., Trenton, N. J., has published in an attractive morocco binding a little pamphlet of directions concerning the proper form in which to order wire rope and wire, so as to have the shipment made without delay.

The Crane Co., of Chicago, has issued a 161-page catalogue of valves, gates, specials, boiler accessories and other supplies for the steam fitter and plumber. It is a very complete book of convenient size and well bound. Its contents are so varied that a list of them would require more space than is available here. The sections on high-pressure piping deserve special mention.

The Goulds Mfg. Co., Seneca Falls, N. Y., has published a handsome book on power pumps for every class of service, from the tank pump in houses to the powerful machines for pulp mills and mine drainage.

A concrete catechism has been published by T. L. Smith, 134 Tenth St., Milwaukee, Wis., which ought to be in the hands—or heads—of all concrete foremen. It tells in the simplest language what is essential to securing a good product.

The Ashton Valve Co., 271 Franklin St., Boston, has issued a folder describing a new blow-off valve. This has a split piston fitting a cylindrical seat. When screwed down the piston is wedged tight in the chamber, and when screwed up the wedge is drawn up first so as to allow the piston to rise freely out of the way of the discharge.

Personal and Obituary Notes.

Mr. James A. Omberg, Jr., has been appointed city engineer of Memphis, Tenn., succeeding Mr. A. T. Bell, resigned.

Mr. A. F. Doremus, state engineer of Utah, and Mr. F. C. Kelsey, former city engineer of Salt Lake City, have formed a partnership, with offices in the McCormick Block, Salt Lake City, for the construction of water-works and irrigation works.

Mr. George W. Birdsall for 32 years with the water department of New York City and for 20 years its chief engineer, has been appointed consulting engineer of the department, which is now the Department of Water Supply, Gas and Electricity. He is succeeded as chief engineer by Mr. Nicholas S. Hill, Jr. Mr. Hill is probably best known as engineer for the Electrical Subway Commission of Baltimore, and later, in 1897, as chief engineer of the Baltimore Water Department. Of late he has been conducting a private practice.

Mr. J. F. Wallace, past president of the American Society of Civil Engineers, for many years chief engineer of the Illinois Central Railroad, and since January, 1901, assistant general manager of that road, has been appointed general manager with headquarters in Chicago. Mr. W. J. Harahan, Assoc. M. Am. Soc. C. E., chief engineer of the road, succeeds him as assistant general manager, and Mr. H. U. Wallace, superintendent of the Freeport division of the Illinois Central Railroad, becomes chief engineer, succeeding Mr. Harahan. Mr. J. F. Wallace, who, by his steady advancement into executive positions has frequently been held as an exponent of the growing practice of installing the engineer into positions of business management, has filled a succession of responsible railway engagements since 1879, when he was elected chief engineer of the Burlington, Monmouth & Illinois Railway. Mr. Harahan began his railway career in 1881 as messenger and clerk in the superintendent's office of the Louisville & Nashville Railroad, and in 1899 was appointed engineer of maintenance of way on the Chesapeake & Ohio Railroad, from 1890 to 1892 was in charge of structures on the Baltimore & Ohio Southwestern, and in 1892 entered the service of the Illinois Central Railroad. Mr. H. U. Wallace entered upon railroad work in 1888, and began with the Illinois Central in 1894, serving successively as assistant engineer, roadmaster, assistant superintendent and superintendent.

The following candidates for the various grades of membership in the American Society of Civil Engineers were announced elected October 1. Members: Percy Allan, engineer, Pyrmont bridge, Sydney, New South Wales, Australia; G. J. Bell, county surveyor and bridge master, Carlisle, Eng.; G. H. Binkley, engineer and manager, Railway Dept., Kohler Bros., Chicago; George Bowers, city engineer, Lowell, Mass.; F. E. Crane, city engineer, Amsterdam, N. Y.; Harvey Farrington, Croton-on-Hudson, N. Y.; J. W. Kendrick, city engineer, Birmingham, Ala.; C. H. Kluegel, chief engineer, Oahu Railway & Land Co., Honolulu, H. I.; T. H. Mather, chief engineer for C. D. Beebe, Syracuse, N. Y.; F. B. Sanborn, prof. Civil Engineering, Tufts College, Mass.; F. E. Schall, bridge engineer, Lehigh Valley R. R., South Bethlehem, Pa.; G. W. Sublette, city engineer, Minneapolis, Minn.; Fred Thompson, civil engineer, U. S. N., Norfolk, Va.; C. H. West, chief engineer, Mississippi Levee District, Greenville, Miss.; R. C. Young, chief engineer, Des Moines, Iowa Falls & Northern Ry., Iowa Falls, Ia. Associate members: Ralph Albree, partner with Chester B. Albree, Allegheny, Pa.; R. W. Carter, assistant engineer, Missouri Valley Bridge & Iron Works, Leavenworth, Kan.; A. A. Conger, assistant engineer, Michigan Lake Superior Power Co., Sault Ste. Marie, Mich.; D. T. Corning, assistant engineer, Troy Water-Works Extension, Tomhannock, N. Y.; W. R. Craig, engineer, maintenance of way, Pittsburg, Shawmut & Northern R. R., St. Marys, Pa.; F. O. Dufour, assistant professor, Civil Engineering, Univ. of Cincinnati, Cincinnati; G. H. Fenkell, civil engineer to Comm. of Water Works, Erie, Pa.; F. L. Ford, city engineer, Hartford, Conn.; R. E. Griswold, assistant general agent, New Trinidad Lake Asphalt Co., Port of Spain, Trinidad, B. W. I.; L. W. Hall, chief draftsman, U. S. Engineer office, Tuscaloosa, Ala.; F. E. Lane, resident engineer, Atlantic Ave. Improvement, Brooklyn, N. Y.; N. B. Livermore, private practice, San Francisco; D. A. MacCrea, division engineer, Choctaw, Oklahoma & Gulf R. R., Guthrie, O. T.; L. H. Mattair, sanitary engineer, Matanzas, Cuba; H. F. Nichols, manager, James Hill & Sons, Adelaide, So. Australia; E. P. Ramsay, assistant engineer, Rapid Transit R. R. Comm., New York; C. L. E. Schenk, contracting engineer, Tate, Jones & Co., Pittsburg, Pa.; W. F. Steffens, with New York Central & Hudson River R. R., New York City; W. A. Tyrrell, engineer for E. P. Maule, Jr., St. Louis, Mo.

Attention to Water Gates between the high and low-service gates of the Brooklyn, N. Y., water-works has resulted in an important reduction in the high-service pumping. Mr. I. M. De Varona, chief engineer of the department, refers particularly to these results in a recent report as an illustration of the economy attainable by an intelligent study of water distribution and a careful adjustment of the boundary between districts having supplies under different pressures.

Traction on Highways was the subject of a long report to the Engineering Section of the recent convention of the British Association. The general conclusions are that the resistance to traction comes from three independent sources, axle friction, rolling resistance and grade resistance. The last is known to be 20 pounds per ton for a 1 per cent. grade. Axle friction has nothing to do with the surface of the road, and varies with the material of the parts and the lubricant. It is nearly independent of the velocity, but varies inversely as the load. With good lubrication, it is about 2 per cent. of the axle load with light carriages and 1½ per cent. with heavy carts. The tractive force required to overcome axle friction is about 3 to 3½ pounds per ton of axle load for ordinary wagons. The rolling resistance varies with the diameter of the wheel, the width of the tire, the speed, the presence or absence of springs and the nature of the road surface. The rolling resistance increases with the velocity owing to the effect of the shocks or concussions produced by the irregularities of the road surface. It requires from two to eight times as much force to start a vehicle as to keep it in motion at 2 or 3 miles an hour. The committee credits Prof. I. O. Baker with furnishing much valuable experimental data.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvii, xviii and xxvii.

WATER.

Providence, R. I.—Local press reports state that a 12-in. main is to be run through Park Ave., replacing smaller pipe for the supply of water to the western part of the town of Cranston.

Newport, R. I.—See "Government Work."

Troy, N. Y.—Bids are wanted Oct. 15 for building 1 gate house with fixtures and appurtenances and laying approximately 120 ft. of 20-in. cast-iron pipe. John Phelan, Comr. of Pub. Wks.

Baldwins, L. I., N. Y.—The contract for constructing the Millburn pumping plant has been awarded to Henry R. Worthington for $51,000, and the contract for 2 boilers to Edwin Burhorn, of Brooklyn, for $11,400.

Pittsburg, Pa.—The Pennsylvania Water Co. is stated to have awarded the contract for constructing a storage reservoir of 6,000,000 gal. capacity on a high point near Wilmerding to the T. A. Gillespie Co., Pittsburg.

Canajoharie, N. Y.—The Fultonville Water Co., of Canajoharie, has been incorporated, with a capital of $30,000. Directors: David Gring, Newport, Pa.; Mark E. and S. S. Johnson, of Canajoharie.

Troy, Pa.—Local press reports state that the Boro. Council has decided to accept the offer of the Troy Water Co. to sell its plant to the Boro. for $25,000, with the reservation of the reservoir, two wells near the power house, windmill and one line of pipe of minor importance.

Erie, Pa.—The Bd. of Water Comrs. is reported to have engaged Geo. H. Fenkell, of Detroit, Mich., to make surveys for the extension of the intake water pipe across the Peninsula and into the lake from where the city water supply is to be pumped.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Oct. 18 for furnishing cast-iron specials, as advertised in The Engineering Record.

McRae, Ga.—Moore & McCrary, Engrs., of Atlanta, Ga., have the contract for furnishing labor and material necessary to complete the water works, their bid at $15,000 being the only one received Sept. 23.

Lynchburg, Va.—City Surveyor M. H. Garland is making surveys of the route for a line of pipe with which it is proposed to supply water from Pedlar River in Amherst Co., by means of gravity.

Berryville, Va.—D. G. Adelsberger, of Baltimore, has prepared plans for the improvement of the water works, which call for a new 600,000-gal. reservoir at Mountain Springs and a new 2,500,000-gal. reservoir on the west side of town.

Graham, Va.—Town Recorder O. A. Metcalfe writes that the contract for constructing water works was let Sept. 29 to Fred. Minshall, of Greenwood, S. C., on his bid of $17,300, work to begin at once. Capacity of plant will be half a million gallons per day.

Lima, O.—An ordinance before the Council provides for the issue of $150,000 bonds for the construction of a storage reservoir.

Springfield, Ill.—The Council has adopted an ordinance providing for the placing of water meters (to be furnished by the city) on all service pipes in the city, not later than Jan. 1, 1904.

Sweet Springs, Mo.—Water and electric light bonds to the amount of $12,000 are reported to have been sold.

Webster Groves, Mo.—At the special election held Sept. 30, it was voted to issue bonds not to exceed $50,000, for installation of a system of water mains within the city limits.

Chicago, Ill.—The lowest bid received for constructing the foundation for the superstructure, pumps and intake for 39th St. pumping station is stated to have been from John P. Agnew at $215,000.

Colby, Wis.—Bids will be received by the Mayor and City Council until Oct. 14 for furnishing machinery, apparatus, material and supplies for water works and electric light plant, as advertised in The Engineering Record.

East Dundee, Ill.—Bids are wanted Oct. 21 for constructing a standpipe and engine and pump, as advertised in The Engineering Record.

Elgin, Ill.—The City Council has passed an ordinance providing for the issue of $64,000 bonds for the purpose of changing the supply of the water works system from Fox River to artesian wells. Wm. F. Sylla, City Clk.

Kirkwood, Mo.—The contract for constructing water mains is reported to have been let to Geo. Stuckey, for about $30,000.

Grossdale, Ill.—The contract for installing 9 miles of pipe for the water works system is reported to have been let to John M. Healy, of Chicago, for $51,200.

Howell, Ind.—The Town Bd. has granted a franchise for water works to G. H. Williams and E. J. Ellis, both of the Evansville Gas & Electric Light Co. Estimated cost of plant to be installed, $32,000.

Armada, Mich.—Bonds to the amount of $4,000 have been voted for water works.

Des Moines, Ia.—Local press reports state that the Des Moines Water Co. will lay 8 miles of new mains this fall.

Slater, Ia.—Bids are wanted Oct. 10 for drilling and completing a well.

Mt. Clemens, Mich.—Bids are wanted Oct. 17 for a 3,000,000-gal. pumping engine. Henry C. Benton, City Clk.

St. Louis, Mo.—Bids are wanted Oct. 11 for a high pressure system of water pipes for fire protection at the World's Fair, as advertised in The Engineering Record.

Abingdon, Ill.—Hydraulic Engr. Geo. Cadogan Morgan, Royal Insurance Bldg., Chicago, Ill., writes that water works contracts (bids opened Sept. 23) have been awarded as follows: To Stilwell-Bierce & Smith-Vaile Co., Chicago, deep pumping engine and cylinder, $776; to Washington Steam Boiler Wks., Chicago, steel work of water tower, $1,496; to J. A. Miller & Bro., Chicago, cornice, etc., for $156; to Jones & Laughlin, Chicago, eye beams, for $48.50; all other materials in detail and masonry and brick work by local contractors; the boiler and heater bids under advisement. About 5 miles of water mains to be let late this fall or early in the winter.

Tryon, Okla. Ter.—The Tryon Townsite & Water Co., of Tryon, has been granted a charter for five years, with a capital stock of $2,500. The incorporators are: A. M. Jines, of Ochiltree, Tex.; R. B. Queen, of Guymon; H. L. Huber, and others, of Tryon.

Quanah, Tex.—Local press reports state that water works bonds have been voted and a system is about to be constructed.

Marshall, Tex.—The City Council has passed an ordinance authorizing the issue of $15,000 bonds for the betterment of the water works.

Gueydan, La.—Local press reports state that the Comrs. of Gueydan Drainage Dist. have accepted the report of Engr. Arsene Perrilliat, locating all main canals and branches. The canals will be about 25 miles long, and from 25 to 40 ft. wide at the bottom, with a depth of from 2 to 4½ ft. It is stated that bids for said work will be received until Nov. 4, the work to consist of about 500,000 cu. yds. of mud free from stumps, and about 43,000 cu. yds. to be done with dredge or scrapers.

Biloxi, Miss.—Engrs. Kirkpatrick & Johnson, of Jackson, Miss., write that contracts for furnishing pipe, etc., (bids opened Sept. 16) have been awarded as follows: 7 miles of 8 to 4-in. cast-iron pipe to U. S. Cast-Iron Pipe & Fdy. Co., Chattanooga, at $32 to $34 per ton; hydrants and valves to R. D. Wood & Co., Philadelphia; pipe laying to Thos. Wagner, of Mobile, Ala., at 11 cts., 12 cts. and 13½ cts., respectively, for 4, 6 and 8-in. pipe; connecting service pipes, to Martin Haas, Biloxi, at $2.35 each.

Belzona, Miss.—The Consumers' Light & Water Co., of Belzona, has been incorporated with a capital of $100,000. Incorporators: Stephen Castleman, Jonas H. Levy and Sam Hyman.

Beaumont, Tex.—The Iowa Irrigation Co., of Beaumont, has been incorporated, with a capital of $200,000. Purpose, to construct, maintain and operate dams, reservoirs, lakes, wells, canals, ditches, flumes, feeders, laterals, sluices and other necessary appurtenances for the purpose of irrigation, navigation, mining, milling, stock raising and city water works, in the Counties of Newton, Jasper and Orange. Incorporated by C. P. Bratuober, of Waterloo, Ia.; W. A. Dugane, of Cedar Falls; H. W. Potter, of Beaumont, and others.

Morgantown, Ky.—The contract for putting in a water works plant for this city is reported to have been awarded to the Howe Engine Co., of Indianapolis, for $9,000.

Searcy, Ark.—Owen Ford, of St. Louis, Mo., is reported to have prepared estimates for a water system; the issue of bonds for said improvement is under consideration.

Diamond, La.—The Doullut Canal Co. has been chartered with a capital of $40,000.

Duncan, Ind. Ter.—The City Council is stated to have granted to Mr. Daube a franchise to put in water works.

Houston, Tex.—The City Council has adopted a resolution notifying the Houston Water Co. that at the expiration of its present franchise Nov., 1903, there would be no renewal and asking it to fix a price on the property to the city; the resolution provides that in case the company does not comply with the demand to fix a reasonable price the city is to proceed with the building of a new plant.

Elma, Wash.—This city has decided to sink an artesian well to a depth of 500 ft. for the purpose of increasing the city water supply. F. E. Tompkins, City Clk.

San Pedro, Cal.—The Bd. of City Trus. has authorized City Attorney Karr to confer with the officers of the Seaside Water Co. and formulate a franchise for furnishing water and lights that will meet the requirements of the city and be satisfactory to both parties.

San Bernardino, Cal.—City Engr. Rasor has submitted to the Bd. of City Trustees the following estimates of the cost of acquiring possession of and completing a municipal water system: Cost of Hubbard water and laying pipe line from Lord gate to reservoir, $67,000; new 10-in. main, from reservoir to city, enlarging reservoir and complete piping of the city, $95,832; high-grade pumping plant and 3 deep wells on "ant hill" tract, including twenty-two acres of land and piping, supplementary supply to connect with city system, $67,112; cost of same plant on Baldridge tract, including purchase of five acres of land, $65,801; total cost of water system, using "ant hill" plan as the supplementary supply, $229,944; total cost of water system, using Baldridge plan, as the supplementary supply, $228,633.

Meeteetse, Wyo.—A vote will be taken on the proposition to issue $17,000 bonds for the improvement and enlargement of the city water system.

Toledo, Ore.—The Toledo Water & Electric Light Co., of Toledo, has been incorporated with a capital stock of $10,000; incorporators, Thos. Leese, Wm. S. Carth and B. F. Jones.

Mancos, Colo.—Local press reports state that it is proposed to put in a municipal system of water works.

Debeque, Colo.—The question of constructing a system of water works is under consideration.

Aberdeen, Wash.—J. L. Stannard, of Seattle, is said to have been engaged to advise the city authorities concerning water system improvements.

La Junta, Colo.—According to local press reports farmers along the line of the Otero Canal have voted to bond the ditch for $300,000. The city of La Junta will contribute $100,000, making in all $400,000 to be used in the purchase of water rights and the construction of a reservoir.

Sterling, Colo.—Preliminary surveys are stated to have been made for the proposed gravity pressure water system to be built for this city at a probable cost of about $50,000. Water to be brought from Springdale, 5 or 6 miles from the city.

Silver City, N. Mex.—J. A. Harlan is reported to have submitted to the city officials plans for the construction of a breakwater dam for the prevention of floods. Estimated cost, $17,000.

Los Angeles, Cal.—Local press reports state that the Bd. of Water Comrs. recently awarded contracts, amounting to over $150,000, as follows: To U. S. Cast Iron Pipe & Fdy. Co., 3,200 tons of 4 to 30-in. pipe at $38.75 per ton; to Lacy Mfg. Co., Los Angeles, 6,150 ft. of 36-in. sheet-steel pipe, at $3.38 per ft.

Wilbur, Wash.—Bids will be received until Oct. 15 by Julius Lyse, Chmn. Water Wks. Com., for furnishing about 7,200 ft. of 4 to 10-in. pipe, gates, valves and fittings. Bids will be received on steel lap welded converse joint, asphalted pipe, and on wooden stave galvanized bound asphalt pipe. H. S. Bassett, Mayor.

Columbus, Neb.—Press reports state that the Nebraska Central Irrigation Co. has completed arrangements for the construction of a power and irrigation canal, to divert the water of the Loup River from a point near West Point through the canal to an immense storage reservoir, near this city. From the reservoir the water will have a fall of 91 ft., with an outlet into Platte River, and besides furnishing 20,000 H.-P. will also irrigate several thousand acres of land. H. E. Babcock, Pres. Estimated cost, $3,000,000.

Sedro-Woolley, Wash.—H. R. Lamb, of the Skagit Improvement Co., writes that water works are to be constructed by said Co. W. R. Morgan, Engr. in Charge.

Springfield, S. D.—Press reports state that the Council proposes to sink a new artesian well. Cost, $2,500.

Highmore, S. D.—It is stated that steps are being taken to issue bonds for sinking an artesian well.

Alcester, S. D.—Water bonds to the amount of $3,750 are reported to have been voted.

Parker, S. D.—Press reports state that a system of water works is to be constructed.

Raton, N. Mex.—Local press reports state that the Raton Water Works Co. has decided to construct an additional reservoir in Sugarite Canon, and to extend its works at a total cost of $75,000. C. N. Priddy, of Leadville, Colo., is one of the stockholders of the Co. and A. L. Hobbs is Supt.

Golden, Colo.—The following bids are stated to have been received by the City Council for the construction of water works: Mr. Linder, of Golden, $117,000; Holme & Allen, Denver, $114,000, and R. P. McDonald, Denver, $97,000.

Sheridan, Wyo.—The lowest bid recently received for the extension of Shoshone Canal, 8 miles, was from T. F. Frasure, of Garland, at 65 cts. a cu. yd. for solid rock, 40 cts. for loose rock, 25 cts. for gravel and 10 cts. for earth; total, about $18,000.

Cucamonga, Cal.—Articles of incorporation of the Old Settlers' Water Co., of Cucamonga, were filed recently. Capital stock, $33,840. Directors: D. R. Kilbourne, W. J. Kincaid, Thos. Farm and others, of Cucamonga.

Morgan, Utah.—Local press reports state that Weber, Davis, Morgan and Summit Counties propose to construct a reservoir in which to store water for irrigating; the dam, which it is proposed to build, will be about 60 ft. high and 3/5 of a mile long. Estimated cost of reservoir about $500,000.

Sacramento, Cal.—The Bd. of City Trustees has adopted the ordinance providing for the issue of $150,000 bonds for water mains.

Whitney, Idaho.—Articles of incorporation have been filed by the Whitney Reservoir & Ditch Co. Capital, $5,000. Directors: Jos. Moser, Jas. Cutler and others, of Whitney.

Cedar City, Utah.—The City Council is reported to have voted in favor of bonding the city for the construction of a system of water works.

Pueblo, Colo.—The Trus. of the North Side Water Works are reported to have let the contract for a horizontal compound high duty pumping engine, capacity 10,000,000 gal. every 24 hours, to Holme & Allen, of Denver, for $41,000.

Winnipeg, Man.—Rudolph Hering, of New York City, in a recent report on the question of increasing the city water supply, recommends the plan which provides for the sinking of another well about 100 or 200 ft. from the present well, from which a lateral drift or gallery is driven in the rock for a distance of about 200 ft. Estimated cost, $15,130.

SEWERAGE AND SEWAGE DISPOSAL.

Boston, Mass.—Bids will be received by Jas. Donovan, Supt. of Streets, until Oct. 8, for constructing sewerage works in Aldrich St., also until Oct. 10 for constructing sewerage works in Florida St.

Hartford, Conn.—Local press reports state that bids will be received Oct. 15 by the City Engr. for widening the canal below the Franklin Ave. sewer and arching same as recommended by him.

Salem, Mass.—In a communication to the Council Mayor Hurley urges the passage of the $50,000 South Salem sewerage order.

New Castle, Pa.—The City Engr. has been directed to prepare plans for a lateral sewer system for the north end of the 7th Ward.

Seneca Falls, N. Y.—The Municipal Bd. has received maps of the village from Allen & Farrington, of Syracuse, who established grades for sewers, pavements and sidewalks. The maps show 14 miles of sewers necessary for the complete system, the construction of which it is estimated will cost $68,000.

Baltimore, Md.—Major Venable's sewer ordinance, which has been referred to the Com. on Sewerage, provides for the appointment of an engineer to prepare and report to the City Council a plan for a general sewerage system for the city, appropriating $25,000 for expenses.

Syracuse, N. Y.—The Common Council has received from City Engr. Schnauber an estimate of $17,500 for cost of the proposed improvement of Harbor Brook for drainage purposes.

Newark, N. J.—Bids are wanted Oct. 16 for building Section 6 Millburn-Summit division of the joint outlet sewer, as advertised in The Engineering Record.

Washington, Pa.—An ordinance has been passed providing for the construction of a sewer on Jefferson Ave. F. H. Judson, Ch. Burgess.

Reading, Pa.—The Council has passed an ordinance authorizing the Bd. of Pub. Wks. to construct a 20-in. storm water sewer on Walnut St. from 12th to 14th Sts.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Oct. 18 for furnishing and erecting ready for use the pumping machinery, boilers and auxiliaries required to equip a sewage pumping plant at the Industrial Home School in the Dist. of Columbia. John Biddle, Comr. D. C.

Yonkers, N. Y.—Local press reports state that bids will be opened by the Common Council on Oct. 13 for a relief sewer in McLean Ave. and Van Cortlandt Park Ave. to Post St. Resolutions are under consideration for the construction of several other sewers.

Bayonne, N. J.—It is stated that bids are wanted Oct. 7 for constructing sewers in Ave. C, 16th, Evergreen and West 9th Sts. Everett Smith, City Engr.

Ardmore, Pa.—The Com. of the Lower Merion Township Comrs., to whom was referred by a vote of the people the matter of borrowing $350,000 for the construction of a sewer system and the purchase of property and erection of municipal buildings, has agreed to recommend to the Comn. that the proposed loan be reduced to $250,000, the municipal building proposition being abandoned temporarily.

Kingston, N. Y.—According to local press reports the contract is about to be let for the construction of a sanitary sewer through E. O'Reilly St., Jansen Ave. and Prince St.

Philadelphia, Pa.—Bids are wanted Oct. 7 for constructing main and branch sewers. Cost, according to local press reports, to be about $500,000, of which $425,000 will be expended for 7 main sewers. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Surveys.

Newark, N. J.—The following bids were opened Sept. 25 for building Section 4, Second and Third Divisions of the West Branch of Joint Outlet Sewer. Alexander Potter, New York City, Ch. Engr.

Items and Quantities.	John P. Hall, Jersey City.	David Peoples, Phila, Pa.	J. F. Shanley, Newark.	Jas. Conway, Newark.	Earle & Humphrey, Hackensack.	T. J. Shea, Quincy, Ill.	Ludwig Batt, S. Orange.	W. T. Connelly, Jersey City.
24-in. pipe sewer, 0—6 ft. deep, 3,215 ft....	$2.00	$2.10	$2.36	$2.15	$2.20	$2.20	$2.25	$2.95
24-in. pipe sewer, 6—10 ft. deep, 6,990 ft...	2.40	2.35	2.51	2.70	2.50	2.60	2.75	3.30
24-in. pipe sewer, 10—14 ft. deep, 1,390 ft..	2.90	2.80	2.96	2.90	2.60	3.60	3.50	3.60
24-in. pipe sewer, 14—18 ft. deep, 870 ft....	3.25	3.80	3.46	3.65	3.00	4.10	4.75	3.75
24-in. pipe sewer, 18—22 ft. deep, 50 ft....	3.50	5.00	3.96	4.65	3.25	4.80	5.00	4.00
24-in. C. I. pipe, 200 p. ft., 0—6 deep, 396 ft.	6.00	8.00	5.25	7.00	5.00	5.00	6.50	6.00
22-in. pipe sewer, 0—6 ft. deep, 2,310 ft....	2.00	2.00	2.11	2.00	2.10	1.75	2.25	2.70
22-in. pipe sewer, 6—10 ft. deep, 1,470 ft...	2.50	2.30	2.41	2.50	2.30	2.25	2.50	2.90
22-in. pipe sewer, 10—14 ft. deep, 530 ft....	2.70	2.50	2.81	2.75	2.60	3.50	4.00	3.20
Manholes, 10 ft. deep or less, 44..........	34.00	35.00	40.00	35.00	35.00	30.00	35.00	40.00
Manholes, 10—15 ft. deep, 27 ft..........	4.00	4.00	5.00	5.00	5.00	2.00	3.25	6.00
Manholes, 15—20 ft. deep, 2 ft...........	4.00	4.00	8.50	5.00	6.00	3.00	4.00	10.00
Sheeting, 30 M. ft.......................	25.00	20.00	22.00	10.00	35.00	30.00	25.00	25.00
Rock excavation, 1,000 cu. yds...........	.95	1.00	.50	.25	3.00	1.50	.50	5.00
Extra concrete, 50 cu. yds...............	8.00	8.00	10.00	10.00	10.00	9.00	8.00	7.00
Extra brick work, 50 cu. yds.............	8.00	12.00	12.00	12.00	10.00	9.00	13.00	8.00
22-in. pipe branches, 20.................	2.50	4.50	3.00	2.10	3.50	3.00	2.50	5.00
24-in. pipe branches, 50.................	3.00	5.00	3.50	2.50	4.00	4.00	2.75	7.00
Asphalt joints on 22-in. pipe, 600........	.25	.20	.15	.20	.15	.20	.10	.20
Asphalt joints on 24-in. pipe, 1,000......	.25	.30	.20	.20	.15	.20	.15	.20
6-in. tile drain, 1,000 ft...............	.50	.45	.82	.60	.60	.50	.20	.50
Totals	$47,553	$48,586	$49,957	$50,171	$50,370	$51,003	$53,804	$65,302

York, Pa.—The proposition to increase the city's indebtedness $400,000 for the construction of a sanitary sewerage system is now being considered by the taxpayers.

La Grange, Ga.—The contract for constructing 49,300 ft. of 6 to 18-in. pipe sewers, with 96 manholes and 18 flush tanks has been awarded to Moore & McCrary, Atlanta, Ga., for $21,196.

Alliance, O.—It is stated that bids are wanted Oct. 13 for $90,000 sanitary sewer bonds.

Girard, O.—It is stated that bids are wanted Oct. 20 for survey, plans and specifications for a sewer system in this village. E. L. Hauser, Corporation Clk.

Iola, Kan.—It is stated that bids are wanted Oct. 16 for constructing sewer outlet, septic basins, mains and laterals for Sewer Dist. No. 1. J. H. Harris, City Engr.

Cass Lake, Minn.—Bids will be received by W. S. Cobb, Village Recorder, until Oct. 15 for constructing a sewer system in this village.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Oct. 28 for improving a portion of Linwood Ave., by constructing a trunk sewer and drains. Geo. F. Holmes, Clk.
The Bd. of Public Service has adopted specifications for a trunk sewer in Rieder St., Liston Ave. and Portland St. Estimated cost, $30,713.

Springfield, Ill.—The Council has passed an ordinance providing for an 18-in. pipe sewer in Pasfield St.

Toledo, O.—Bids are wanted Oct. 20 for furnishing material and constructing 8 and 10-in. circular pipe sewers in portions of 2 streets. Chas. H. Nauts, City Clk.

Marion, Ind.—Bids are wanted Oct. 21 for constructing a sanitary sewer. C. G. Robbins, City Clk.

Kenton, O.—Bids are wanted Oct. 22 for $11,000 sewer bonds. John P. Dougan, City Clk.

Tomah, Wis.—Press reports state that surveys are being made for a sewer system.

Vincennes, Ind.—Bids will be received by the Common Council until Oct. 27 for constructing 5th and Church St. sewer, Broadway and St. Clair St. sewers. Thos. Robertson, City Clk.

St. Joseph, Mo.—Ordinances have been introduced in the Municipal Assembly for the construction of five sewers in Dist. 78.

Pontiac, Mich.—The City Engr. has been instructed to report on the cost of constructing a girder and cement bridge.

Pekin, Ill.—Local press reports state that the citizens of Mackinaw Township will vote upon the building of a $5,000 bridge across Mackinaw River.

Elizabethtown, O.—Local press reports state that the following bids were opened by the Co. Comrs., Sept. 24, for constructing the superstructure of the Elizabethtown bridge; Engineer's estimate, $115,000; Bellefontaine Bridge Co., Bellefontaine, $129,570; Massillon Bridge Co., Massillon, $114,900; King Bridge Co., Cleveland, $121,600; Champion Bridge Co., Wilmington, O., $140,162; Variety Iron Wks., Cleveland, $133,361; Huston & Cleveland (2 bids), $112,000 and $116,000; Brackett Bridge Co., Cincinnati (3 bids), $105,600, $108,500 and $114,000.

Marion, Ind.—It is stated that the Cleveland, Cincinnati, Chicago & St. Louis R. R. and the Toledo, St. Louis & Western R. R. Companies are having plans prepared for a $100,000 bridge which the said roads propose building between Marion and North Marion.

Danville, Ill.—City Engr. W. H. Martin writes that the construction of a bridge over the North Fork of Vermilion River is contemplated. Estimated cost, $10,000.

Cleveland, O.—Bids will be received by the Bd. of Co. Comrs. until Oct. 15 for constructing a culvert on the North Ridge Road in Dover Township and a culvert on Dille Road, Nottingham. Julius C. Dorn, Clk.

Marysville, Kan.—Bids will be received by the Bd. of Co. Comrs. until Oct. 9 for constructing several steel bridges, the largest to be 100 ft. long. John Montgomery, Co. Clk.

Spencer, Ind.—Bids are wanted Oct. 18 for constructing a bridge across White River, between Owen and Marion Counties. Address Co. Aud., Spencer.

Suamico, Wis.—Bids are wanted Oct. 8 for constructing a steel bridge with stone abutments across Big Suamico River, in this city. Address Co. Clk., Green Bay.

South Bend, Ind.—Local press reports state that the Elkhart, South Bend & Chicago Ry. Co. has made a proposition to the city to construct a $45,000 bridge across St. Joseph River at Colfax Ave., or, to contribute $45,000 toward a structure which the city may build at said avenue, provided a franchise to construct, maintain and operate a street railway in the city is granted to the said company.

Kalamazoo, Mich.—Bids for the construction of storm sewers were opened Sept. 23 as follows (all bids rejected):

Bidders.	Portland cement concrete. 42 inch.	36 inch.	33 inch.	30 inch.	Excavation. Under 6 ft.	6 to 8 ft.	8 to 10 ft.	10 to 12 ft.	Manholes.	Totals.
Geo. Rickman, Kalamazoo	$2.80	$2.65	$2.50	$2.25	$.70	$1.00	$1.20	$2.40	$55	$19,524
A. B. Lutin, Grand Rapids	3.27	2.90	2.75	2.50	.40	.60	.75	.95	20	16,659
B. F. Roe, Kalamazoo	2.65	2.50	2.35	2.10	.78	1.05	1.35	2.58	53	18,943
Wheeler & Pitkin, Kalamazoo	2.83	2.70	2.51	2.29	.70	1.05	1.18	2.37	59	19,621

Birmingham, Ala.—The Bd. of Aldermen has confirmed the ordinance providing for storm sewers on Southside, beginning at 19th St. and Alley F; estimated cost, $45,000.

Nashville, Tenn.—See "Paving and Roadmaking."

Marysville, Cal.—At a recent citizens' meeting a resolution was passed requesting the City Council to employ an engineer to make a report with regard to the sanitary condition of the city and to report on the disposal of all sewage.

San Francisco, Cal.—The Bd. of Superv. has passed an ordinance directing the reconstruction and completion of the 6th St. sewer at a cost of $50,250.

BRIDGES.

Center Rutland, Vt.—At a town meeting held Sept. 22 the residents of Rutland refused to contribute 40% of the cost of constructing a street railway bridge across Otter Creek at Center Rutland. A correspondent writes that it is likely that the Rutland St. Ry. Co. will construct an independent steel bridge. Address David Fox, Jr., Gen. Mgr. of Ry. Co., Rutland, Vt.

Springfield, Mass.—The increase of the accommodations of the present bridge or the building of an entire new structure across the Boston & Maine tracks at Plainfield St., is being considered.

Elizabeth, N. J.—The building of a steel bridge across Elizabeth River at Prince St. is being considered.

New York, N. Y.—Comr. Eustis, of the Bronx Parks, has secured from the Bd. of Estimates an appropriation of $350,000 with which to construct a bridge in place of the Pelham Bay structure.

Downingtown, Pa.—The Co. Comrs. have granted the West Chester St. Ry. Co. permission to construct a bridge on Lancaster turnpike, in Downington. W. A. MacDonald, Secy. Ry. Co., West Chester, Pa.

Danville, Pa.—It is stated that the Delaware, Lackawanna & Western R. R. Co. is to build a single span, steel truss bridge across Mahoning Creek, in this city. W. K. McFarlin, Ch. Engr., Hoboken, N. J.

Millhall, Pa.—Engineers are reported to be surveying for a 3 span iron bridge, which is to be built across Fishing Creek.

St. Joseph, Mo.—Press reports state that an agreement has been reached between the Grand Island & Rock Island R. R. Cos., whereby a $400,000 bridge is to be built across Missouri River at St. Joseph. It is stated that bids will be asked in the near future.

Danville, Ill.—John Beard is reported to have secured the contract to construct a bridge across Vermillion River at Jenkins Ford, in Georgetown Township, for $12,895.

Kankakee, Ill.—The Ind., Ill. & Ia. R. R. Co. will build a plate girder bridge over the Kankakee at this place. Estimated cost, $40,000. Contract for the piers and abutments has been awarded to the McLaughlin Const. Co., of Kankakee, for about $15,000.

St. Charles, Mo.—Bids will be received until Oct. 16 by Carr Edwards, Co. Surv., for building several small steel bridges and for repairing several other small bridges.

Chattanooga, Tenn.—Press reports state that the officials of the Knoxville & Augusta R. R. intend constructing a steel viaduct across Tennessee River in this city, at a cost of $60,000. W. P. Hood, Gen. Supt., Knoxville, Tenn.

Portland, Ore.—The building of a steel bridge at Grand Ave. is being considered.

Los Angeles, Cal.—H. Hawgood, Ch. Engr. of the San Pedro, Los Angeles & Salt Lake R. R. is reported to have prepared plans for a solid concrete bridge that is to be built across Santa Ana River, in Los Angeles Co., Cal. It is reported that the bridge will be 800 ft. long and 24 ft. wide, consisting of 8 spans, 86 ft. in the clear, and piers 14 ft. thick and 64 ft. high.

Belfield, N. D.—See "Railroads."

Aberdeen, Wash.—Bids are wanted Oct. 25 for $20,000 bridge bonds. Geo. A. Black, Clk.

PAVING AND ROADMAKING.

Boston, Mass.—The estimated cost of macadamizing Cornell St., West Roxbury, is placed at $20,000.

New York, N. Y.—Bids are wanted Oct. 9 for resetting curb and edging and resurfacing walks and lawns and other work in Corlears Hook Park, also for resetting curbstones and paving with granite block pavement portions of the roadway of W. 96th St., between West End Ave. and the right of way of the Hudson River R. R. Wm. R. Willcox, Comr. of Parks.
Bids will be received until Oct. 7 by Jacob A. Cantor, Boro. Pres., for regulating, grading and paving with asphalt on portions of numerous streets, in all about 50,516 sq. yds. of pavement, including binder course, and 45,890 sq. yds. of old stone pavement to be relaid as foundation and in approaches; also for paving about 4,761 sq. yds. with asphalt block and 1,200 sq. yds. with granite block.

Jersey City, N. J.—Bids will be received by the Bd. of Street & Water Comrs. until Oct. 7 for improving portions of 3 streets, work to include 4,174 sq. yds. of Belgian paving and 2,790 sq. yds. of asphalt paving. Geo. T. Bouton, Clk.

Brooklyn, N. Y.—The lowest bid for grading 61st St. from 4th to 5th Aves. (bids opened Oct. 1) was that of Chas. J. Bofrie at 26 cts. per cu. yd. for 38,880 cu. yds. earth excavation.

Buffalo, N. Y.—The Bd. of Park Comrs. has adopted a resolution providing for the construction of a boulevard along the east bank of the Genessee River to Seneca Park, east. Estimated cost, $11,100.
The Com. on Streets, Bd. of Aldermen, has voted in favor of paving Chestnut St.

Washington, Pa.—The Town Council has passed an ordinance providing for the paving of a portion of E. Maiden St. with brick for a distance of 18 ft. on either side of the center line thereof. F. H. Judson, Ch. Burgess.

Swissvale, Pa.—Boro. Engr. C. B. Judd, of Pittsburg, Pa., writes that paving contracts (bids opened Sept. 25) have been awarded as follows: To Ross P. Houston, Pittsburg, Pa., Monongahela St. paving at $1.34, curbing at 63 cts. and excav. at 42 cts.; La Clair and Macon Sts., both at $1.34 for paving, 65 cts. for curbing and 34 cts. for excav.; total, $21,487. To Ott Bros., Pittsburg, Columbia Ave. and Westmoreland St., both at $1.40 for paving and 60 cts. for curbing; 37 cts. and 40 cts., respectively, for excav.; total, $13,380.

Niagara Falls, N. Y.—City Engr. Walter McCulloh writes that contracts for paving (bids opened Sept. 19) have been awarded as follows: To Barber Asphalt Paving Co., 11th St., 1,600 sq. yds. asphalt pavement at $2.49, total $4,468; 4th St., 2,925 sq. yds. asphalt pavement at $2.39, total $7,475; 5th St., 2,206 sq. yds. asphalt pavement, at $2.39, total $5,756. To John F. Speicher, Niagara Falls, 13th St., 2,020 sq. yds. brick pavement, at $2.30, total $5,017.

Reading, Pa.—Chas. C. Weltmer, Asst. Registry Clk., writes that the following bids were opened Sept. 26 for paving Cherry and 13th Sts. and Chapel Terrace (10,000 sq. yds.) with repressed vitrified shale brick: Mayer & Nolan, $1.99 per sq. yd., $19,900 total; Penna. Asphalt Paving Co., $1.95 per sq. yd., $19,500; John K. Faust, $1.71 per sq. yd., $17,100; Hawman Bros., $2.14 per sq. yd., $21,400; Adam H. Leader (awarded) $1.59 per sq. yd., $15,900.

Norwich, N. Y.—Bids are wanted Oct. 9 for improving certain streets with macadam and brick walks. Estimated cost, $8,300. A. R. Chowles, Village Clk.

Buffalo, N. Y.—County Treas. Wm. H. Daniels is reported to have sold an issue of $102,918 Erie Co. good road bonds.

Rochester, N. Y.—The residents of Gibson St. have appointed a committee, of which Frank H. Hamlin and Edw. G. Hayes are members, to investigate the question of providing a permanent pavement for that street.
The Park Comrs. have approved plans submitted by Engr. Laney for a boulevard on the east bank of the river from Norton St. to the park entrance, 4,223 ft., at an estimated cost of $11,100.

Brooklyn, N. Y.—The following bids were opened Oct. 1, by Boro. Pres. J. Edw. Swanstrom, for granite paving on Varick Ave., from Metropolitan to Flushing Aves.: A, Frank J. Gallagher; B, Edw. Roche; C, Thos. F. Byrnes; D, Dennis Norton; E, John O'Grady:

Bidders.	Granite, 12,690 sq. yds.	New curb, 4,140 ft.	Old curb, 1,800 ft.	Earth exc., 200 cu. yds.	Earth fill, 10,060 cu. yds.	New bridge-stones, 700 sq. ft.	Old bridge-stones, 740 sq. ft.
A	$1.93	$.75	$.15	$.10	$.30	$.85	$.10
B	2.24	.63	.20	.22½	.22½	.70	.20
C	1.99	.70	.10	.10	.15	.80	.10
D	1.99	.75	.29	.20	.10	.75	.20
E	1.90	.01	.50	.30	.01	.90	.20

Bids were also opened Oct. 1 for asphalt paving, as follows: A, Uvalde Asph. Pavg. Co.; B, Brooklyn Alcatraz Asph. Co.; C, Crawford Co.:

Nostrand Ave. from Macon St. to Prospect Pl.

Bidders.	Asphalt, 4,470 sq. yds.	Concrete, 850 cu. yds.	New curb, 3,320 ft.	Old curb, 550 ft.	Manhole covers, 4.
A	$1.38	$4.40	$.70	$.25	$3.00
B	1.35	5.50	.80	.40	5.00
C	1.25	4.90	.85	.35	3.00

Bergen St. from Bedford to Kingston Aves.

Bidders.	Asphalt, 6,260 sq. yds.	Concrete, 1,200 cu. yds.	New curb, 5,400 ft.	Old curb, 500 ft.	Manhole covers, 5.
A	$1.32	$4.40	$.70	$.25	$3.00
B	1.35	5.50	.80	.40	5.00
C	1.25	4.90	.85	.35	3.00

Buffalo, N. Y.—The bids received for paving Kingston Pl., 1,520 sq. yds., and Riverside Ave., 3,509 sq. yds., were as follows: With asphalt, Barber Asphalt Paving Co., $3,846 and $8,597, respectively; with brick, Frank V. E. Bardol, Buffalo, $3,750 and $9,000, respectively.

Baltimore, Md.—The Bd. of Pub. Improv. has approved ordinances for the paving of portions of Hoffman St. with brick, Windsor Ave. and Stockholm St. with cobbles.

Fredericksburg, Va.—Bids are wanted Oct. 20 for curbing and paving with brick or spalls, or both, on portions of Commerce and Main Sts. W. S. Embrey, Chmn. St. Com.; C. E. Dickinson, Engr.

Tuscola, Ill.—The contract for paving N. and S. Main, E. Sale and Scott Sts. with Clinton brick has been awarded to Thompson & Chase, of Peoria, at $1.36 per sq. yd. for paving, 52 cts. per ft. for curbing and 16 cts. per yd. for excavating. It is estimated that 1,000,000 bricks will be required for this contract.

Peoria, Ill.—Thompson & Chase, of this city, are reported to have the contract for paving on St. James St. with brick, for $16,941.

Mexico, Mo.—City Engr. R. S. McKinney has estimated the cost of grading 6 blocks of streets in the business portion of the city at $789 and the cost of paving at $13,470.

Cincinnati, O.—The County Comrs. are stated to have received the following bids for the improvement of Carthage Pike: T. F. McClure & Sons, $425,026; F. H. Kirschner & Co., $425,320, and J. A. Eberhardt, $421,395 Other bids received were rejected as not conforming to the specifications.

Toledo, O.—Bids are wanted Oct. 20 for furnishing material and grading and paving with various kinds of block pavement on a portion of Federal and Clark Sts. Chas. H. Nauts, City Clk.

Bids are wanted Nov. 3 for furnishing material and repaving a portion of Front St. with various kinds of block on a concrete or sand foundation. Chas. H. Nauts, City Clk.

Laporte, Ind.—Bids will be received by the Co. Comrs. until Oct. 17 for furnishing material and completing Michigan, Coolspring and Springfield Townships system of macadam roads in said Laporte Co., as previously let to A. Runyan & Co. Francis H. Doran, Co. Aud.

Wichita, Kan.—Local press reports state that contracts for nearly 1 mile of asphalt paving on W. Douglas Ave. are about to be let. H. J. Harding, Engr. in Charge.

Wellsburg, W. Va.—The Council has ordered the paving of Commerce St. from 7th to 11th Sts.; also a portion of 8th St.

Cleveland, O.—Local press reports state that plans have been prepared for 28 miles of paving for next year; estimated costs being as follows: With asphalt, $19,813; with brick, $120,424; with Medina block, $141,129.

Pontiac, Mich.—City Engr. Wm. J. Fisher writes that the contract for 4,850 sq. yds. of paving on E. and W. Pike Sts. has been awarded to Lennane Bros., Detroit, Mich., for $12,161; Nelsonville brick to be used on concrete, with Berea curb.

Kansas City, Mo.—Bids are wanted Oct. 8 for paving and repaving with asphalt on portions of several streets, and with brick on portions of 2 alleys; also for constructing granitoid sidewalks on portions of numerous streets. Robt. W. Waddell, City Engr.

Tipton, Ia.—City Clk. M. Earl Clark writes that the contract for about 11,000 sq. yds. of brick repressed block paving has been awarded to Snouffer & Ford, Cedar Rapids, Ia., at $1.65 per sq. yd.

Elgin, Ill.—City Clk. Wm. F. Sylla writes that a petition is now in court for the paving of S. State and W. Chicago Sts. with brick on 5-in. concrete foundation. Estimated cost, $30,100. Adin Mann, City Engr.

Columbus, O.—Local press reports state that bids are about to be asked for the grading and paving of 4th and Maple Sts. and Reinhard and Jefferson Aves.

Janesville, Wis.—City Engr. C. V. Kerch writes that the following bids were opened Sept. 20 for paving, etc.: A, Jas. Cape & Sons, Racine, Wis., $16,955; B, Blake Bros., Madison, Wis., $15,644; C, P. W. Ryan, Janesville, $15,448; D, Brown & Connors, Janesville, $15,222 (awarded); E, Frank M. Savage, Chicago, Ill., $16,442. For detail bids see accompanying table:

Bidders.	5,145 cu. yds. exc.	17,061 sq. yds. macadam pave.	7,712 lin. ft. cement curb.	482 lin. ft. concd. cement curb & gutters.	203 sq. yds. brick gutters.
	Cts.	Cts.	Cts.	Cts.	
A	35 & 25	66.58 & 57.55	60 & 57	88	$2.40
B	40 & 39½	55 & 50	55	77	2.00
C	40 & 39	49½ & 54½	54	75	2.00
D	39½	48½ & 53	53½	74	2.00
E	40	60 & 54	..	80	2.00

Cincinnati, O.—Bids will be received by the Bd. of City Affairs until Oct. 14 for improving a portion of Lyon St. and Kelley alley, by grading, curbing and paving with brick. Bids will be received until Oct. 28 for similar work on a portion of Huron Ave. Geo. F. Holmes, Clk.

Tiffin, O.—Bids will be received by the City Council until Oct. 17 for grading, draining, curbing and paving. Oct. 22 for $9,000 Coe St. improvement bonds.

Bids will be received by the Finance Com. until Oct. 22 for $9,000 Coe St. improvement bonds. John E. Diemer, City Clk.

Nashville, Tenn.—The City Council has passed bills carrying appropriations of $116,000 for street improvements and sewer extensions, including $73,000 for the Edgefield Branch sewer and $25,000 for bituminous macadam pavement on Russell St.

Jackson, Miss.—The City Council is said to be considering the proposition to pave the business streets of the city.

Lead, S. D.—City Engr. J. P. Crick writes that bids will be received Oct. 15 for stone, brick and asphalt pavements, estimated to cost $60,000.

Lincoln, Neb.—City Engr. Geo. L. Campen writes that the contract for paving in Dist. No. 16 (bids opened Sept. 22) has been awarded to the Green River Asphalt Co., St. Louis, Mo., which bid was as follows: Class "A," rock asphalt, 5-in. native cement concrete, 2½-in. wearing surface, 4,000 sq. yds., 10-year guarantee, at $1.89 per sq. yd.; Class "A," vit. brick, for gutters, with 5-in. native cement concrete, 1½-in. sand cushion and 4-in. brick, 1 year guarantee, 3,550 sq. yds. at $1.75 per sq. yd.; Class "2," artificial stone curbing, 5,420 lin. ft., 5-in.x20-in., at 36 cts. per lin. ft.; broken stone, $2.05 per cu. yd.; cement filler, 11 cts. per sq. yd.

Denver, Colo.—The Bd. of Pub. Wks. is stated to have received the following bids for resurfacing, with disintegrated granite 2 to 2½ ins. thick, the roadway of Capitol Hill Improv. Dist. No. 1 (total area, 140,000 sq. yds.): The Colorado Paving Co., at 23¾ cts. per yd., $33,250; Thos. J. Tully, at 25 cts., $35,000, and Chas. Connors, at 27 cts., $37,800.

Omaha, Neb.—Bids are wanted Oct. 10 for improving a portion of 21st St., by paving with asphaltum, vitrified brick, stone block or vitrified block and for curbing with artificial stone or artificial stone combined curb and gutter. Wm. Coburn, Secy. Bd. Pub. Wks.

Winnipeg, Man.—The City Council has decided to improve a portion of George Ave. by paving with asphalt to a width of 24 ft., and curbing with cut stone. Estimated cost, $8,720. C. J. Brown, City Clk.

Montreal, Que.—Local press reports state that plans are now being prepared at the City Hall for the construction of the proposed boulevard for the Island of Montreal; plans call for a main boulevard 300 ft. wide for a distance of 30 miles; also side boulevards to run to the principal towns.

POWER PLANTS, GAS AND ELECTRICITY.

South Norwalk, Conn.—The Council Com. is reported to have recommended the construction of a city electric light plant.

Lewiston, N. Y.—Philip Pitz is reported to be Chmn. of a Com. appointed to investigate the cost of installing an electric plant.

Glen Gardner, N. J.—The Hunterdon Electric Light & Power Co. is reported organized here, to furnish power and light the town.

Castile, N. Y.—It is stated that bids are wanted by J. S. Chapman, until about Oct. 15, for constructing a power plant to cost about $10,500. There will be 30 arc and 650 incandescent lamps. Wm. J. White, Engr., 111 White Bldg., Buffalo, N. Y.

Staunton, Va.—E. M. Funkhouser, of Staunton, who recently purchased the Staunton Light & Power Co.'s plant, writes that improvements are contemplated in the electric lighting.

Marion, O.—Henry Strelitz and John A. Huber have petitioned the Council for a franchise for a heating plant.

Grand Rapids, O.—The Council is stated to have granted Augustine Pillod a franchise to light the town by electricity.

Arcadia, O.—The Council is stated to have granted P. A. Wheeland, a franchise to light the streets by electricity.

Marion, O.—It is reported that the electric plant at the Susquehanna Silk Mills will cost $18,000. The mills will be thoroughly wired and equipped with electricity. H. Klert is Gen. Supt. of the mills.

Decatur, Ill.—R. E. Pratt, of Chicago, and Harvey Bates, of Indianapolis, Ind., are reported interested in the construction of an electric light plant at Decatur.

Ann Arbor, Mich.—A press report states that a survey of the Huron River is in progress for a new dam west of the city on the site of the old McMahon dam, where it is said the Washtenaw Power Co. proposes to put in a plant for the purpose of furnishing power and light to Jackson, Grass Lake, Chelsea and Dexter.

Sweet Springs, Mo.—See "Water."

Hubbardston, Mich.—The Village Council is reported to have voted to contract for an electric light plant.

Wyandotte, Mich.—The Ecorse Township Bd. is stated to have granted the Wyandotte Gas Light & Fuel Co. a franchise to sell gas in the Township.

Trenton, Mich.—Pres. Stokes is stated to have received an estimate of the cost of a municipal lighting plant from Village Engr. Keating, who states that a 125-H.-P. engine with a 60-Kw. electrical machine capable of supplying 25 street lights and 1,000 incandescent lights should not cost more than $5,315. This does not include additions to the water works, pump house or a boiler to develop steam to run the electrical machinery. It is stated that the citizens will be asked to bond for $10,000.

Lansing, Mich.—The State Bd. of Agriculture is reported to have approved the plans of E. A. Bowd, of Lansing, for a building for heating and lighting plant. The specifications call for a brick building 1 story high. The plant will cost about $125,000.

Winona, Minn.—Plans and specifications are being prepared and it is expected to ask for bids about Dec. 1 for a municipal electric light plant. Two plans are under consideration, one for 250 lights of 2,000 c. p., and one for 350 lights of 1,600 c. p. G. P. Coleman, City Engr.

Colby, Wis.—"See "Water."

Iowa City, Ia.—Thos. C. Carson, Pres. of the Iowa City Gas Light Co., writes that it is proposed to enlarge and remodel said company's plant at a cost of about $30,000, but work will not be done until 1903.

Akron, O.—The Co. Comrs. are stated to have granted the East Ohio Gas Co. a 25-year franchise to construct and maintain a line of gas mains and a telegraph line through Summit Co.

Cleveland, O.—The Northern Ohio Natural Gas & Pipe Line Co., of Cleveland, is reported to have been incorporated at Columbus Sept. 30 to pipe natural gas from the central part of the State to cities and towns in Northern Ohio. The intention of the new company is said to be to supply natural gas to such cities as Elyria, Lorain, Norwalk and Sandusky.

Chattanooga, Tenn.—The date for receiving bids for lighting the streets and public buildings has been changed from Oct. 7 to Oct. 28, as advertised in The Engineering Record.

Huntsville, Ala.—The City Council is stated to have decided to construct a municipal electric light plant.

Del Rio, Tex.—The Del Rio Electric Light & Power Co. has been incorporated, with a capital of $8,000. Incorporators: Fred Mayer, Henry C. Mayer and John M. Gray.

Crockett, Tex.—J. B. Smith is reported to have organized a company to build new electric light works and ice factory. This plant will supply the place of the one recently destroyed by fire.

Little Rock, Ark.—The City Council is stated to have granted W. H. Hipolite a franchise for a gas plant.

Lubbock, Tex.—The Lubbock Electric Co., of Lubbock, has been incorporated; capital, $2,500. Incorporators, C. E. Spath, M. C. Abernathy and H. S. Graham.

Flandreau, S. D.—City Aud. E. G. Coleman writes that on Sept. 25 it was voted to issue $8,000 bonds for the construction of a gasoline gas plant.

Columbus, Neb.—See "Water."

Thermopolis, Wyo.—The Thermopolis Electric Light & Power Co. has been incorporated, with a capital of $10,000, to build a light plant at Thermopolis. Chas. Wallace and John L. McCoy are among the incorporators.

Stanton, Neb.—The dam of the Stanton Water Power Co. recently completed at a cost of $7,500 is reported to have been carried away.

ELECTRIC RAILWAYS.

Biddeford, Me.—W. B. Getchell, of Augusta, Me., is making surveys for 12 miles of electric railway from Biddeford City to Biddeford Pool and Fortunes Rocks E. A. Hubbard, Dir.

Tiverton, R. I.—A petition is reported to be in circulation in Tiverton, asking that the Old Colony St. Ry. Co. extend its line to Bliss Four Corners and to Adamsville. Colon M. Ingersoll, Jr., Ch. Engr., New Haven, Conn.

Foxboro, Mass.—The Norton & Taunton St. Ry. Co. is stated to have petitioned the State R. R. Comrs. for permission to extend its line into Foxboro and Sharon. C. E. Short, Ch. Engr., Norton.

Duncansville, Pa.—The Boro. Council is stated to have granted a franchise to the Altoona Belt Line St. Ry. Co.

Brooklyn, N. Y.—Plans have been prepared by the Brooklyn Rapid Transit Co. for placing an arch over its tracks between 38th and 39th Sts., from 4th to 8th Aves., So. Brooklyn, and filling in the cut there, which is 30 or 40 ft. deep. J. C. Brackenridge, Chief Engr., 168 Montague St.

Red Bank, N. J.—Alfred Stoney, of Keyport, and Wm. Taber Parker, of Little Silver, are reported interested in the construction of an electric railway between Red Bank and Oceanic.

Doylestown, Pa.—The Town Council is stated to have granted a franchise to the Doylestown & New Hope Ry. Co.

Loysville, Pa.—The Loysville Trolley Co. is stated to have secured the entire right of way for its line, and the work of surveying will begin at once.

Pittsburg, Pa.—The Pittsburg Railways Co. is reported to have secured control of the franchises of the Pittsburg, Coraopolis & Monaca St. Ry., and will soon begin constructing the line; the company also proposes doubling its tracks from the head of Neville Island to Coraopolis. F. Uhlenhaut, Ch. Engr., Pittsburg.

Laurel, Md.—A press report states that Geo. H. Harries, Vice-Pres. of the Washington Ry. & Electric Co., and W. H. Fuller, Gen. Mgr. of the same system, both of Washington, D. C., were here on Sept. 25 and went over the route of the proposed railway from Laurel to Brookeville, via Sandy Spring.

Frederick, Md.—A charter has been granted to the Frederick & Jefferson Electric Ry. Co., with a capital of $125,000, to construct an electric railway from Frederick to Jefferson, a distance of about 8 miles. Lewis O. Whipp and C. E. Lakin are among the incorporators.

New York, N. Y.—Plans have been filed for two 3-story brick sub stations for the underground Rapid Transit Railroad, to be built, one at 29 to 33 City Hall Place, 58x99 ft., to cost $60,000; the other at 108 to 110 E. 19th St., 50x91 ft., to cost $55,000. They will be of granite and limestone with terra cotta trimmings. Plans have also been filed for a 1-story inspection shed, to be built at 148th St. and 7th Ave., being 338 ft. front by 199 ft. deep. This building is to be constructed of re-enforced cement work supported by a structural steel framework, and will be used for the inspection of cars, etc., and will cost $95,000. The Rapid Transit Subway Constr. Co. is the owner. Van Vleck & Hunter, Park Row Bldg., are the architects.

Kirkland, N. Y.—The Oneida Ry. Co. is stated to have secured a right of way through the village. G. Leggett, Supt., Oneida.

Hazleton, Pa.—A charter has been granted to the Hazleton, Weatherly & Mauch Chunk Traction Co., with a capital of $100,000, to construct an electric railway about 15 miles in length. Incorporators: Frank W. Larned, Wilkesbarre; Lawrence Tarleton, of Weatherly, and others.

Morgantown, W. Va.—A press report states that the Morgantown Electric Light & Power Co. has sold $300,000 bonds, a large portion of which will be spent in building ten miles of trolley line.

Dunbridge, O.—The Toledo, Bowling Green & Southern Traction Co. is reported to have secured a right of way from Dunbridge to Toledo. W. Nusbaum, Ch. Engr., Cincinnati.

Greenville, O.—The Greenville & Union City Traction Co., of Greenville, is reported incorporated with a capital of $75,000, by Jos. E. Lowes, T. J. Weakley, and others, to construct an electric line from Greenville to Union City.

Middletown, Ind.—The Town Bd. is stated to have granted a franchise to the Union Traction Co., of Indiana. G. F. McCulloch, Gen. Mgr., Anderson.

Jasper, Ind.—A corps of engineers, under Robt. W. Hunt & Co., of Chicago, Ill., are reported to have commenced surveying for an electric line from this place to Mitchell, Ind., by way of French Lick and West Baden.

Frankfort, Ind.—Wm. George, of Aurora, Ill.; O. V. Darby, of Kokomo, Ind., and D. A. Coulter, of Frankfort, are reported interested in the construction of an electric railway from Frankfort to Logansport, and from Kokomo to Lafayette.

Muncie, Ind.—A correspondent writes that the survey for the Muncie-Portland Interurban Ry. has been completed, and that the line will probably be completed in the early part of 1903.

Paxton, Ill.—The Paxton, Danville & Wilmington Ry. Co. has been incorporated to construct a line from Danville through Paxton, Potomac and other towns to Wilmington; capital, $5,000. Directors: J. K. Butz, Potomac; W. O. Johnson, Paxton, and J. W. Dale, Danville, and others.

Madison, Wis.—The Madison & Northeastern R. R. Co. is reported incorporated to build an electric railway from Madison to Oshkosh and Fond du Lac via Sun Prairie, Columbus, Beaver Dam and Waupun. The line will be 130 miles in length. Incorporators: Chas. Scherleker, Sun Prairie; Frank Stegerwald, East Bristol; R. Bailey, Waupaca, and others.

Marquette, Mich.—Wm. K. Rhoades, of Cleveland, O., is promoting the building of an electric railway from Marquette to Negaunee and Ishpeming, a distance of about 14 miles. It is proposed to build the road so that the heavy snowfalls will not interfere with traffic. Power will be generated at the Dead River Falls, 4 miles from Negaunee.

St. Louis, Mo.—The St. Louis Co. Court at Clayton, Sept. 25, granted a franchise for a street railway over the Olive St. road to Creve Coeur Lake to the St. Louis County St. Ry. Co., of which Judge H. W. Bond is Pres.

Cincinnati, O.—The Cincinnati, Milford & Loveland Traction Co., of Cincinnati, has been incorporated, with a capital of $700,000. Incorporators: B. H. Kroger, J. Nevin Roberts and others.

Ft. Wayne, Ind.—P. A. Randall, of Ft. Wayne, is reported interested in the construction of an electric railway between Ft. Wayne and Garrett; also to Waterloo and Avilla.

Louisville, Ky.—Local press reports state that articles of incorporation have been filed by a company which proposes to turn the present Louisville, Harrods Creek & Westport R. R. into an electric line. The property has been leased from the Louisville & Nashville R. R., and the new company has an option and may become absolute owners later on. The new company has a capital of $350,000. Directors: Bethel Veach, W. N. Cox, Lafon Allen and others.

Falls City, Neb.—The Sycamore Ry. & Improvement Co. has been incorporated, to construct an electric road from Falls City south to Topeka, Kan., and north to Auburn, Neb. Incorporators: E. V. Kauffman, John H. Judy, Roy Hesseltine, and others.

Seattle, Wash.—T. O. Abbott, a local attorney, representing F. M. Wade, of Portland, Ore., is stated to have petitioned the Council for a franchise for a railway to cover about 20 miles of streets.

Santa Barbara, Cal.—It is stated that bids are wanted Oct. 13 for a franchise to construct an electric street railway on certain streets in this city. Alfred Davis, City Clk.

RAILROADS.

Wellsburg, W. Va.—A press report states that a charter has been granted to the Wellsburg & State Line R. R. Co. to construct a railroad up Buffalo Creek.

Duluth, Minn.—The Duluth, Virginia & Rainy River R. R. Co. is reported to be considering the extension of its line to Pelican Lake.

Nashville, Ill.—Lewis Krughoff, Julius Huegely and others, of Nashville, are reported interested in the construction of a railroad from Springfield to Murphysboro through Nashville, Pinckneyville, Greenville, Carlyle and Hillsboro.

Maryville, Tenn.—A charter has been granted to the Tennessee & Carolina Southern Ry. Co., with a capital of $200,000, to construct and operate a railway from a point of connection with the Southern Ry. at Maryville, through the counties of Blount and Monroe to a connection with the railway of the Carolina & Tennessee Southern, a distance of about 40 miles. Incorporators: Leon Jourolmon, Henry Fonde and others.

Memphis, Tenn.—A press report states that work will soon be commenced by the Arkansas, Missouri & Kansas Ry. Co., which proposes constructing a line from Memphis, through Joplin, Mo., to Chanute, Kan.

Birmingham, Ala.—Maj. J. W. Bushnell, Eng. in charge of the construction work of the Seaboard Air Line R. R., is reported to be in Birmingham arranging to let contracts for construction work on the line between Coal City, on the East & West R. R., to Birmingham, a distance of about 37 miles. The East & West is owned by the Seaboard and is to be rebuilt entirely from Cartersville, Ga., to Pell City. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

Geneva, Ala.—W. W. Barnett, J. J. Morris and J. R. Clarke, all of Geneva, are reported to have applied to the Sec. of State for a charter for the Geneva R. R. Co. The road is to run from Geneva to a junction with the Chattahoochie and Gulf R. R.; capital is placed at $100,000.

Asher, Okla. Ter.—A press report states that the Rock Island R. R. will construct a line from Asher to Dallas, Tex. W. E. Dauchy, Ch. Engr., Chicago, Ill.

Harrodsburg, Ky.—A surveying corps of the Southern Ry. (C. M. Ackert, Gen. Mgr., Washington, D. C.) is reported to be surveying for the extension of the Louisville Southern from Harrodsburg to Danville.

Belfield, N. D.—Engineers are stated to have completed two surveys for a new route for the main line of the Northern Pacific between Belfield and Sentinel Butte. The estimated cost of the new line, which will be 65 miles in length, is $3,500,000. It will require 3 years to complete it. A bridge, over a mile long and 225 ft. high, will be built over the Little Missouri. W. L. Darling, Ch. Engr., St. Paul, Minn.

Cripple Creek, Colo.—The Cripple Creek & Pueblo R. R. Co. has been incorporated, with a capital of $2,000,000, by T. B. Casey, of Boston, Mass.; John T. McAuley, of Chicago, Ill., and C. W. Spurgeon, of Colorado Springs, to construct a railroad from Cripple Creek to Pueblo.

Butte, Neb.—A charter is stated to have been granted to a company to construct a railroad from Anoka to Butte, at a cost of about $60,000. W. D. Forbes and J. T. Adkins are among the incorporators.

Santa Fe, N. M.—The New Mexico & Pacific Ry. Co. is reported incorporated by Hugh Keohler, Paul Reiss and others, all of St. Louis, to build to the Pacific Coast, following the 37th parallel.

Butte, Mont.—A press report states that the Oregon Short Line R. R. is contemplating an extension of its St. Anthony branch to the National Park, a distance of about 75 miles. J. B. Berry, Consulting Engr., Omaha, Neb.

PUBLIC BUILDINGS.

Concord, N. H.—Major H. G. Sargent writes that The E. B. Hutchinson Bldg. Co., of Concord, has secured the contract for erecting the city hall, for $79,750; this does not include the heating and plumbing.

Adams, Mass.—The congregation of the Polish Church is reported to be considering plans for an edifice, to cost about $60,000. Rev. Mr. Kloptlewicz pastor.

Newark, N. J.—V. J. Hedden & Sons, 431 Ogden St., are stated to have secured the contract for erecting the Essex Co. Court House for $952,366. The exterior walls will be of Indiana limestone with a granite base.

New York, N. Y.—Plans have been filed for a 3-story brick and stone library to be erected by the city on E. B'way and Catherine St., to cost $65,000. Architects, McKim, Meade & White, 160 Fifth Ave.

Brooklyn, N. Y.—Bids are wanted Oct. 16 for the following work in the Boro. of Brooklyn: Furnishing material and labor required for bath tubs, water closets, lavatories, etc. Thos. W. Hynes, Comr. Dept. of Correction, N. Y. City.

Thos. Dwyer, 107th and 108th Sts. and 1st Ave., N. Y. City, has secured the contract for the additions, extensions and alterations in the Kings Co. Hall of Records, for $398,700.

Albion, N. Y.—Bids will be received by the Bd. of Managers until Oct. 7 for constructing a conduit and manholes, enclosure for sewage disposal plant, fire escapes, cell door locking device, changing doors and plumbing for additional bathroom in hospital, Western House of Refuge for Women, Albion. Wm. J. Sterritt, Pres.

Greensburg, Pa.—Press reports state the Co. Comrs. on Sept. 27 awarded the contract for the erection of the new Westmoreland Co. Court House to Caldwell & Drake of Indianapolis, Ind., for $872,000. The structure, it is understood, will be of Webb granite.

Pittsburg, Pa.—Marcus Rousseau, 307 Smith Blk., is stated to be preparing plans for an edifice and a parish house for the St. Lawrence R. C. Church, to be erected on Penn and Atlantic Aves., to cost about $200,000.

Baltimore, Md.—Bids are wanted Oct. 8 for erecting a building, to be known as engine house No. 23, at Saratoga St. and Tyson alley. Thos. G. Hayes, Pres. Bd. of Awards.

Athens, Ga.—The citizens on Sept. 27 voted to issue $50,000 bonds for the erection of a city hall. Address J. W. Barnett, City Engr.

Macon, Ga.—The congregation of the Centenary Church is stated to have decided to erect a $20,000 edifice.

Columbia, S. C.—Bids will be received by M. R. Cooper, Secy. of State, until Dec. 15, for a new boiler and heating apparatus for heating and ventilating the State Capitol.

Richmond, Va.—Bids will be received by the Penitentiary Bldg. Com. until Oct. 23 for erecting a cell building; building to be of steel and concrete, containing 336 steel cells, steam heating and electric lighting plant, plumbing and mechanical ventilating system. Geo. W. Le Cato, Chmn.; P. Thornton Marye, Archt., 1st Nat. Bank Bldg., Newport News, Va.

Hartwell, O.—Bids will be received until Oct. 14 by the Bd. of Pub. Service of Cincinnati, for a battery of horizontal tubular boilers at the City Infirmary, Hartwell. Geo. F. Holmes, Clk.

Walker, Minn.—Plans and specifications will be received by the Bd. of Co. Cmrs. until Oct. 28 for a Court House to be erected in this city, and until Oct. 29 for erecting said building. C. E. Griffith, Co. Aud.

Indianapolis, Ind.—Bids will be received until Oct. 8 by the Bd. of Trus. for the Central Indiana Hospital for Insane, for plumbing at the department for women.

Canton, O.—Bids are wanted Oct. 10 for furnishing material and erecting a city auditorium and market house. C. C. Lloyd, City Clk.; L. W. Thomas & Co. Archts., Harter Bank Bldg.

Columbus, O.—Geo. M. Schneider is stated to have secured the contract for erecting the Greer and Awl Hospitals, for $72,046.

Wilmington, O.—Bids are wanted Oct. 10 for constructing a low-pressure steam-heating system to be installed in the City Hall. Lee Baker, Corporation Clk.

Oskaloosa, Ia.—John Gier, of Marshalltown, is stated to have secured the contract for erecting the Carnegie Library, for $16,956.

Westmoreland, Kan.—Bids are wanted Oct. 10 for furnishing a plant to heat the court house by hot air or steam heat. A. P. Scritchfield, Co. Clk.

St. Louis, Mo.—Bids will be received until Oct. 11 by Isaac S. Taylor, Dir. of Wks., La. Purchase Expo., for erecting the "Manufactures" Building at the Exposition.

Austin, Minn.—It is stated that bids are wanted Oct. 7 for erecting a Carnegie Library. John H. Anderson, Secy. Library Bd.

Owensboro, Ky.—The Christian Society is reported to be preparing to erect a $25,000 church. Dr. R. H. Crossfield, Pastor.

Alexandria, La.—This city has voted to issue $25,000 bonds for the erection of a city hall. It is probable that plans and specifications will be called for at the next City Council meeting, which takes place Oct. 7. I. W. Sylvester, City Engr.

Abbeville, La.—The Police Jury is stated to have decided to erect a $12,000 jail.

Clarksville, Tex.—Andrew Carnegie is stated to have offered this city $10,000 for a public library.

Paris, Ky.—J. C. Gibson, of Logansport, Ind., is stated to have secured the contract for erecting the Bourbon County Court House, for $157,000.

Lexington, Ky.—Bids are wanted Oct. 9 for erecting a public library. C. J. Bronston, Pres.; H. L. Rowe, Archt., Lexington.

Danville, Ky.—Bids are wanted until Oct. 28 by the Bldg. Com. of the Bd. of Comrs. of the Ky. Institution for Deaf, at Danville, for erecting 2 dormitory buildings, power building and steam plant, according to plans prepared by Dittoe & Wisenall, 75-76 Blymyer Bldg., Cincinnati, O. B. O. Rodes, Pres. Bd. of Comrs.

Omaha, Neb.—Bids are wanted Oct. 10 for erecting a public market house on Capitol Ave. Wm. Coburn, Secy. Bd. Pub. Wks.

Pasadena, Cal.—Dawson & Eldridge, of Los Angeles, are stated to have secured the contract for erecting the city hall, for $36,532.

Nogales, Ariz.—It is stated that bids are wanted Oct. 23 for erecting a court house. Philip Herold, Clk.

Redding, Cal.—It is stated that bids are wanted Oct. 13 for erecting a stone jail. J. B. Landis, Clk.

Montreal, Que.—R. Finley, 260 St. James St., and Jos. Perrault are stated to have prepared plans for the civic hospital; the estimated cost of the entire structure, including the laying out of the grounds, is $125,000.

Richibucto, N. B.—Bids are wanted Oct. 14 for erecting a Post Office in this city. Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

Port Colborne, Ont.—Bids are wanted Oct. 9 for a hot water heating apparatus at the Port Colborne Public Building. Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

BUSINESS BUILDINGS.

Boston, Mass.—Plans have been filed by Architect and Builder A. S. Driske, 166 Devonshire St., for a $45,000 3-story brick stable, 80x80 ft., to be located on Gibson St., Dorchester Dist.

Danbury, Conn.—The N. Y., N. H. & H. R. R. Co. will erect a depot at Danbury. C. M. Ingersoll, Jr., Ch. Engr., New Haven.

New York, N. Y.—Henry Siegel will erect a 10-story store building on 6th Ave. and 14th St., to cost about $1,000,000. Architects, Cady, Berg & See, 31 E. 17th St. Builders, Geo. A. Fuller Const. Co., 137 B'way.

Pittsburg, Pa.—Struthers & Hannah, 146 6th St., are stated to have prepared plans for a bank for the Merchants' Savings & Trust Co., to be erected on 5th Ave. and Stevenson St., to cost about $40,000.

A building permit is stated to have been issued to Henry Phipps for the erection of a 10-story stone, brick and steel office building at 6th St. and Duquesne Way to cost $800,000.

McKeesport, Pa.—The D. L. Clark Co., manufacturing confectioners, is stated to have decided to erect an 8-story building, 38x146 ft. on 5th Ave., to cost about $150,000.

Wilmington, Del.—W. L. Dockstader, of Wilmington, is stated to have commissioned Geo. I. Lovett, 424 Walnut St., Philadelphia, Pa., to prepare plans and specifications for a theater, office and store building to be erected on Market and 8th Sts.

Lockport, N. Y.—Wm. E. Huston, Lincoln Bldg., is stated to have secured the contract for erecting the Y. M. C. A. building for about $30,000.

Newark, N. J.—It is stated that plans have been completed by the Engineering Dept. of the Pennsylvania R. R. for the two freight houses which are to be erected along the Centre St. branch of the line in this city; one will be 380x51 ft. and 30 ft. high, the other 300x34 ft. and 30 ft. high. W. H. Brown, Ch. Engr., Philadelphia.

Chester, Pa.—Jos. Huston, Witherspoon Bldg., Philadelphia, is reported to be preparing plans for an office building to be erected on E. 5th St. for Josiah Smith and Wm. I. Schaffer.

Pittsburg, Pa.—A press report states that the Pittsburg Railways Co. will soon let contracts for 3 large car barns. One of the new barns will be an enlargement of the present barn at McKees Rocks. Another will be located within easy access of the Butler St. division, and will have a capacity of 100 cars. The third barn will be located in Wilmerding, and will furnish quarters for 50 cars. All of the buildings are to be modern structures of brick and steel, with the necessary repair shops attached. F. Uhlenhaut, Ch. Engr., Pittsburg.

Washington, Pa.—The contract for erecting the new Y. M. C. A. building is reported to have been awarded to Walker & Slater, of Washington, for $48,135.

Philadelphia, Pa.—It is stated that bids will be received until Oct. 15 by the Building Com. for erecting the Lu Lu Temple of the Mystic Shrine, on Spring Garden St. Estimated cost, $100,000. Milligan & Webber, Archts., 520 Walnut St.

Baltimore, Md.—E. M. Noel, 322 W. Biddle St., is stated to have secured the contract for erecting a 7-story warehouse on Paca and Lombard Sts., for Dr. B. Tilghman, to cost $75,000.

Spring Lake, N. J.—The Spring Lake Hotel & Realty Co. is stated to have selected Watson & Huckel, 1208 Chestnut St., Philadelphia, Pa., to prepare plans for a $150,000 hotel to be erected on the site of the old Monmouth Hotel at Spring Lake. It will be a 5-story structure, in the Spanish Renaissance style, to measure 200x350 ft., with wings at either end 42 ft. wide. The extension walls will be of buff and red brick, with a Spanish tile roof.

Oswego, N. Y.—John Seeber, 11 Arcade Blk., is reported to be preparing plans for a brick store and office building to be erected on West Bridge and 2d Sts. for Louis C. Rowe.

Philadelphia, Pa.—Addison Hutton, 400 Chestnut St., is reported to be preparing plans for a 5-story basement and sub-basement fireproof building, to be erected at 827 to 831 Market St., for Strawbridge & Clothier, to cost about $400,000.

Buffalo, N. Y.—The International Steam Pump Co. is reported to be about to build a brick foundry on Roberts Ave. near Clinton St. Cost, $95,000.
The Buffalo Dental Mfg. Co. is about to build a $35,000 brick factory.
A plant of 4 buildings is about to be built on Military Road, near city line, for the American Cabinet Co. Cost, $250,000.
C. W. Goodyear is about to build a $23,000 barn at 874 Delawsre St.

Columbus, Ga.—The contract for erecting the Columbus Y. M. C. A. building is stated to have been awarded to Barlow Bros., of Columbus, for $47,181.

Cleveland, O.—A permit has been issued for the erection of a 2-story brick warehouse, 180x360 ft., for the Basset-Presley Co. on Merwin St.; cost about $50,000. Architects, Knox & Elliott, Mercantile Bank Bldg.

Terre Haute, Ind.—H. L. Breinig, Mgr. of the Casino, is reported interested in the erection of a new opera house, to cost about $100,000.

Battle Creek, Mich.—It is stated that the Malta Vita Food Co. will erect a $25,000 office building.

Chicago, Ill.—Cass Gilbert, Endicott Bldg., St. Paul, Minn., is reported to be preparing plans for a 16-story building to be erected on La Salle and Adams Sts., for the Continental Bank, to cost about $4,000,000.

Menasha, Wis.—It is stated that a new hotel to replace the burned National Hotel is about to be built. C. W. Howard, Chris Walters and C. R. Smith are reported interested; probable cost, $35,000.

Birmingham, Ala.—The building occupied by Louis Saks' clothing store was destroyed by fire Sept. 23. It is stated that it is proposed to rebuild at once.

Mobile, Ala.—Geo. G. Johnson, 54 N. Royal St., is the architect for stores and apartment houses to be built at a cost of $46,000.

Tallulah, La.—Bids will be received until Oct. 22 by the Madison Planters' Cotton Oil Co. for erecting mill buildings in this city. J. M. Johnson, Pres.

Memphis, Tenn.—The Geo. B. Swift Co., of Chicago, Ill., is stated to have secured the contract for erecting the shops and roundhouses at Memphis, for the Illinois Central R. R.; contract reported to be about $500,000.

Natchez, Miss.—Eugene M. Clarke, of the Temple Opera House, is reported interested in the erection of a new theater to cost from $60,000 to $80,000.

Tacoma, Wash.—Russell & Heath are reported to be preparing plans for a $30,000 brick block, to be built on A St. and 11th Ave. for Wm. F. Sheard.

Los Angeles, Cal.—John Parkinson, Laughlin Bldg., is the architect for 5-story marble and pressed brick club building to be built for the Cal. Club at 5th and Hill Sts. Estimated cost, $150,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

279 to 283 E 3d St., br stores & tenemts; c, $60,000; o, Mrs Jennie Wanderer; a, Bernstein & Bernstein.
109th St. & Amsterdam Ave, br stable; c, $35,000; o, Michael A Hoffman; a, S B Ogden & Co.

DWELLINGS.

New York, N. Y.—Plans have been drawn by Herts & Tallant, 32 E. 28th St., for a house to cost $750,000 for Isaac L. Rice, Vice-Pres. of the Holland Submarine Boat Co. It will be built on 89th St. and Riverside Drive.

Philadelphia, Pa.—Okie & Ziegler are stated to have prepared plans for a 4-story tenement house to be erected on 7th and Christian Sts.

Homewood, Pa.—Milligan & Miller, 520 Walnut St., Philadelphia, are reported to be preparing plans for two apartment houses in Homewood. One will contain 12 and the other 8 flats. The two will cost $25,000.

Minneapolis, Minn.—F. T. Heffelfinger is stated to have secured a permit for the construction of a stone dwelling at 2205 Park Ave., to cost $20,000.

St. Paul, Minn.—A permit has been issued for a 4-story brick flat to be erected on Nelson Ave., near Louis St., for M. J. O'Neil, to cost $60,000.

Cheyenne, Wyo.—The plans of C. W. Murdock, of Omaha, Neb., are stated to have been accepted by the Capitol Comn. for the 2-story brick mansion for the Governor.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Hancock & Houston Sts, 2 br tenemts; c, $60,000 all; o, estate of N Low; a, Mcilvaine & Tucker.
Riverside Drive, 73d and 74th Sts and West End Ave, stone front dwelg; c, $900,000; o, C M Schwab; a, Maurice Herbert.

SCHOOLS.

Brockton, Mass.—Plans for a new high school have been received from several architects, but the Public Property and School Committees have not yet been able to agree upon a selection.

New Haven, Conn.—The Bd. of Educ. is reported to have decided to remodel the high school as a grammar school, at a cost of $30,000. Architect, L. W. Robinson, 423 Exchange Bldg.

Hoboken, N. J.—The City Council is stated to have voted to erect a $130,000 school.

Bordentown, N. J.—Bids will be received until Oct. 7 by the Com. on Manual Training & Industrial School for Colored Youth of the State Bd. of Educ., at the Dept. of Pub. Educ., Trenton, for erecting a school, including plumbing and heating, on the grounds at Bordentown.

New York, N. Y.—Bids are wanted Oct. 13 for the general construction of Pub. School No. 110. C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ.

Brooklyn, N. Y.—Bids are wanted Oct. 10 for installing ventilating and heating apparatus in School No. 141, Boro. of Brooklyn. C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., N. Y. City.

Oneida, N. Y.—Local press reports state that bids will be received until Oct. 9 by the Bd. of Educ. for a system of plumbing in the High School. Address City Clk.

Middletown, N. Y.—Bids are wanted Oct. 8 for erecting a school at Beattie Ave. and Albert St. A. B. Wilbur, Chmn. Bldg. Com.

Wilkinsburg, Pa.—E. Z. Peffer, of Wilkinsburg, is stated to have secured the contract for erecting a school on Anderson St. and Swissvale Ave. for $65,000.

Scranton, Pa.—Edw. Langley, Cornell Bldg., is the architect for a Manual Training School, to be erected here at a cost of $50,000.

Plainfield, N. J.—The Bd. of Educ. is reported to be considering the erection of a high school, to cost about $100,000.

Gainesville, Ga.—J. W. Golucke, of Atlanta, is stated to have been selected to prepare plans for a school, to cost about $20,000.

Milwaukee, Wis.—It is stated that the Wisconsin College of Physicians and Surgeons within the coming year will build an extension to its present building at a cost of about $30,000.

Minneapolis, Minn.—The Bd. of Educ. is stated to have secured a permit to erect a brick school at Bryant and 37th Aves. N., to cost $24,000.

Dewitt, Ia.—Bids are wanted Oct. 15 for erecting a school. R. M. Smith, Secy.

Kansas City, Mo.—City Clk. E. J. Becker writes that on Sept. 27 it was voted to issue $500,000 bonds for the construction of new schools.

Reedsburg, Wis.—It is stated that bids are wanted Oct. 20 for erecting a high school. John D. Devor, Clk.

Baton Rouge, La.—Bids are wanted Oct. 25 for erecting a 2-story brick workshop, 200x80 ft., at the La. State Univer., Baton Rouge. Thos. S. Boyd, Pres.; W. L. Stevens, Crowley, La.

Stockton, Cal.—Bids will be received by James A. Barr, Clk. of High School Bd., until Oct. 30, for erecting a high school. Estimated cost, $100,000.

STREET CLEANING AND GARBAGE DISPOSAL.

North Adams, Mass.—T. J. Putnam, Chmn. Bd. of Health, writes that the contract for the collection of garbage in this city for a term of 5 years (bids opened Sept. 25) has been awarded to Wm. A. Ballou (present contractor), North Adams, at $2,500 per annum.

Atlanta, Ga.—Bids will be received by the Bd. of Health until Dec. 1 (extension of date) for the collection and disposal of garbage and night soil and cleaning the streets of the city for a period of 5 years. Bids are wanted for the collection and disposal of garbage alone; also for the collection and disposal of night soil alone; also for cleaning the streets. Bids are also wanted for the cremation or incineration of all the garbage, night soil and refuse of the city for a period of 5 years. Location of plant to be selected by the Bd. of Health. Address, Dr. E. H. Richardson, Secy. of Bd.

GOVERNMENT WORK.

Watertown, Mass.—Bids are wanted Oct. 23 for erecting a barrack building complete, exclusive of cellar excavation and stone footing, at the Watertown Arsenal. Separate bids are asked for other walls and stone work, omitting roof and all wood work, and for plumbing, heating and gas fitting. Address Lieut. Col. John G. Butler, Ord. Dept. Comdg.

Portland, Me.—The following bids were opened Sept. 29 by Maj. S. W. Roessler, Corps of Engrs., U. S. A., for dredging: *a*, Bucksport Harbor, Me., 150,000 cu yds.; *b*, Camden Harbor, 45,000 cu. yds.; *c*, Georges River, Me., 16,000 cu. yds. (prices are for scow measurements): Hamilton & Sawyer, Chebeague Island, Me., *a* 14½c., *b* 19½c., *c* 20c.; $8 per ton for boulders, Camden Harbor and Georges River. Eastern Dredging Co., Portland, Me., *a* 13⅝c., *b* 19¾c., *c* 22c.; $5 per ton for boulders, Camden Harbor and Georges River. Morris & Cumings Dredging Co., New York, N. Y., *a* 12.48c., *b* 18 9/10c.; $4 per ton for boulders.
Bids opened at the same time for ledge excavations at Sullivan Falls, Me., were as follows (price per cu. yd. situate): H. Herbert Sturgis So. Standish, Me., $22.50: Harrie & Letteney Co., Boston, Mass., $44; Nathaniel E. Gordon, So. Portland, Me., $24.97.

Portland, Me.—Bids are wanted Oct. 20 for constructing a barrack building and 2 sets of officers' quarters at Ft. McKinley, Me., as advertised in The Engineering Record.

Newport, R. I.—Bids will be received until Oct. 15 at the Bureau of Equipment, Navy Dept., Washington, D. C., for water supply and storage system at the U. S. Naval Coal Depot, Narragansett Bay, Newport.

Boston, Mass.—The following bids were opened Sept. 30 by Lieut. Col. W. S. Stanton, Corps of Engrs., U. S. A., for dredging at the entrance channel to Lynn Harbor and in Mystic River, Mass.: *a*, dredging per cu. yd.; *b*, removing boulders over 3 tons each per cu. yd.:

Bidders.	Lynn Harbor *a*	Lynn Harbor *b*	Mystic River *a*	Mystic River *b*
East'n Dredg. Co., Boston .	$.24¼	$5.00	$.24¾	$5.00
Chas. H. Souther, Boston .	.27	4.50	.22³/₁₀	4.50
Bay State Dredg Co., do. .	.23½	5.00	.23½	5.00

New York, N. Y.—The following bids were opened Sept. 25 by Col. S. M. Mansfield, Corps of Engrs., U. S. A., for dredging: *a*, in Great South Bay, 170,000 cu. yds.; *b*, in Patchogue River, 130,000 cu. yds.; *c*, total: The Newburgh Dredging Co., Newburgh, N. Y., *a* 28c., *b* 25c., *c* $80,100; Kirk, Driscoll & Co., Dunfee Bldg., Syracuse, N. Y., *a* 23½c., *b* 23c., *c* $69,850 (recommended for award).

Philadelphia, Pa.—Bids are wanted at the U. S. Engr. Office, Phila., until Oct. 16, for the erection of a dwelling addition at Absecon Light Station, Atlantic City, N. J., as advertised in The Engineering Record.
Bids are wanted Nov. 1 for furnishing material and erecting a light-house, oil-house and barn at the new Reedy Island Front Light Station, Del., as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until Oct. 14 by E. A. Hitchcock, Secy. Dept. of the Interior, for furnishing the following: Pipes, fittings and valves; radiators; thermostatic temperature regulation; covering of pipes, fittings, etc., and for furnishing labor and material and installing complete, in the Patent Office Bldg., a steam heating system.

Charleston, S. C.—Bids are wanted at the U. S. Engr. Office until Nov. 12 for constructing 2 wooden hull, sea-going, self-propelling suction dredges, as advertised in The Engineering Record.

Norfolk, Va.—The Washington "Star" states that all bids opened at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., on Sept. 13, for constructing a concrete and granite dry dock at the Navy Yard, Norfolk, have been rejected, and that new bids will be asked. For bids opened Sept. 13 see The Engineering Record of Sept. 20.
Bids will be received until Oct. 31 at the U. S. Engr. Office, U. S. A., Rm. 2, Custom House, Norfolk, for dredging Appomattox River, Va.

Wheeling, W. Va.—Bids are wanted at the U. S. Engr. Office until Oct. 30 for building lock walls and guide walls for dam No. 18, Ohio River, as advertised in The Engineering Record.

Nadeau, Kan.—Bids are wanted Oct. 16 for furnishing material and constructing 2 bridges over Big Soldier and Little Soldier Creeks on Pottawatomie reservation, Jackson Co., Kan. Address Wm. R. Honnell, U. S. Indian agent, Pottawatomie Agency, Nadeau.

Chicago, Ill.—Bids are wanted Oct. 29 for dredging and rock excavation in Calumet River, Ill., as advertised in The Engineering Record.

Ft. Snelling, Minn.—Bids are wanted Oct. 25 for erecting several buildings at this post. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Cheyenne, Wyo.—Bids are wanted at the Treasury Dept., Washington, D. C., until Nov. 4, for a conduit and electric wiring system for the U. S. Public Building at Cheyenne, as advertised in The Engineering Record.

Denver, Colo.—Bids are wanted at the Treasury Dept., Washington, D. C., until Nov. 12, for safety vaults, vault doors and work incidental thereto in the U. S. Mint, Denver, as advertised in The Engineering Record.

MISCELLANEOUS.

Bridgeton, N. J.—The City Council has passed an ordinance providing for the issue of $40,000 bonds for a public park.

New York, N. Y.—The contract for rebuilding the pier at the foot of E. 32d St., has been awarded by the Dock Dept. to Augustus Walsh for $20,890.

Buffalo, N. Y.—The Dept. of Pub. Wks. is stated to have completed plans for the improvement of the Buffalo River and Cazenovia Creek, which will abate the flooding of the South Buffalo Dist., and also widen and improve the channels of the river and creek.

Buffalo, N. Y.—Bids will be received until Oct. 9 by Chas. S. Boyd, Supt. of Pub. Wks., Albany, for deepening and improving the channel of Erie Basin, Buffalo, between Buffalo River and Slip No. 2.

New York, N. Y.—Bids will be received by Jacob A. Cantor, Boro. Pres., until Oct. 7, for furnishing, erecting, maintaining and illuminating for a period of 1 year, on existing electric light poles and on other electric light poles that may be erected, 600 street sign boxes; also for furnishing, erecting, maintaining and illuminating, for a period of 1 year, on existing gas lampposts, and fire alarm posts, and on other gas lampposts that may be erected, 1,025 street sign boxes; also for furnishing, delivering and erecting (without maintaining or illuminating) on existing electric light poles, gas lampposts, and on other poles and posts that may be erected, 800 street sign boxes of 2 different patterns, 1 for electric light poles and the other for gas lampposts.

Jersey City, N. J.—The Street & Water Bd. has passed a resolution formally requesting the Bd. of Finance to provide an appropriation of $100,000 for the improvement of new parks and the extension of the city's park system.

Babcock, Wis.—Bids will be received by J. E. Ingraham, Secy. Remington Drainage Dist., Babcock, for dredging about 350,000 cu. yds.

New Orleans, La.—Local press reports state that the Dock Comrs. are about to let contracts for the construction of 4 new steel sheds. Coleman, Malochee & Villere, Engrs. of the Bd. are now preparing plans for these sheds, which are to be located at Clouet St. wharf, Picayune tier, Orange St. and the new Market St. wharf.

NEW INDUSTRIAL PLANTS.

The Reliance Mfg. Co., Winchester, Ky., will erect a wood-working plant to replace that recently burned. The main building will be 100x250-ft., and the power plant, 150 H.-P.

H. Abrams, Winston, N. C., contemplates erecting a new factory.

The Griffin, Ga., Mfg. Co. will build additions to its plant during the coming year, but no definite plans have been made.

The Hewson Woolen Mills, Amherst, N. S., will install a power plant of 150 to 200 H.-P., the boilers to be two of 125 H.-P. each.

The Oneida Knitting Co., De Pere, Wis., will erect a 2½-story, 120x50-ft. mill, to be driven electrically and heated by steam.

Plans have been prepared for a 3-story brick mill to cost about $20,000 for the Eaton-Hurlbut Paper Co., Pittsfield, Mass.

Tillman Bros., Reepsville, N. C., will erect a 4-story, 30x40-ft. flour mill and a 22x30-ft. engine house at North Brook, N. C. They are in the market for a 30-H.-P. engine and a 35-H.-P. boiler.

The Bridal Veil, Ore., Lumbering Co. is having plans drawn for a new mill.

E. W. Wilbur, Mesa City, Ariz., expects to be in the market within 60 days for equipment for a creamery, including refrigerating plant and a 10-ton ice machine.

The Hamilton, O., Brick Co. will build a plant having a daily output of 40,000 or 50,000 in the early spring. An engine of about 50 H.-P. and the necessary boilers will be installed.

The New York Air Brake Co., 66 Broadway, New York, is erecting a 272x300-ft. foundry at Watertown, N. Y., to have a daily capacity of 100 tons. Steam power will be used during the winter, but by next summer it is hoped to install electricity.

The Huntington, W. Va., Cold Storage & Commission Co. is erecting a cold-storage house having a capacity of 250,000 cu. ft., an ice plant having a daily capacity of 35 tons, and a 1,000-ton ice-storage house.

Milam & Williams, Watauga Valley, Tenn., will erect a 28x40-ft. flour mill next spring, to have a capacity of 30 to 40 bbls. The capacity of the power plant will be 42 H.-P.

The American Cabinet Co., Canisteo, N. Y., which has absorbed the Smith Table Works, Warren, Pa., has broken ground at Fairmount, near Buffalo, N. Y., for a 100x200-ft. main factory building, 50x150-ft. finishing and packing room, 58x100-ft. dry-kiln and gluing house, and 40x60-ft. boiler, engine and pumping house. The cost of the plant will be $250,000. Geo. S. Davis, Warren, Pa., Supt.; L. M. Hewit, Canisteo, Chmn. Bd. of Directors.

The United Shoe Machinery Co., Albany Bldg., Boston, Mass., will erect a new plant at Beverly, Mass., to include a 3-story, 60x80-ft. administration building; two 3-story and basement, 600x60-ft. manufacturing buildings; a 3-story and basement, 300 to 400x60-ft. storage building; a 60x220-ft. drop forge, blacksmith, die sinking and hardening plant; a 20-ton foundry requiring 72,000 ft. floor space, and a 1,500 to 1,800-H.-P. central power plant. The plant will probably be driven electrically. F. M. Andrews, Dayton, O., architect; Dean & Main, Boston, consulting mechanical engineers.

BUSINESS NOTES.

The Chapman Fuel Economizing System of Albany has been incorporated with a capital of $35,000 to manufacture an invention of John S. Chapman for economizing fuel, arresting smoke and increasing steam boiler capacity. The directors are: John S. Chapman, Isaac La Grange, James W. Bentley and B. A. Chapman, of Albany; John Pressley, M. Pressley and M. Weighill, of Rochester.

The Ball Engine Co., Erie, Pa., reports the following among its recent orders: Detroit Iron & Steel Co., three 350-H.-P. engines, each arranged for direct connection to a generator; C. O. Lamson, Waterloo, Ia., an engine for direct connection to a Westinghouse generator; Penna. R. R. Co., Ft. Wayne, Ind., an engine for electric service; Pueblo, Colo., Electric Co., an additional unit.

The Otis Elevator Co. has recently closed a contract with the Rapid Transit Subway Const. Co., New York, for an escalator, or moving stairway, to be installed at the Manhattan St. station of the new rapid transit road. At this point the subway crosses the Manhattan Valley on a viaduct, the tracks being about forty feet above the level of the street. The escalator will carry passengers both up and down, the two tracks being arranged in the same vertical plane. The guaranteed carrying capacity of the device is 20,000 people per hr., 10,000 in each direction. A motor of 35 H.-P. will be sufficient to operate the mechanism when working at its maximum capacity.

The Buffalo & Susquehanna Iron Co., Buffalo, N. Y., has contracted with Wm. B. Scaife & Sons Co., Pittsburg, for a 6,000-H.-P. We-Fu-Go water softening and purifying system. This is the third plant purchased by that company, located at different points. Wm. B. Scaife & Sons Co. has now in successful operation over 200,000 H.-P., in the United States alone, handling over 25,000,000 gallons of water daily, principally for boiler use, although a part of this amount is used in industries where soft water is desirable.

The Crocker-Wheeler Co. held at its works at Ampere, N. J., on Sept. 25 and 26, its annual managers' convention. Those present were the officers of the company, Schuyler S. Wheeler, Gano S. Dunn, W. L. Brownell, Putnam A. Bates, C. N. Wheeler and F. V. Henshaw, and the branch managers, Samuel Russell, Jr., Julian Roe, J. Bally Craig, Louis P. Hall, W. H. Wissing, Francis B. DeGress, Henry J. Sage, William A. Doble and Harold Lomas. Francis B. DeGress, of the company's New York office, who has been in the service of the company longer than any of the other branch office managers, presented to the general sales manager, Putnam A. Bates, in the name of the managers, a token of their esteem.

The Chicago Pneumatic Tool Co. has declared a quarterly dividend of 2 per cent., payable Oct. 15; the capital stock of the company is $10,000,000. Appropriation was made to enlarge the Detroit plant, the addition projected to increase the company's capacity one-third. An order has been granted by the courts restraining the making, selling or use of tools in infringement of the Moffet patent owned by the company until the further order of the court.

Some of the contracts recently awarded the New England Structural Co. are the extension to the Boston & Maine shops at Concord, N. H., and bridges at Everett and Revere, Mass., for the same railroad, which are part of the system of elimination of grade crossings, which has been begun by the railroad.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng Record
Oct. 7.	Findlay, O.	Sept. 27
Oct. 9.	Brooklyn, N. Y.	Sept. 27
Oct. 10.	Slater, Ia.	Oct. 4
Oct. 11.	St. Louis, Mo.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 11.	Paulsboro, N. J.	Sept. 27
Oct. 14.	Colby, Wis.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 14.	Tonawanda, N. Y.	Sept. 27
	Adv., Eng. Record, Sept. 27.	
Oct. 15.	Wilbur, Wash.	Oct. 4
Oct. 15.	Troy, N. Y.	Oct. 4
Oct. 15.	Newport, R. I.	Oct. 4
Oct. 17.	Mt. Clemens, Mich.	Oct. 4
Oct. 18.	Washington, D. C.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 21.	East Dundee, Ill.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 22.	El Paso, Tex.	Sept. 6
Oct. 29.	Moline, Ill.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Nov. 4.	Gueydan, La.	Oct. 4
Nov. 8.	Pumping plant, Brockton, Mass.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Dec 1.	Pumps, Seguin, Tex.	July 26
———	Fayette, Miss.	Sept. 27

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 7.	Bayonne, N. J.	Oct. 4
Oct. 7.	Philadelphia, Pa.	Oct. 4
Oct. 8.	Boston, Mass.	Oct. 4
Oct. 10.	Boston, Mass	Oct. 4
Oct. 10.	Waukegan, Ill.	Sept. 27
	Adv., Eng. Record, Sept. 27.	
Oct. 10.	Ridley Park, Pa.	Aug. 16
	Adv., Eng. Record, Aug. 16.	
Oct. 11.	Akron, O.	Sept. 20
Oct. 13.	Yonkers, N. Y.	Oct. 4
Oct. 15.	Cass Lake, Minn.	Oct. 4
Oct. 15.	Hartford, Conn.	Oct. 4
Oct. 15.	Cincinnati, O.	Sept. 27
Oct. 16.	Newark, N. J.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 16.	Iola, Kan.	Oct. 4
Oct. 17.	Grand Rapids, Mich.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 18.	Washington, D. C.	Oct. 4
Oct. 20.	Girard, O.	Oct. 4
Oct. 20.	Toledo, O.	Oct. 4
Oct. 21.	Marion, Ind.	Oct. 4
Oct. 27.	Vincennes, Ind.	Oct. 4
Oct. 28.	Cincinnati, O.	Oct. 4
Dec. 15.	Montevideo, Uruguay	Sept. 13

BRIDGES.

Oct. 7.	East Grand Forks, Minn.	Sept. 20
Oct. 8.	Suamico, Wis.	Oct. 4
Oct. 8.	Boston, Mass.	Sept. 27
Oct. 8.	Indianapolis, Ind.	Sept. 20
Oct. 9.	Marysville, Kan.	Oct. 4
Oct. 11.	Canton, O.	Sept. 20
Oct. 13.	Thomaston, Ga.	Sept. 27
Oct. 13.	Eureka, Cal.	Sept. 27
Oct. 15.	Cleveland, O.	Oct. 4
Oct. 15.	Yellowstone Park, Wyo.	Sept. 6
	Adv., Eng. Record, Sept. 6, 13.	
Oct. 16.	St. Charles, Mo.	Oct. 4
Oct. 18.	Spencer, Ind.	Oct. 4
Oct. 27.	Victoria, B. C.	Sept. 6
	Adv., Eng. Record, Sept. 6 to Oct. 4.	
Nov. 5.	Chicago, Ill.	Sept. 6
Dec. 1.	Bigtimber, Mont.	Sept. 27

PAVING AND ROADMAKING.

Oct. 7.	New York, N. Y.	Oct. 4
Oct. 7.	Jersey City, N. J.	Oct. 4
Oct. 7.	McKeesport, Pa.	Sept. 27
Oct. 8.	Kansas City, Mo.	Oct. 4
Oct. 9.	New York, N. Y.	Oct. 4
Oct. 9.	Norwich, N. Y.	Oct. 4
Oct. 10.	Omaha, Neb.	Oct. 4
Oct. 11.	San Francisco, Cal.	Sept. 13
Oct. 13.	Newark, O.	Sept. 20
Oct. 14.	Cincinnati, O.	Oct. 4
Oct. 15.	Lead, S. D.	Oct. 4
Oct. 15.	Cincinnati, O.	Sept. 27
Oct. 17.	Laporte, Ind.	Oct. 4
Oct. 17.	Tiffin, O.	Oct. 4
Oct. 20.	Toledo, O.	Oct. 4
Oct. 20.	Fredericksburg, Va.	Oct. 4
Oct. 20.	Newton, N. J.	Sept. 27
Oct. 28.	Cincinnati, O.	Oct. 4
Nov. 3.	Toledo, O.	Oct. 4

POWER, GAS AND ELECTRICITY.

Oct. 8.	Manchester, O.	Sept. 27
Oct. 14.	Colby, Wis.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 14.	San Pedro, Cal.	Sept. 13
Oct. 15.	Castile, N. Y.	Oct. 4
Oct. 15.	Chicago, Ill.	Aug. 23
Oct. 20.	Michigan City, Ind.	Sept. 27
Oct. 23.	Hanford, Cal.	Sept. 27
Oct. 28.	Chattanooga, Tenn.	Sept. 13
	Adv., Eng. Record, Sept. 13 to Oct. 4.	
Nov. 1.	Macon, Ga.	Aug. 30
Nov. 15	Norfolk, Va.	Sept. 13

GOVERNMENT WORK.

Oct. 7.	Joplin, Mo.	Sept. 6
	Adv., Eng. Record, Sept. 6, 13.	
Oct 8.	Portland, Ore.	Sept. 20
Oct. 8.	Chicago, Ill.	Sept. 13
Oct. 8.	Montgomery, Ala.	Sept. 13
	Adv., Eng. Record, Sept. 13 to Oct. 4.	
Oct. 8.	Chattanooga, Tenn.	Sept. 13
Oct. 9.	Washington, D. C.	Sept. 27
Oct. 9.	Ft. Totten, N. D.	Sept. 20
Oct. 9.	Newport News, Va.	Aug. 30
	Adv., Eng. Record, Aug. 30, Sept. 6.	
Oct. 10.	Mobile, Ala.	Sept. 13
	Adv., Eng. Record, Sept. 13 to Oct. 4.	
Oct. 10.	Plattsburg Barracks, N. Y.	Sept. 13
Oct. 10.	Elmira, N. Y.	Sept. 13
Oct. 11.	Mach. bldg., Philadelphia, Pa.	Sept. 27
Oct. 11.	Ft. Lincoln, N. D.	Sept. 20
Oct. 11.	Ft Snelling, Minn.	Sept. 20
Oct. 11.	San Francisco, Cal	Sept. 13
Oct. 11.	Philadelphia, Pa.	Sept. 13
Oct. 11.	Dry dock, Charleston, S. C.	Aug. 23
Oct. 14.	Washington, D. C.	Oct. 4
Oct. 14.	Dover, Tenn.	Sept. 27
Oct. 14.	Ft. Getty, S. C.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 4.	
Oct. 14.	Aberdeen, S. Dak.	Aug. 30
Oct. 15.	Newport, R. I.	Oct. 4
Oct. 15.	Fog-signal bldg., San Francisco, Cal.	Sept. 27
Oct. 15.	Bldgs., Sheridan, Wyo.	Sept. 27
Oct. 15.	Muskegon, Mich.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 4.	
Oct. 15.	St. Louis, Mo.	Sept. 20
	Adv., Eng. Record, Sept. 20, 27.	
Oct. 15.	San Antonio, Tex.	Sept. 20
Oct. 15.	Yellowstone Park, Wyo.	Sept. 6
	Adv., Eng. Record, Sept. 6 to Oct. 4.	
Oct. 16.	Philadelphia, Pa.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 16.	Nadeau, Kan.	Oct. 4
Oct. 16.	San Francisco, Cal.	Sept. 27
Oct. 16.	Tampa, Fla.	Sept. 6
	Adv., Eng. Record, Sept. 6 to 27.	
Oct. 18.	Foundry, Philadelphia, Pa.	Sept. 27
Oct. 18.	Dredging, Boston, Mass.	Sept. 27
Oct. 18.	Wharf, Boston, Mass.	Sept. 27
Oct. 18.	Bldg., Ft. Myer, Va.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 4.	
Oct. 20.	Portland, Me.	Oct. 4
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Oct. 20.	Ft. Riley, Kan.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 20.	San Francisco, Cal.	Sept. 27
Oct. 20.	New York, N. Y.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 4.	
Oct. 21.	(Conneaut Harbor), Cleveland, O.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 22.	(Ft. Rodman), Newport, R. I.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 22.	(Ludington), Grand Rapids, Mich.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 23.	Watertown, Mass.	Oct. 4
Oct. 23.	(Brunswick Harbor), Savannah, Ga.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 23.	(Savannah Harbor), Savannah, Ga.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 23.	(Chesapeake Bay), Wilmington, Del.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 25.	Ft. Snelling, Minn.	Oct. 4
Oct. 25.	Los Angeles, Cal.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 25.	Bremerton, Wash.	Sept. 27
Oct. 29.	Chicago, Ill.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 29.	Pier, Manistee, Mich.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 30.	Wheeling, W. Va.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 30.	Dredging, Boston, Mass.	Sept. 20
	Adv., Eng. Record, Sept. 20, 27.	
Oct. 31.	Norfolk, Va.	Oct. 4
Nov. 1.	West Point, N. Y.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 4.	
Nov. 1.	Light-house, Philadelphia, Pa.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Nov. 4.	Cheyenne, Wyo.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Nov. 12.	Denver, Colo.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Nov. 12.	Charleston, S. C.	Oct. 4
	Adv., Eng. Record, Oct. 4.	

BUILDINGS.

Oct. 7.	Pub. bldg., Albion, N. Y.	Oct. 4
Oct. 7.	School, Bordentown, N. J.	Oct. 4
Oct. 7.	Library, Austin, Minn.	Oct. 4
Oct. 7.	School, Athens, O.	Sept. 27
Oct. 7.	Jail, Gardener, Me.	Sept. 27
Oct. 7.	City Hall improv., New York, N. Y.	Sept. 27
Oct. 7.	Bath, New York, N. Y.	Sept. 27
Oct. 7.	Court House, Miami, Fla.	Aug. 16
Oct. 8.	School, Middletown, N. Y.	Oct. 4
Oct. 8.	Engine house, Baltimore, Md.	Oct. 4
Oct. 8.	Plumb., in pub. bldg., Indianapolis, Ind.	Oct. 4
Oct. 9.	School, Oneida, N. Y.	Oct. 4
Oct. 9.	Htg. pub. bldgs., Port Colborne, Ont.	Oct. 4
Oct. 9.	Library, Lexington, Ky.	Oct. 4
Oct. 10.	Htg. City Hall, Wilmington, O.	Oct. 4
Oct. 10.	Htg. school, Brooklyn, N. Y.	Oct. 4
Oct. 10.	Market house, Canton, O.	Oct. 4
Oct. 10.	Market house, Omaha, Neb.	Oct. 4
Oct. 10.	Htg. Court House, Westmoreland, Kan.	Oct. 4
Oct. 10.	Cathedral, Richmond, Va.	Sept. 27
Oct. 10.	Pub. bldg., Springfield, O.	Sept. 20
Oct. 10.	Police station plans, Milwaukee, Wis.	Sept. 20
Oct. 11.	Pub. bldg., St. Louis, Mo.	Oct. 4
Oct. 13.	School, New York, N. Y.	Oct. 4
Oct. 13.	Jail, Redding, Cal.	Oct. 4
Oct. 13.	Htg. Court House, Texarkana, Ark.	Sept. 27
Oct. 14.	Pub. bldg., Hartwell, O.	Oct. 4
Oct. 14.	Post Office, Richibucto, N. B.	Oct. 4
Oct. 14.	Jail, Louisville, Ky.	Sept. 27
Oct. 14.	Hospital, Springfield, O.	Sept. 20
Oct. 15.	School, Dewitt, Ia.	Oct. 4
Oct. 15.	Bus. bldg., Philadelphia, Pa.	Oct. 4
Oct. 15.	Pub. bldg., Newark, O.	Sept. 27
Oct. 15.	Hospital, Willard, N. Y.	Sept. 13
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Oct. 16.	Pub. bldg., Brooklyn, N. Y.	Oct. 4
Oct. 20.	School, Reedsburg, Wis.	Oct. 4
Oct. 20.	Hospital, Cleveland, O.	Sept. 27
Oct. 21.	Jail, Jefferson, Ga.	Sept. 13
Oct. 22.	Mill, Tallulah, La.	Oct. 4
Oct. 23.	Court House, Nogales, Ariz.	Oct. 4
Oct. 23.	Pub. bldg., Richmond, Va.	Oct. 4
Oct. 24.	School plans, Milwaukee, Wis.	Sept. 27
Oct. 25.	School, Baton Rouge, La.	Oct. 4
Oct. 28.	Court House plans, Walker, Minn.	Oct. 4
Oct. 28.	Pub. bldg., Danville, Ky.	Oct. 4
Oct. 29.	Court House, Walker, Minn.	Oct. 4
Oct 30.	School, Stockton, Cal.	Oct. 4
Dec. 2.	Capitol work, St. Paul, Minn.	Aug. 16
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Dec. 15.	Htg. Capitol, Columbia, S. C.	Oct. 4

MISCELLANEOUS.

Oct. 7.	Street signs, New York, N. Y.	Oct. 4
Oct. 7.	Pier, New York, N. Y.	Sept. 27
Oct. 8.	R. R., Portuguese East Africa	Aug. 30
Oct. 9.	Buffalo, N. Y.	Oct. 4
Oct. 9.	Dredging, Boston, Mass.	Sept. 27
Oct. 9.	Dry dock machinery, Portland, Ore.	Sept. 6
Oct. 13.	El. Ry., Santa Barbara, Cal.	Oct. 4
Oct. 13	Garb. disposal, Brooklyn, N. Y.	Sept. 13
Dec. 1.	Garb. disposal, Atlanta, Ga.	Oct. 4
———	Dredging, Babcock, Wis.	Oct. 4

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The Durability of Concrete-Steel Construction.

One of the most important elements or characteristics of any class of engineering construction is its durability. This quality is generally taken to mean the capacity of the material to resist physical deterioration through chemical changes, such as oxidation in the case of iron and steel, or of decay in the case of timber. The same general deterioration, i. e., that arising from chemical changes, plays an important part in the length of life of many of the less valuable building stones. Deterioration due to chemical changes, therefore, has come to be considered even among civil engineers as the crucial test of the durability of perhaps every class of engineering construction. While in one sense the test of capacity to resist this kind of deterioration may be a proper general criterion, it is not by any means all that must be carefully regarded. There are other features of structural materials and combinations of materials which have frequently a controlling influence on durability, although chemical action may finally play a substantial part in the ultimate results. There is no single class of structural work on which these observations bear more forcibly than on the concrete-steel combination.

Concrete-steel construction possesses characteristics which give it perhaps the possibility of the widest and most varied application of all materials yet employed by the engineer. As a class of masonry it may be advantageously used wherever the conditions are such as to require the use of any grade of masonry, including all varieties of foundation or subaqueous work, retaining walls or other walls of structures, all parts of floors and even much of the ornamental parts of buildings. Among its varied duties is included the resistance to tension, where the tendency is to form cracks and so give play to the various deteriorating influences known as weathering. In other words it may be subject to practically every kind of exposure which any engineering structure whatever may be required to meet. It has already found its way into such extended applications, and is so seriously considered for others, that there have been active discussions among engineers as to the degree of durability which future experience with it may be expected to disclose.

At the annual convention of the American Society of Civil Engineers in May last, one of the subjects brought before it was in essence if not in name the durability of the composite of concrete and steel, and the discussion in full may be found in the "Proceedings" for August. As might be expected there were some clear differences of opinion as to a number of details, although in the main the consensus of judgment favored the durability of steel embedded in concrete. The whole criticism, however, may be considered as being based upon the possible effects due to chemical changes, especially those produced by the penetration of dampness through the surrounding concrete to the steel enclosed in its mass. Although there are other most essential elements in the case, those of a more directly chemical nature may receive the first attention.

It is very generally admitted, if not invariably held, that if iron or steel be effectually covered with Portland cement, mortar or concrete, it will be completely protected from corrosion for an indefinite period. This view is abundantly supported by experience and there is practically no probability of future disclosures to the contrary. In spite of this, however, there is a feeling among at least a considerable number of engineers and architects that, under the usual conditions of construction, water in subaqueous work or storm water in exposed work above ground may percolate through the mass, and possibly produce oxidation of the embedded metal. Indeed, there are probably few engineers who would venture to use much steel below water level even when embedded in concrete if the strength of the work depended upon its preservation. This apprehension is probably well grounded in at least much of the concrete work of the past, but it does not follow from that that further improvements in putting concrete in place may not insure even the indefinite preservation of steel embedded in concrete under water. The defect of past concrete work as a preserving environment of iron and steel is chiefly due to the voids remaining in it in spite of such ramming or other compacting as may have been employed. It is almost, if not quite impossible to force all the voids out of dry concrete mixtures, but a much more nearly continuous mass may be reached by a wetter mixture. That is one of the advantages resulting from a comparatively wet concrete and there are probably others. Again there is considerable experience which goes to show that a mortar made with a suitable percentage of finely ground cement is practically impervious to water, at least sufficiently so for the requisite preservative effects on embedded iron and steel; indeed, some existing records of tests show that the same observation may be applied to concrete suitably made and put in place, even when the cement is of ordinary fineness only. It is believed that it is practicable under reasonable conditions of engineering construction to protect iron and steel for even subaqueous work, by either surrounding the metal immediately with essentially impervious mortar and concrete beyond that, or by suitably made concrete. In the latter event properly balanced proportions of sand and broken stone or gravel is a most important element in the quality of preservative impermeability. Results already obtained in actual work show that the attainment of these results is undoubtedly within the reach of practicable engineering operations, but that the fineness of cement grinding and the balancing of concrete elements materially influence the results. In the preceding observations it has been pointed out, essentially, that the actual continuity of the enclosing mass is imperative for complete protection. This is a feature which almost invariably escapes attention in the discussion of this subject. Yet it is clear that if cracks occur in the concrete, however continuous the mass may originally have been, avenues of entrance for water and all kinds of weathering are created. Fortunately most careful investigations have shown that the action of the steel, among other things, effectively prevents the occurrence of cracks that would otherwise certainly appear. It is one of the unexpected but most advantageous influences of the metal portion of the combination. M. Considère and others have demonstrated that the concrete surrounding a steel bar will stretch far beyond any limits possible when acting by itself; it may even stretch one five-hundredth of its length before parting. Again, experimental determinations during the past two or three years have conclusively shown that the thermal expansion and contraction of concrete (as well as other masonry) is so nearly identical with that of iron and steel that they may be considered the same. The two parts of the combination, therefore, move as a unit under temperature changes and there can be set up no internal stresses tending to separate them or to rupture either. These two latter qualities of the concrete-steel composite are effective influences in the maintenance of continuity of the concrete and, hence, in securing its impermeability. The effect of the embedded steel upon the durability is most important and of a value not yet fully recognized.

Technical Education was the subject of Prof. John Perry's recent presidential address before the engineering section of the British Association, and in the course of his remarks he paid his respects as follows to certain critics among practicing engineers: "When a man has become a great engineer, and he is asked how it happened, what his education has been, how young engineers ought to be trained, as a rule it is a question that he is least able to answer, and yet it is a question that he is most ready to answer. He sees that he benefited greatly by overcoming certain difficulties in his life; and forgetting that every boy will have difficulties enough of his own, forgetting that, although a few difficulties may be good for discipline, many difficulties may be overwhelming, forgetting also that he himself is a very exceptional man, he insists upon it that those difficulties which were personal to himself ought to be thrown in the path of every boy. It often happens that he is a man who is accustomed to think that early education can only be given through ancient classics. Being an exceptional boy, he did not altogether lose his natural inclination to know something of his own language; and he is in the habit of thinking that he learnt English through Latin, and that ancient classics are the best mediums through which an English boy can study anything. He forgets the weary hours he spent getting off Euclid, and the relief it was to escape from the class-room not quite stupefied; and he advocates the study of pure mathematics and abstract dynamics as absolutely necessary for the training of the mind of every young engineer. I have known the ordinary abominable system of mathematical study to be advocated by engineers who, because they had passed through it themselves, had really got to loathe all kinds of mathematics higher than that of the grocer or housekeeper. They said that mathematics had trained their minds, but they did not need it in their profession. There is no profession which so much requires a man to have the mathematical tool always ready for use on all sorts of problems, the mathematical habit of thought the one most exercised by him; and yet these men insist upon it that they can get all their calculations done for them by mathematicians paid so much a week."

A Four-Truss Double-Deck Railroad Bridge.—I.

Bridge No. 1 of the eastern division of the Pittsburg, Fort Wayne and Chicago Railway crosses the Allegheny River between Pittsburg and Allegheny. It has five pin-connected through channel spans on masonry piers about 35 feet high above mean water level, and is about 975 feet long on center line between abutments of end spans. The faces of the north abutment and the sides of the four intermediate piers are parallel and make an angle of 81° 51′ with the axis of the bridge. The south pier of the old bridge was remodeled and extended to serve as south abutment for the new structure and is at an angle of 91° 13′ with axis of bridge. Two of the piers are 10 feet wide and about 58 feet long under the coping and the other two are 12 feet wide and about 66 feet long to provide seats for the heavier trusses of the long span.

Each span has four trusses, three of which are in the same straight lines from end to end of the bridge, and the fourth are in line for the four western spans, but divergent for the eastern span. Each of the trusses in each of the four western spans has the same length as the other three trusses of the same span but in the eastern span the lengths of the trusses from center to center of end pins vary from 164 feet 2 5/16 inches to 157 feet 10 7/16 inch. There are three spans of 156 feet ½ inch and one span of 333 feet 3⅝ inches. In these spans the centers of the trusses are 9 feet and 26 feet 8 inches from the axis of the bridge. The base of the lower rail is 6 feet 6⅞ inches, and the center of lower chord pins is 7 feet 2⅞ inches above the top of the pier masonry in the 333 feet span and 4 feet 2½ inches and 4 feet 11⅝ inches, respectively in the other spans. The bridge is cambered as a whole so as to give a continuous parabolic curve with a horizontal chord 983.96 feet long and a 12-inch center vertical ordinate to the base of rail. This is effected by varying the heights of the pier tops and making the inclined lines which connect the centers of the spans the chords of a parabolic curve. For the camber of each span the center ordinates vary from 0.16 to 0.337 feet and the ordinates between them and the rail base are made in the framing of the cross ties.

The floor is of soft steel and is designed to conform to the standard floor for the Pennsylvania Lines West of Pittsburg. The field rivets are of wrought iron, the shop rivets are of mild steel, and all the remainder of the superstructure is of medium steel designed according to the standard specifications of the railway for 1897, with the stresses increased 20 per cent. for medium steel members. In the 333-foot span the loading assumed is, for the outside trusses, 2,980 pounds dead and 3,750 pounds live per lineal foot and 37,500 pounds concentrated. For the inside trusses, 6,380 pounds dead and 7,500 pounds live per lineal foot and 75,000 pounds concentrated. Wind pressure is assumed at 50 pounds per square foot for the unloaded and 30 pounds per square foot for the loaded structure, and at 600 pounds per foot for moving load. For the floor system the load per track is assumed at 5,000 pounds per lineal foot and at 50,000 pounds concentrated and the dead load of the track at 300 pounds per lineal foot.

It was required that the bridge should carry two pairs of tracks at different fixed levels and the vertical clearance between them was too small to allow for floor beams deep enough to carry two tracks; therefore the bridge was designed with four trusses so as to secure single track floorbeams. The two vacant panels in the transverse sections have been arranged above and below and on opposite sides and are at present occupied by sway bracing, one of them being utilized for a sidewalk between the diagonals, and the other one being designed to receive a third track at the upper grade if necessary in the future. The upper deck is made according to the usual standard of the North West system with four lines of stringers to each track. In the lower floor two more lines of stringers are added for each track and the whole lower deck is covered with plank and protected by railings to permit the ready handling of trains by the yard crews.

In the 333-foot span the lower chord panels are 23 feet 9 11/16 inches long, except in the end panels, which vary on account of the skewed ends. The vertical end posts are 27½ feet high, and the center three vertical posts are 63½ feet high. The bottom chord is horizontal, and the top chord is horizontal in the center two panels and inclined elsewhere. In the center trusses the maximum top chord stress is 3,235,000 pounds and the corresponding cross sectional area is 292.5 square inches. Maximum bottom chord stress 3,064,000 pounds, section 237.5 square inches. End vertical post, 2,224,000 pounds, section 202.5 square inches. End diagonal tie, 2,427,000 pounds, section 190 square inches.

As seen by the cross section diagram each center truss carries half the load from three tracks, while each outside truss carries half the load from one track, therefore the stresses in the side trusses are much lighter than those just given. The maximum top and bottom chord stresses and sections are 1,563,000 pounds and 146 square inches and 1,469,000 pounds and 116.25 square inches respectively, and the stresses in the other members are in proportion.

The trusses are braced together by the two floor systems, one of which is just below the lower chord pin level and the other is about 17 feet in the clear above it, and by transverse girders between the tops of all vertical posts and by lateral diagonals in the planes of the top and bottom chords. There are besides solid web knee braces at both ends of all floorbeams and on both top and bottom flanges of the beams in the upper deck. On one side of the bridge the upper and on the other side of the bridge the lower outside panel of every bent between vertical posts is stiffened transversely by riveted X-braces, thus providing great resistance to lateral deformation.

The bottom laterals are flat plates ½ inch thick and from 6 to 14 inches wide. Each one is stiffened by a 5x3½x⅜-inch angle riveted to the upper side, between stringer intersections. The top laterals are single clevis ended bars from 1⅜ inches to 2 7/16 inches square. All lateral diagonals extend across three panels longitudinally and are connected to each of the four trusses, thus completely X-bracing each panel between trusses and floorbeams. The intermediate center floorbeams are proportioned for a maximum moment of 7,530,000 pounds and have a 31¾x11/16-inch web, two 6x6x½-inch angles and three 16x½-inch plates, one full length, one 13 feet and one 10 feet long, in each flange. The outside and end floorbeams have somewhat lighter stresses and have the same depth of web and size of flange angles and plates, but are made with lighter metal.

The 26 feet 10¼-inch stringers have a maximum moment of 2,593,000 pounds and are made with a 26¾x⅜-inch web plate and two 6x6x11/16-inch flange angles. The flange stress is 110,200 pounds and its area 14.4 square inches. The lower outside panel not occupied by a railroad track has a sidewalk with floorbeams 32½ inches deep, having 4x3½x⅜-inch flange angles. The two stringers outside the four track stringers in each of the two lower deck tracks are made with a 26¾-inch x ⅜-inch web and two 5x3½x⅜-inch flange angles. In all work it was required that all rivets were ⅞-inch in diameter, and that their holes were punched ¾-inch and reamed except where the material was ⅞-inch or more thick where they were drilled from the solid. All holes in flats were also drilled from the solid and all holes for field connections were reamed to cast iron templates.

The skew is taken up in the varying lengths of the end panels, so that the intermediate transverse members are all at right angles to the trusses and their connections to the vertical posts are central. The end floorbeams are skewed to correspond with the angle of the pier axis and the end panel stringers have varying lengths and oblique connection angles. The pedestals, shoes and bed plates are square with the trusses and skewed with the pier masonry so that the line connecting their center points forms an offset line as indicated by the end floor beam webs in the drawing of half the end elevation of the bridge.

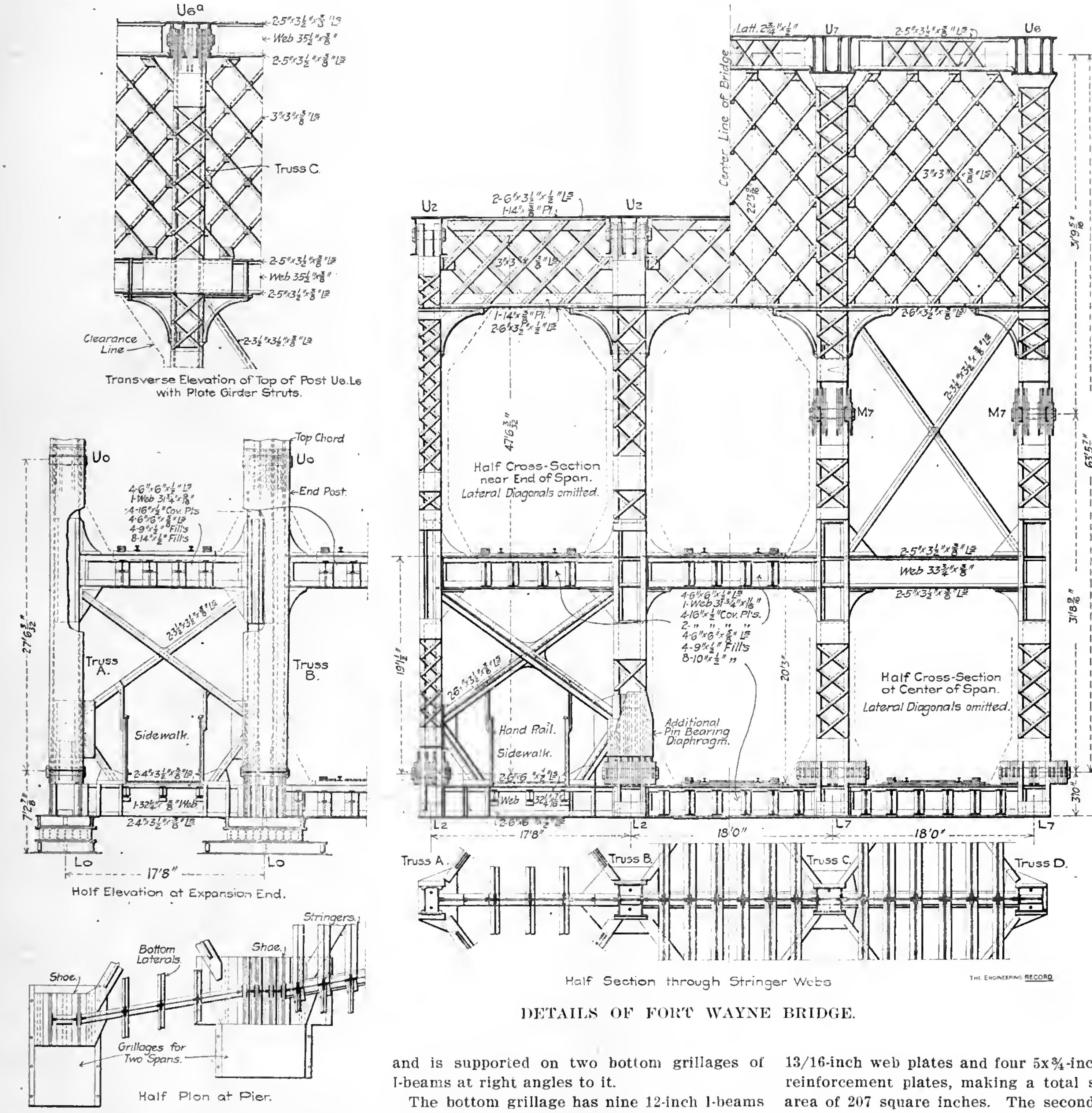
The upper deck floor beams are only about 8 feet in the clear below the end top chord pins so that it is impossible to have portal bracing, the upper tracks are at this point half through and sway bracing is provided by the heavy solid web plate knee braces at the ends of the floor beams, by one panel of transverse X-bracing over the sidewalk and by the depth of the floorbeam connections. The elevation of the end of the span is not symmetrical about its center line beyond the outside of the center truss, B. One outside truss, D, is much heavier than the other outside truss A, and the transverse panel between trusses C and D is different from that between trusses A and B, but the variations correspond to those clearly shown in the intermediate vertical transverse sections.

The top chord pin U1 is only about 18 feet above the top of the upper deck floorbeam and there is no top lateral strut at that point. Top chord pin U2 is about 28 feet above the top of the upper deck floorbeam and the upper transverse bracing there consists of lattice girders about 7 feet deep with T shaped flanges and pairs of diagonal angles with their flanges riveted together at intersections. At U4 and 6 the bracing is similar except that the top and bottom flanges of the transverse lattice girder are replaced by light plate girders as shown in the detached detail of connections to truss. At vertical posts 3-5 and 7 there are diagonal tie connections to the post between the chord pins which are made as shown in the section at U7-L7 and the transverse upper bracing consists of light top struts with I-shaped cross sections and latticing of single 3x3-inch angles between the posts, which is made in each case as deep as the train clearance allows.

The vertical end posts of the center trusses are each made with one 48x½-inch cover plate, four 36x¾-inch web plates, eight 6x4x¾-inch flange angles and four 5x¾-inch flange reinforcement plates. The distance between the inside webs is a little greater than that between them and the outside ones, and their flange angles are riveted on opposite sides, as is shown for the top chord sections to which the end posts correspond, in a manner to make each web with its flanges resemble a Z-bar and promote the facility of shop assembling and riveting. The inner flanges are stayed by ½-inch top and bottom tie plates 51 inches long and by zigzag 5x⅜-inch lattice bars. At the pin bearings each web is reinforced by two full width ¾-inch plates on each side, giving a combined length of 13½ inches bearing for the four supports of each 9-inch pin. The ends of the post are cut to bisect the angles made with the top and bottom chords and are milled to ¼-inch clearance from the center line of the chord pin and have jaw plates merely to hold the members in position, the bearings being made with half holes exclusively.

The webs are connected with horizontal diaphragm plates about 4 feet from the pin centers and by a vertical diaphragm in the plane of the center line of the chord pins which extends from the top of the upper to the bottom of the lower upper deck floorbeam knee brace. The shoe has four webs in the planes of the end to enclose the ends of the rollers. The ends of the rollers are attached by stud bolts to pairs of horizontal bars, the upper one of which is hooked at the ends to engage the lower one and prevent the motion of the rollers beyond a fixed angle. The rollers are grooved for 3¾x ⅝-inch top and bottom center guide bars and rest on fourteen ⅞-inch flat bars 4 and 5 inches wide and 71 inches long on a 71x77x1⅜-inch bed plate, which is riveted across the top flanges of ten 12-inch I-beams 10 feet 1½ inches long. These beams form a top grillage which receives the shoe for the adjacent span in each space. At the fixed end of the span the shoe is the same and the arrangement is like that at the expansion end except that the nest of rollers is replaced by a third or upper grillage made similar to the lower one with nine 10-inch I-beams 5 feet long parallel to those in the bottom grillage and having a cap plate somewhat larger than the base plate of the shoe.

The end section of top chord is made in a two-panel length of nearly 53 feet, and is composed of one 48x½-inch cover plate, eight 6x4x ¾-inch angles, two 36x¾-inch and two 36x



DETAILS OF FORT WAYNE BRIDGE.

post webs and of corresponding thicknesses. They are connected, as shown in the end elevation of the span, by a vertical diaphragm in the plane of the center line of the lower chord pin, and the outside webs are field-riveted to the end vertical web stiffener angles of the end floorbeam. This is seated on the edge of the base plate, which is 71 inches wide, 76½ inches long and is planed to a thickness of 1¼ inches.

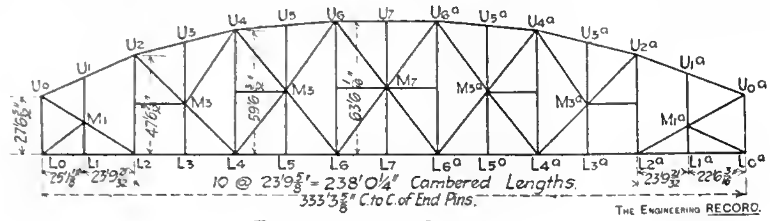
At the expansion end of the truss the shoe is seated on thirteen 9-inch segmental rollers and has on each side a 11x⅜-inch vertical plate and is supported on two bottom grillages of I-beams at right angles to it.

The bottom grillage has nine 12-inch I-beams 10½ feet long countersunk-riveted to 72x⅞-inch top and bottom plates 11 and 12 feet long, and has a ⅛-inch lead filler plate between the base plate and the masonry. In both grillages the spaces between the beam webs are closed by 12-inch channels across the ends of the beams with their flanges turned out, and in the same planes as the beam flanges and their webs connected to the webs of the outside beams by short vertical angles. The webs of the grillage beams are connected by a vertical transverse diaphragm on the center line, which consists of a ⅜-inch plate and two 3x3-inch angles 13/16-inch web plates and four 5x¾-inch flange reinforcement plates, making a total sectional area of 207 square inches. The second section of top chord reaches from U2 to U4 and has its section increased 63 square inches by reinforcing the web plates, the thicknesses of the other materials remaining the same. The remainder of the top chord is made in three two-panel sections and has a uniform cross section which is increased 22½ square inches more by thickening the web plates to 4⅜ inches.

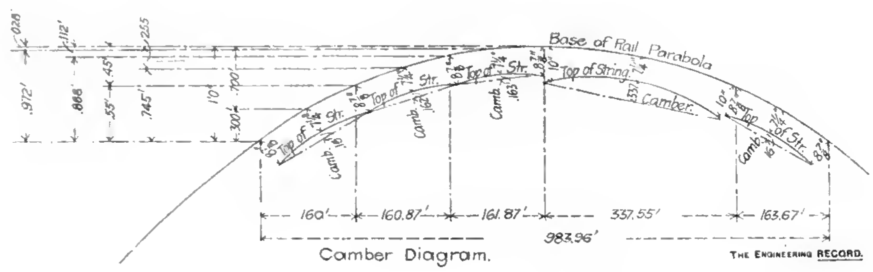
Except as noted the construction of the top chord corresponds to that described for the end post, with end transverse diaphragm plates connecting the webs and half-hole bearings for the 9-inch pins at U0-U2-U4 and U6. At each of these points the inclination changes and the joint is protected by a thin splice plate over the top flange cover plates. This plate is extended beyond the flanges to serve as a connection plate for the top lateral rods and transverse bracing and at U3-U4-U5-U6 and U7 there are similar narrower plates riveted to the upper sides of the bottom flanges of the top chord angles to receive the lower flange connections of the I-shaped top lateral struts. There are no top chord pins at U3-U5 and U7 and the tops of the vertical posts are flange riveted to the lower flanges of the top chords.

The transverse strut at U2 is shallow and is not connected to the bottom flange of the top chord. All of the other transverse struts have an intermediate pair of horizontal flange angles which are connected to the lower flange of the top chord. At U4 and U6 the top lateral strut has an I-shaped upper member as deep as the top chord, and flush with it, and a rectangular lower member with top, bottom and side plates, the latter extending across the faces of the vertical posts and riveted to them. The vertical posts U2-L2, U4-L4 and U6-L6 have continuous sections from top to bottom and are made of built channels, latticed and have two 32-inch web plates and four 4x4-inch flange angles.

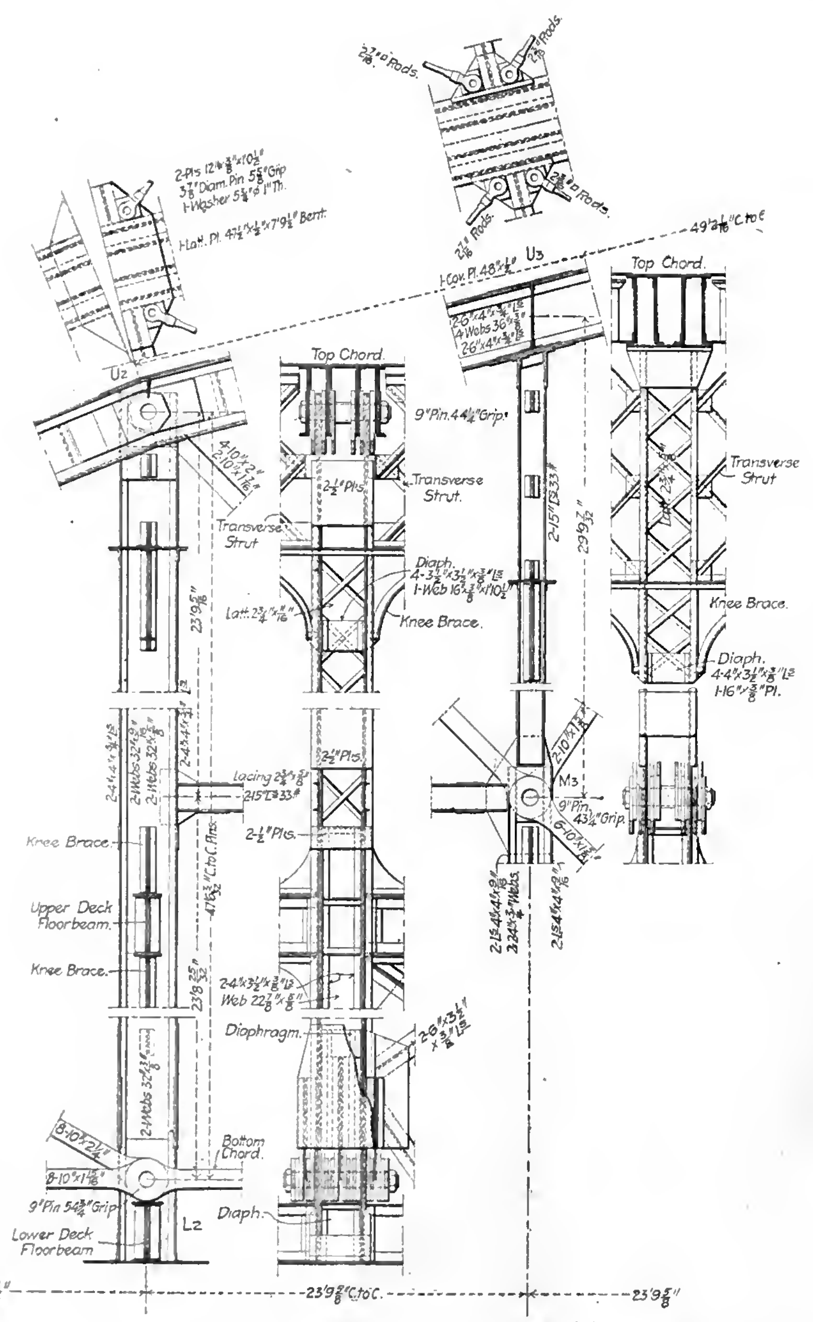
The intermediate vertical posts are made in two sections each. The lower section is similar to those at L2 L4 and L6, but the upper portions are merely struts to carry the top chords and are made of pairs of 15-inch channels about 2 feet apart back to back and latticed. The feet of all vertical posts project about 4 feet beyond the centers of the lower chord pins to receive the vertical flange connections for the lower deck floorbeams. Vertical diaphragms in the planes of the chord pins connect the post webs above and below the pins and wide horizontal connection plates are riveted to the lower ends of the posts to receive the bottom lateral diagonals. The lower ends of all the vertical posts



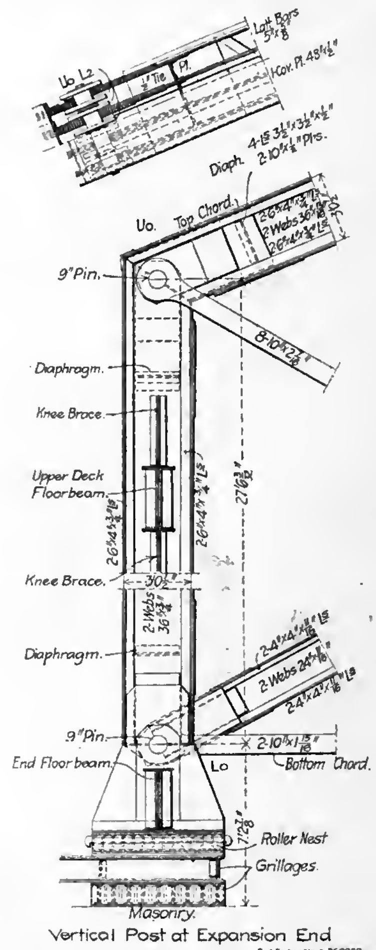
Trusses in Main Span.



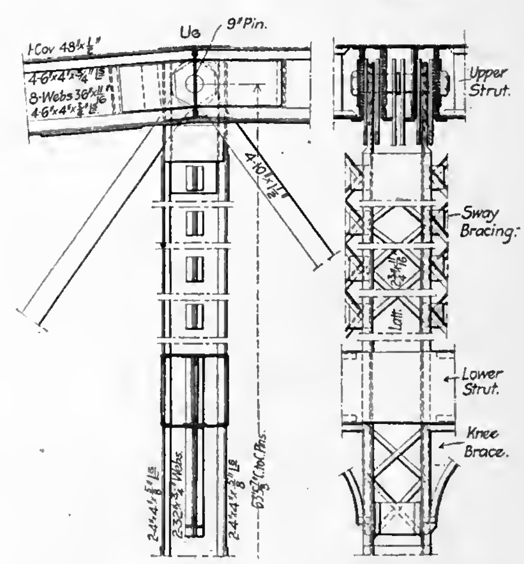
Camber Diagram.



Sway Bracing at End and at Intermediate Panel Point.



Vertical Post at Expansion End



Sway Bracing near Center of Span.

DETAILS OF FORT WAYNE BRIDGE.

are similar to that of post U2-L2 except that the latter has the bottom tie plates extended to receive an additional pair of outside vertical diaphragms and there is a center diaphragm, all carried down to the pin center and reinforced with side plates so as to make, with the two main webs, five bearings for the pin. The other vertical posts have only two pin bearings each, one in each main web. All the truss pins are 9 inches in diameter and have shouldered ends with 1-inch washers and octagon nuts. Pin L7 has a 74-inch grip and carries twenty 10x2⅜-inch eyebars.

The outside trusses resemble the inside ones except that they are lighter and that the lateral and transverse member connections are different on account of the arrangement of the floor systems, but the details are substantially similar and are varied only as necessary on account of their relative functions and positions. The top chord is 36 inches wide and 36 inches deep and has only two webs, throughout, but these webs are reinforced in six panels. The end two panels of bottom chord are made with pairs of 10x1 3/16-inch bars which have a 3½x3½-inch angle riveted to the inside of each, from end to end, to serve as a connection for tie plates and lattice bars by which they are braced together.

This span weighs about 3,000 tons and was designed and constructed under direction of Mr. Thomas Rodd, chief engineer, and Mr. J. C. Bland, engineer of bridges for the Pennsylvania Lines West of Pittsburg. The inspection was performed by the railroad company's force under Mr. C. P. B. Buchanan, inspector of bridges. The riveted members were built at the Pencoyd plant, and bars, pins and rods at the Keystone plant of the American Bridge Co., Mr. Paul L. Wolfel, chief engineer. The erection was done under direction of Mr. S. P. Mitchell, chief engineer and Mr. H. A. Green, assistant engineer and superintendent of erection for the western district.

(To be Continued.)

The Cement and Concrete Exhibits at the Düsseldorf Exhibition furnish excellent examples of the admirable results obtainable with skilled workmanship and good materials properly used. These exhibits are grouped in and about a large terrace on the bank of the Rhine. At the head is a large fountain and basin, adorned with concrete sculptural work and on each flank is a lofty column. The steps, balustrades and arcades of the terrace are all concrete, and one of the neighboring buildings is a concrete structure resembling in exterior appearance some of the city halls in small German towns. The columns have a total height of 114¾ feet. The foundations extend 18 feet below the surface and are made of 1 part cement to 10 parts gravel, with a grillage of steel beams; the foundations are square and measure 42.7 feet on a side. The rather elaborately ornamented pedestals are 40.3 feet high. The shafts are 52.1 feet high, 7.4 feet in diameter at the base and 6.2 feet at the top. The bottom portion, with ornamental reliefs, is a ring of rammed 1:5 concrete while above the work is a succession of rings of similar concrete with a 1:2 plain mortar facing; the rings are about 3.2 feet high, and each has six vertical and three horizontal steel rods as reinforcement. The shaft has an ornamental capital with a metal dome surmounted by a large concrete figure. Another special feature of the exhibits is a 1:4:4 concrete bridge of 98.4 feet span, and but 6.56 feet rise. The arch is 2.3 feet thick at the springing and 2.13 feet at the crown, and showed no appreciable deflection under a load of over 90 pounds per square foot.

A Concrete-Steel Sewer.

A contract was awarded a short time ago by the Board of Public Works of Harrisburg, Pa., for the construction of a concrete-steel sewer, which is among the most interesting works of the kind recently designed. The plans and specifications for the work were prepared by Mr. James H. Fuertes, M. Am. Soc. C. E., consulting engineer to the Board, and the construction will be under his general supervision. In a general way the problem was the design of a sewer to intercept the ordinary flow of a system of combined sewers in a district lying on both sides of a small stream, Paxton Creek, which has been receiving these liquids directly. The creek now receives about twenty times as much sewage as should be discharged into it, and consequently during dry weather it is extremely offensive.

The interceptor will be large enough to receive the total flow, during ordinary rainstorms, of all the sewers to be connected with it; that is, the flow from storms of ¼-inch or less per hour. As about 95 per cent. of the rainstorms have these low rates, the overflows will discharge sewage into the creek only at rare intervals. About twenty per cent. of the annual precipitation falls in storms of high rate for short periods of time, and during such storms, the mixed sewage and street water will overflow into the creek, the creek being then at a high stage. The discharge of sewage at the overflows at such times will be unobjectionable for the reason that the heavy discharges at the overflows will cease before the creek floods run out, and therefore as the creek subsides all traces of the dilute sewage discharged at the overflows will be carried away.

The engineering difficulties were increased by the presence of considerable ground water in the gravel formation in which the construction must be done, and by the necessity of using extremely flat grades in order to avoid prohibitive excavation and pumping. The grade problem has been overcome by making the sewer somewhat larger than necessary for the interception of the dry weather sewage alone and by forming a connection between the upper end of the interceptor and the creek, where automatic regulating gates have been provided which will admit during dry weather enough creek water to the conduit to keep the flow in all its parts at a self-flushing velocity. During rainstorms when the lateral sewers are discharging large quantities of both sewage and street water into the interceptor, a float will rise, closing the valve and thus shutting out the creek water.

The form of this regulating chamber is shown in the accompanying drawings. There will be two sets of three 12-inch vitrified pipes laid through the concrete head wall to serve as inlets for the creek water, one set 4 feet higher than the other. Before entering the regulating chamber proper the water will pass through a large rectangular silt basin in order to allow as little suspended matter as possible to get into the sewer. This silt basin in largest internal dimensions will be 20x8 feet and 12 feet deep. A grating of steel bars spaced 1¼ inches apart will prevent large floating articles from entering the inner chamber. After being roughly screened in this manner, the water will pass through the rectangular cast iron orifice tube into the regulating chamber proper.

The valve regulating the quantity of creek water allowed to enter the sewer is in general principle the usual form adopted for such purposes, the opening of the valve being automatically controlled by a galvanized iron float. As the float rises the rotating valve closes. The chief difficulty with such valves heretofore has been in getting the valve to slide smoothly and accurately on its seat, some very careful adjustment and machining being usually necessary to accomplish this. In the design here adopted a great deal of this is avoided. The rotating arm will be attached to the concrete wall of the float well by means of a short length of angle iron, the holes through which it is bolted to the latter being slotted so as to permit a vertical adjustment. The horizontal leg of this angle, and the flanges of the trunnions carrying the rotating arm will be slotted to allow a play horizontally in two directions. By this simple arrangement, when the valve is first installed it can be loosely bolted in place, adjusted by means of the slotted holes until it works perfectly, and then securely bolted to its final position.

The float well is to be connected to the sewer by a 4-inch vitrified pipe extending underneath the invert about 10 feet down the sewer, where the opening will be covered by a cast iron grating cemented into the bell of the pipe. All parts of the valve with its rotating arm and lever will be of cast iron except the face of the valve and all wearing parts, which will be bronze. The galvanized iron float is 11x24 inches and 9 inches deep. With the exception of the brick manholes this whole construction of inlet and regulating chamber at the head of the interceptor will be of 1 : 2½ : 4½ concrete, reinforced as shown in the illustrations by 3-inch mesh No. 10 expanded metal.

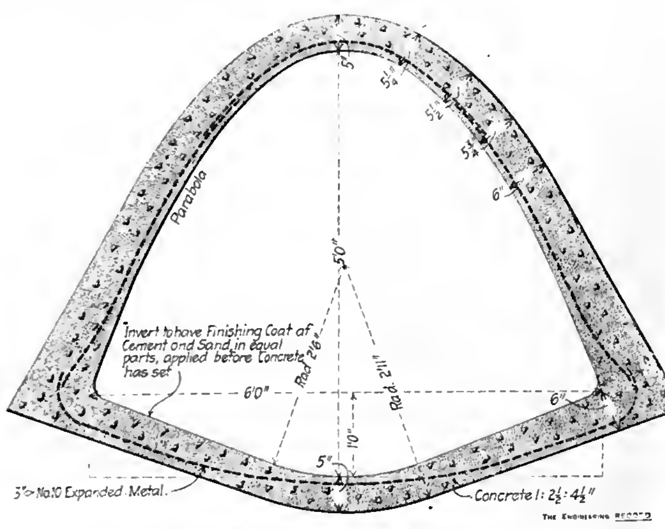
The contract for this work includes 6,780 feet of the 5-foot parabolic sewer, 7,635 feet of the 4-foot parabolic sewer and 385 feet of a 5-foot rectangular section where the interceptor passes longitudinally under the tracks of the Philadelphia & Reading Railway Company. The design of the main intercepting sewer, although somewhat unusual in section, is nevertheless easy of construction. The crown of the arch is a simple parabola. The invert is rounded in the middle, and for the 5-foot section has an inside radius of 2 feet 6 inches, the rest of the invert being tangent to this and extending out to points on either side 3 feet from the center line and 1 foot above the bottom, the corners being slightly rounded to connect smoothly with the arch. For the 4-foot section the radius of the invert is 2 feet and the total width to the ends of the tangents, 4 feet 9.4 inches, the height of these points above the bottom of the invert being 9.4 inches.

The same thickness of concrete will be used for both the 4-foot and the 5-foot sections. In the invert it increases from 5 inches at the center to 6 inches at the sides, while in the arch it varies from 5 inches at the crown to about 9 inches at the base. The sections being of abundant strength to support the vertical loads which will come upon the sewers, it was not considered necessary to place the expanded metal along the exact lines of greatest tension. It may be stated that throughout the designs, the use of expanded metal was so arranged that there would be no waste—either whole or half sheets being used in all cases. An interesting peculiarity in regard to the section adopted for this sewer is the fact that it will give practically the same discharge as a circular sewer of the corresponding diameter. More exactly stated, the 5-foot parabolic section running full will discharge 54 cubic feet per second, while a 5-foot circular sewer of the same material under the same conditions of grade would discharge about 3.7 per cent. more, or 56 cubic feet per second.

Where the interceptor passes under the tracks of the Philadelphia & Reading Railway, for a distance of 385 feet, a rectangular section will be substituted for the standard parabolic section. It will have an inside width of 5 feet, and a height, from invert to springing line of roof arches of 4 feet. The shape of the invert will be the same as that of the regular parabolic section. The side walls will be of concrete 12 inches thick and without reinforcement by expanded metal. The roof of this section will consist of 8-inch I-beams running crosswise of the sewer and spaced 3 feet apart, between which concrete arches with 3¾ inches rise will be laid, thus inclosing all parts of the beams except the lower flanges, which will be surrounded with heavy wire lathing and plastered with 1 to 1 cement mortar. The beams will be 6 feet 4 inches long over all, resting on 7/16-inch steel bed plates 8 inches wide and 12 inches long, carefully bedded into the top of the side walls at the proper height. The top of the concrete roof will be 10 inches above the crowns of the arches.

The concrete for all the main parts of the interceptor will be a 1 : 2½ : 4½ mixture. The specifications call for a careful storage of the cement, which is to be of an approved brand of American Portland, in a building sufficiently large so that different lots can be kept separate, and no cement is to be used which has not been kept in the store house for at least two weeks. The building is to be provided with suitable scales for weighing, and an inclosed space for cement testing, this space to be properly lighted and maintained during the cold weather at a temperature of from 60 to 70 degrees.

As it is important that the cement to be used on this work should be of the best, it is required to be of a uniform color, fresh and



Section of Five-Foot Interceptor.

ground so that not more than 10 per cent. by weight will be left on a sieve of 100 meshes per inch. Its specific gravity must be at least 3.1. Round pats of neat cement 3 inches in diameter and ½ inch thick at the center, tapering to a feather edge, must show none of the usual signs of unsoundness after being left in air or water at ordinary temperatures for 28 days. The accompanying table shows the ultimate strength which must be developed by briquettes of one square inch section, as determined from an average of five specimens.

Required Strength of Briquettes, pounds per square inch.

	1 :3		Neat		
Age, days....	7	28	1	7	28
Strength	150	200	170	450	550

The specifications for sand state that it shall be sharp, sufficiently coarse, and shall not contain more than 3 per cent. by weight of loam, clay, coal and perishable matter. This provision is especially necessary in the vicinity of Harrisburg because much of the sand used there is taken from the river bed and contains at times very large quantities of fine coal washed from collieries.

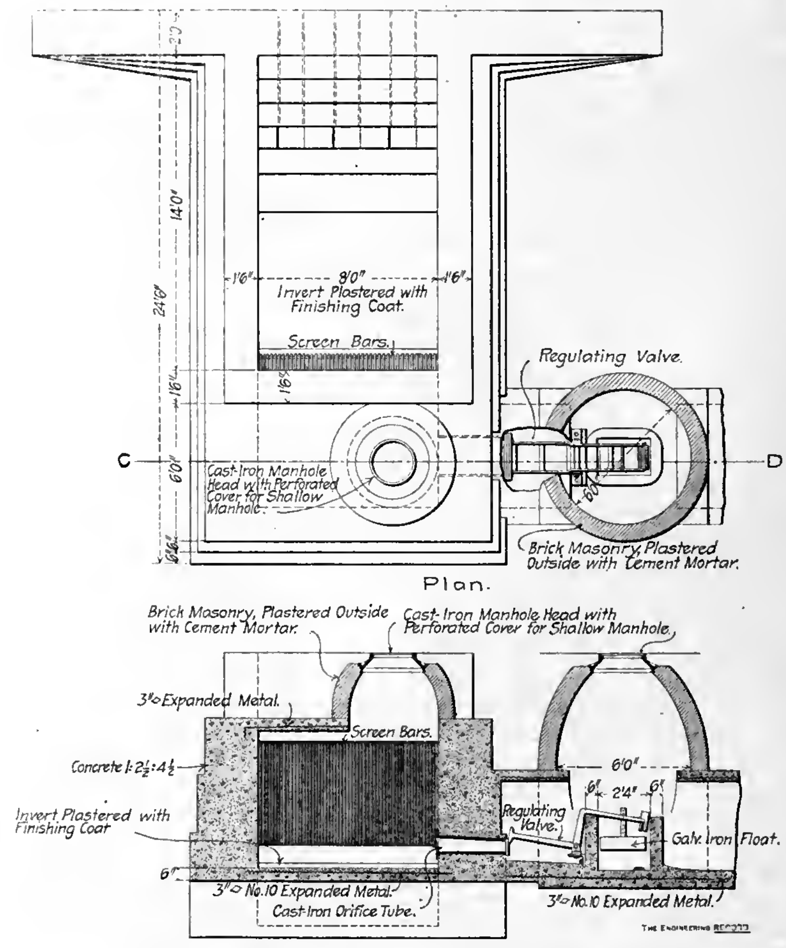
Either gravel or broken stone or a mixture of both may be used as the ballast for the concrete. The stone must be broken to pass a 1½-inch ring, and all dust and fine particles are to be screened out. The materials are to be graded from fine to coarse and will be mixed so as to give as uniform a proportion of voids to be filled by mortar as possible. If deemed necessary by the engineer the ballast must be washed or screened to free it from dirt, clay, coal, shale or other improper substances.

Standard boxes are to be provided for measuring the exact proportions of the ingredients of the concrete for each batch before placing in the mixers. The concrete is to be thoroughly mixed, and wet enough to permit satisfactory tamping. In laying concrete in walls the layers will be from 4 to 9 inches thick. In other places the thickness of the layers will depend on the character of the work in hand. As the concrete is placed in the molds it is to be tamped with suitable rammers until a film of water appears on the surface and all the interstices between the stones are thoroughly filled with mortar. Special tools will be used and special care taken to insure the thorough tamping of the concrete where it is in contact with the surfaces of the centers.

In joining new work to that which has already set, or partially set, the edge of the old portion is to be brushed thoroughly clean, broken down if required, washed, and slushed with neat cement. The invert of the interceptor is to have throughout its whole length a finishing coat of mortar consisting of one part cement to one part sand, which coat is to be carefully applied with trowels before the concrete has set, and after the concrete surface has been brushed clean and thoroughly wetted. No walking will be permitted on the invert after the application of this finishing coat until it has thoroughly set. After the removal of the arch centers the junction of the side walls with the invert is to be carefully trimmed to a smooth, rounded surface. The inverts on the bottoms of manholes, especially those at the ends of the inverted syphons, will receive particular attention so as to preserve the continuity of flow. The respective channels will gradually merge into one, leaving no pockets to cause eddies or retain deposits.

The expanded metal used is to be cut and bent to the proper shapes before being placed in position. Where sheets meet on either horizontal or vertical seams, they must lap at least two inches. The metal will be held firmly in place by blocking while the concrete is being tamped around it.

In order to connect the existing sewers on the further side of Paxton Creek with the interceptor it will be necessary to construct several inverted syphons. The connections at both ends of these are shown in detail in the accom-



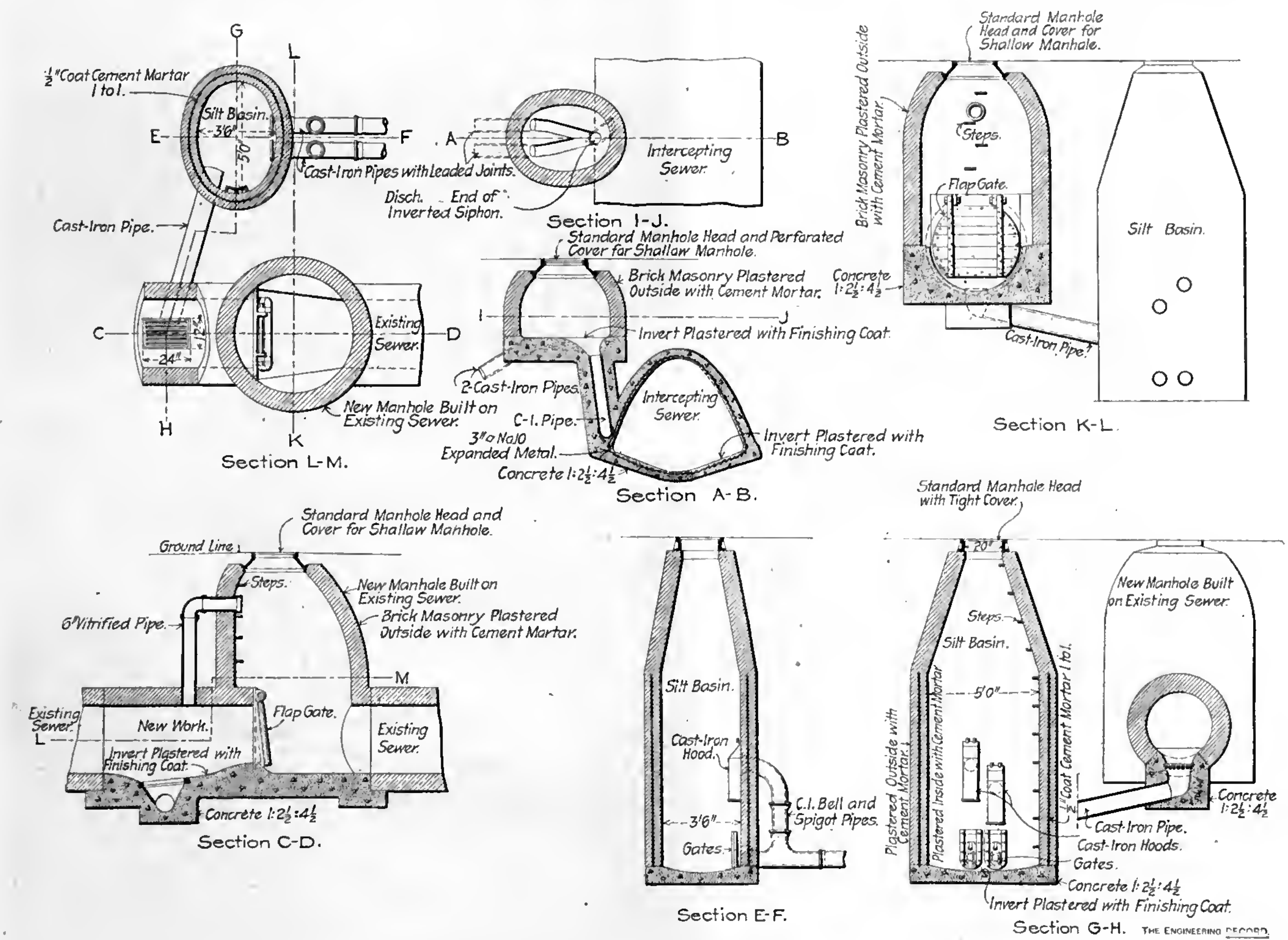
Regulating Chamber at Head of Interceptor.

panying cuts. At the inlet ends of each of these syphons a section of the existing sewer will be taken out sufficiently long to permit the construction of a new manhole, sump and connection with a silt basin. According to the new arrangement, the ordinary flow of house sewage as it comes down the old sewer will flow down a cast-iron pipe leading from the sump in the sewer invert to the silt basin, which will be 5x3½ feet in plan and of a depth depending upon the conditions encountered in each case. The two outlets from this silt basin will be 3½ and 4½ feet from the bottom, and the sewage will flow through these and down under the creek in two lines of cast iron pipe, rising at the other side into a shallow manhole from which it will be discharged into the interceptor.

As the sewers are built on the combined system, the entrances to these inverted syphons were designed to permit the greater part of the storm water to pass directly into the creek through the old outlets, flap gates being provided just beyond the sumps to prevent back water in times of flood from flooding out the interceptor. These flap gates are to be made of cypress lumber in order to secure lightness, and faced with rings of steel where they bear upon the cast iron frames. Each gate will be hung on two wrought iron strap hinges extending the entire width of the gate and sunk into the under side of it. On the outside of the gate two wrought iron straps will be placed and securely bolted through the gate to the hinges. After the gate has been hung and closed the face joint is to be made by pouring the groove left in the face of the frame for that purpose full of lead.

The sump at the intake end of the inverted syphons, through which the sewage will enter the silt basin, will be protected by a cast iron grating, and the diameters of the pipes leading from these sumps will of course be different for each case. The walls of the silt basins will be of brickwork 8½ inches thick, and up to 2 feet above the crown of the existing sewer the walls will consist of two separate rings with a ½-inch layer of 1 : 1 cement mortar between.

The outlets from the silt basins will be provided with cast iron hoods to prevent floating matters from getting into the syphons, and gates at the bottoms of the basins will lead directly into the syphons at the lowest level for flushing purposes. The two pipes under the creek will unite at the discharge end in a manhole from which the sewage will flow down a cast iron pipe into the interceptor. The sizes of the syphon pipes, and the differences in elevation between their intake and outlet ends have been proportioned in each case, so that when the sewers are discharging at their maximum capacity, each syphon will take to the interceptor its quota of flow, the balance going directly to the creek through the overflow.



DETAILS AT ENDS OF INVERTED SY PHONS.

It may be noted here that the forms for the proposal, specifications, contract, and bond under which this work is to be done are printed in a carefully arranged and well indexed pamphlet so that any doubtful points may be quickly referred to by the contractor or the engineer. A clause in the contract providing for a penalty in case of failure to complete the work on time, and an equal bonus for completion of the work ahead of time, deserves special notice and is quoted in full.

"In consideration of the agreement of the party of the first part to grant the contractor extensions of time for the completion of this contract, and in consideration of the material losses and damages that would accrue to the party of the first part, on the failure of the contractor to fully complete the works within the time specified in this agreement, and of the fact that the actual value of such damages would be difficult of ascertainment, it is hereby mutually agreed that there shall be deducted from the amount due the contractor for work done and materials furnished under this contract \$50 per day as just and liquidated damages for each and every day required (except Sundays and legal holidays) after the expiration of the extended time above mentioned, for the completion of the work; and further, in consideration of the material benefits which would accrue to the party of the first part should the contractor be able to complete the work before the expiration of the time limit above mentioned it is hereby mutually agreed that there shall be paid to the contractor \$50 per day (providing he completes the work under this contract before the expiration of the time limit above mentioned) for each and every day (except Sundays and legal holidays) between the date of the completion of the work and the expiration of the said extended time, as provided for by this contract. The date of the completion of the work is mutually understood to be the date upon which the engineer shall transmit to the contractor the certificate of acceptance."

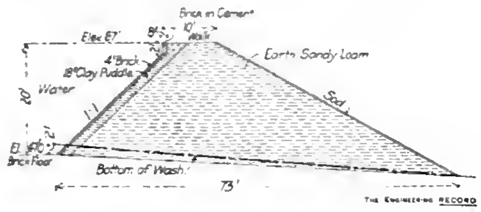
The contractor for the work is Mr. S. M. Neff, of New York, whose prices for the 5 and 4-foot sections were \$9.80 and \$8.95, respectively. The contract price for the total work, which includes a 36-inch outfall into the Susquehanna River of vitrified and cast-iron pipes, was \$167,-227. The date set for its completion is October 31, 1903.

A Reservoir Break at Camden, N. J.

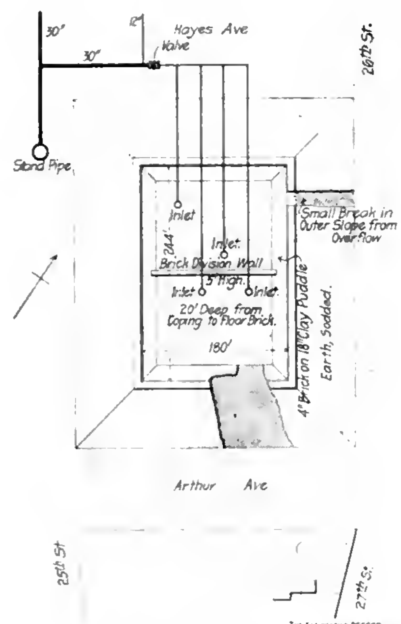
When the city of Camden, N. J., took over, about thirty years ago, the property of a private water company which had previously supplied its citizens, it became the possessor of a service reservoir built some time before by Henry Allen. It is located on a sandy hill about 47 feet above the high-water level of the Delaware River, and its dimensions on the inside of the coping are about 244 feet length, 180 feet width, and 20 feet depth. A low division wall separates the basin into two sections, but when the water is over 5 feet deep the reservoir is practically a single basin. The original capacity was 4,500,000 gallons, but this was increased later to 5,250,000 gallons. Water is delivered to the basin through four inlet pipes and a by-pass from a main supplying a nearby standpipe. South of the reservoir, across Arthur avenue, is another standpipe belonging to the Stockton Water Company.

The embankment seems to be made of sandy loam, and measures about 70 feet on the base and 10 feet on the top. It is lined with 18 to 24 inches of stiff clay, and this clay is covered with one layer of common brick set on edge and apparently grouted at one time, although nothing but mud remains in many of the joints. There was no core wall of any sort. About fifteen years ago, when the embankment was slightly raised, a brick wall was added to the top of the lining; this was not backed with puddle, as shown erroneously in the diagram.

The reservoir is now employed only during repairs to the pumping plant of the driven-well system, described in The Engineering Record of May 6, 1899. One of the pumps was overhauled recently, and the reservoir was employed to hold the excess of the night pumpage for use during the daytime. When the pump was again in service, the chief engineer at the station personally ordered the watchmen to close the valves controlling the flow to the basin. Whether they were not fully closed or whether, after being shut, some one opened one of them, seems to be in dispute. There can be no question, however, that water entered the reservoir during the night of October 1, for about 4 o'clock in the morning of October 2 the embankment at the southeast corner gave way.



CROSS-SECTION OF EMBANKMENT.



POSITION OF THE BREAK.

Only a part of the piping is shown in this diagram. There are two cross-connected 30-inch pipes running to the standpipe. One of them has a 30-inch connection with gate valve to the reservoir and was used as an overflow from about 1871 to about 1890, when the standpipe was built; it was then used as an inlet and the original 12-inch force main employed as a drain pipe, for it has a blow-off some distance from the reservoir which adapts it to the purpose. There is a 30-inch branch from this 12-inch main and from the second 30-inch main to the standpipe, with a valve in the position shown in the diagram. This valve was the one that was open.

The appearance of the break, which is 69 feet wide on the coping line, and about 30 feet at the bottom, is fully shown in the accompanying illustrations. A smaller overflow occurred on the east bank.

On three sides the reservoir is quite closely surrounded with frame houses. Directly opposite and only 60 feet distant from the break, is the standpipe of the Stockton Water Co., which divided the outpouring flood into two main streams. These swept down the streets to low ground, where the general repair shops of the Amboy Division of the Pennsylvania Railroad are located; these were flooded one or two feet and it was necessary to shut them down half a day to clean out the mud and water. Numerous fences were carried away and several cellars were filled with water. The division of the water into several streams spread over a uniformly sloping hillside prevented any serious damage, while the early hour of the accident prevented loss of life, which would probably have occurred if people had been on the streets.

It has been claimed locally that the accident was due to a high wind, which caused waves heavy enough to break over the embankment. This seems incredible in view of two facts. First, the basin is too small for wave action to amount to anything. Second, the main overflow occurred at a point where the coping wall was 2 to 6 inches lower than elsewhere, but there was also enough overflow at a point 200 feet away to wash out the sod and about 50 cartloads of the outer slope. These two independent overflows indicate that the basin was overfilled and water was pumped into it continuously; in fact, one of the valves supposed to have been shut, was found open after the accident.

The reservoir seems to have been a fairly safe structure, barring the absence of a core wall, which would probably have saved it. It had been emptied and filled a number of times without any weakness being detected in the embankment. Its failure can therefore be attributed to the same cause as that of the Grand Rapids reservoir, described in The Engineering Record of July 14, 1900, namely, overfilling. It is to be hoped that the lesson of these failures will be appreciated by Water Boards having basins similarly neglected, for a reservoir without any high-water alarm connection with the pumping station supplying it, or an equivalent safety device, cannot be considered properly cared for. It makes little difference whether the reservoir is used once a year or every day; it is a source of danger unless there is some safeguard against overfilling it. The gauge on the force mains at the pumping station is too unreliable. A special lesson of the Camden accident is the necessity of keeping valves safe from the possibility of manipulation by persons unconnected with the water department.

VIEW OF BREAK FROM INSIDE THE RESERVOIR.
The standpipe belongs to the Stockton Water Company and parted the flood as it issued from the break.

VIEW OF BREAK FROM OUTSIDE THE RESERVOIR.
The clay lining is still in place under the three boys.

Direct-Current Transmission of 5,000-horsepower at 23,000 volts is effected by the city of Lausanne, Switzerland, from a water-power plant near St. Maurice, 35 miles distant. The power plant comprises five main generating units, each consisting of two 500-horse-power dynamos driven by a 1,000-horse-power turbine, the dynamos all connected electrically in series. Each turbine is 3.28 feet in diameter and operates under a head of 105 to 111.5 feet, with a flow of 110 cubic feet of water per second and at a speed of 300 revolutions per minute.

Sewer Maintenance; Under Whose Supervision and Why?

Extracts from a paper presented to the American Society of Municipal Improvements by John H. Emigh. City Engineer, North Adams, Mass.

The object to be sought in the maintenance of sewers is to provide at all times for an unobstructed flow of the sewage, to prevent solid matter from lodging along the main line or its laterals, and to secure good ventilation. Neglect of the first is likely to result in a set-back into house fixtures and an overflow at their lowest outlet. Neglect of the second leads to decomposition and the attendant offensive or dangerous gases; and of the third to an increased pressure of those gases until they are forced through the house traps and into residences. Only about 1 ounce pressure per square inch is sufficient to force the seal of an ordinary house trap; and I suppose that in every city there are many residences whose plumbing is of the older methods and is practically without ventilation. This means that when sewer gas has once entered the house it has no means of escape other than through fixtures into the rooms.

The first requisite for successful maintenance is good construction. This consists in having proper foundation, thorough tamping about the body of pipe in back-filling, imperviousness of joints, uniformity of grade and good alignment between manholes or lantern-holes, easy curves and smooth flow surfaces at the manholes, frequent Y branches for connecting house laterals, all with a plan and profile containing a clear and reliable record of location, depth, grade, position of Y's and other sewer adjuncts and sometimes the proximity of water or gas pipes. The designer and the inspector have always to contend against a disposition towards cheap construction—a tendency to use an easy way around difficulties because, no doubt, of the belief that, when covered, a critic's eye may not see the faults, and, too, of the possibility that he who causes them may not have to suffer from their results.

The ideal conditions that should be striven for are those that will cause all matter entering the sewer to be delivered so quickly at the final outfall that there has been no time for decomposition. These conditions very rarely if ever exist in any extended system.

The second requisite for good maintenance is systematic vigilance. It is injudicious, expensive and the cause of much annoyance or damage to neglect the sewer until it has become stopped, and the only way to avoid such a condition is to take proper precautionary measures which should include regular examinations at not too great intervals. There is probably no more efficient and economical method of keeping the sewer clean than frequent flushing.

Manhole covers should be placed flush with the surface of the street both for convenience and as a means of ventilation.

Laterals entering from factories and similar buildings should be provided with some arrangement for keeping from the sewer anything that is likely to form in it an obstruction. A piece of cloth, 20 yards in length, late from the loom, or a piece of 4-inch belting 10 feet long found within the sewer are indications that some people are indiscreet. I know of no better provision for such places than a manhole near the outside of the building, its bottom made slightly below the outlet, enough so that the discharge is made first into a quarter-turn, opening downward. This works very well, it keeps the outlet opening always submerged and acts as a trap. It is objectionable in that matter accumulates in the manhole and may need occasional cleaning out, but it is probably less objectionable than the usual form of connection.

In a combined system or in the surface water sewer of a separate system there is frequently an accumulation of gravel or street dirt that greatly reduces the capacity of the sewer or stops it entirely. Too often this condition is not known until there is a heavy shower and the sewer refuses to do its work. There is great liability to trouble of this sort wherever the higher parts of the system are in dirt roads and along steep hills. The strong wash along street surfaces carries gravel and sometimes stone beyond the catch-basin trap into the sewer, thence to the flat grades where the reduced velocity allows them to stop and accumulate. These places of accumulation should be watched and frequently attended to. If taken in time the obstructions may generally be removed by a strong stream of water obtained by a direct connection with the street main as already described or through a line of hose attached to the nearest hydrant. Sometimes a heavy chain with knots in it may be drawn either way in the sewer, thus loosening the material that has been deposited. Much of this may be taken from the next manhole below if a shoveler is kept constantly at work and the water is made to flow over a blocking which covers the lower half of the outlet of that manhole. When the sewer is large enough so that men may conveniently work inside it becomes simply a case of shoveling the material and conveying it out by an arrangement that best suits the conditions.

When the sewer is entirely stopped the problem is one of greater difficulty. No rule can be set down for its treatment and the solution must be as the case requires even to the taking up of a portion of the street, if necessary. Ordinarily the obstruction must be worked at from the manhole next below. Sometimes a sewer may be probed for 200 or 300 feet by a rod made up of sections, either in wood or iron, each 3 or 4 feet in length, joined at their ends by Felton's improved coupling. These constitute a convenient arrangement and may accomplish the purpose in small sewers of from 8 to 12 inches in diameter. Sections made of wood are light and easily carried about. A stronger rod and one capable of greater length may be made of ½ or ⅝ inch iron pipe, cut in sections of the same length as above described and fastened together by screw couplings. This with hook or claw at the end is likely to accomplish much better work than the other. It is slower to make up and much heavier to handle than the one made of wooden sections.

A water-jet may, at times, be very useful. Perhaps a mirror may be made to throw sunlight into the sewer and help to determine the location and character of the obstruction.

Whatever the difficulty I believe it is well to keep a tabulated record of the date, character, location, cost of removal and such other explanations as may seem wise, as well as a record of the flushings. They are convenient for reference, they explain accounts, and are likely to be of use to the successor in office.

Cleaning catch-basins is an important item of maintenance and one of the most expensive unless well managed. Hardly another bit of work has so strong a tendency to slowness on the part of the workmen. As suggestive of a good method now being used, I take the liberty to quote from a letter recently received on this subject as follows:

"All catch-basins are numbered and are regularly inspected by a man who records the depth of dirt in each. From this record lists of the basins needing cleaning are made out and given to the cleaners, with the route they are expected to follow. The cleaners make a return each day of the basins cleaned and of the number of loads taken from each. From these returns we obtain a check upon the work each cleaner is doing and are able to obtain the cost per cubic yard of the material removed from the basins.

"When the cost per cubic yard runs above normal figures we detect it and at once investigate the cause. By the adoption of this method we have succeeded in greatly reducing the cost of cleaning (I believe it to be capable of still further reduction), and obtain a record of each basin which is valuable in case of complaints.

"By this method the men do not stop to clean a basin that has 3 feet of water and only 1 foot of dirt but attend to only those basins which need attention. They do not have to be accompanied by a foreman, as the returns show the amount of work done each day."

The same writer says that the cost per cubic yard for removing and hauling away was $0.665 in the year 1899 and was $0.68 in the year 1900. The haul was probably about 2,000 feet and the difference in cost probably due to the difference in length of haul.

The manner of connecting house laterals with pipe sewers is a matter that belongs frequently to maintenance and is of considerable importance, especially if no Y has been provided, in construction, for the connection. Cutting an opening through the side of the sewer should not be allowed. Removing a length of pipe and replacing it by another that contains a Y branch is objectionable because with any considerable run in the sewer or with the run turned on before the cement has had time to set is very likely to result in leaky joints. Taking up three or four lengths of the old pipe in order to not be obliged to cut away any of the bells in relaying is open to the same objection. The writer believes there is no better method than to excavate entirely around the pipe and encase it in brick masonry or concrete nearly to its top, then carefully cut the hole in the top of the sewer and join the lateral to this by a quarter of an eighth bend, making sure that none of the smaller pipe extends inside the shell of the larger pipe; then continue the masonry to cover the joint thus made. This, if properly done, does not weaken the sewer, nor cause it to leak or become rough on the inside. It may reduce somewhat the grade of the lateral but this it should be able to stand or the elevation of the fixture is dangerously close to that of the sewer.

The laying of house laterals is probably more faulty than that of any other part of the system and is, in consequence, the place of more stoppages. They are frequently laid without supervision, by contract and at the lowest price. There is no reason why these should not be placed, by the city, under the same supervision and restrictions as other parts of construction. A license to the drain layer does not insure good results.

The third requisite for successful sewer maintenance is a right kind of man to do the work. If the system is large divide it into sections and select a man for each, all subject to the direction of the head of the department. The selection should not be made in accordance with the policy that anything will do. The man should be intelligent, reliable, and have a reasonable degree of common sense. His work is not of an agreeable character but he should have an interest in it and should take pride in doing it well. Very much of his method and what he does may be hidden, so he must have an ability to see what needs to be done and be honest in carrying out instructions. He must, like every other man, in order to do good work, feel that he has a responsibility and is being trusted. The one under whom he works must show that good service is appreciated and must, as far as possible, make use of the subordinate's judgment. Respect him and let him know it. If he is unworthy of this he should not have the place. Make him feel and know there is as much dignity and honor in well filling his position as there is in filling any other. This, it seems to me, is the only way to get from a man the best that is in him.

The question of maintaining ventilation is a somewhat difficult one, especially in dirt roads. In paved streets a perforated manhole cover seems reasonably satisfactory if the perforations are kept open, but in the dirt road they are very liable to become stopped: yet there seems to be no better method even here. To obtain good results they must be watched and frequently cleaned. A 4-inch pipe connected with the drain just outside the running trap of each house and running to a point above the roof no doubt provides a first class ventilation for the sewer and protects the house from sewer gas as much as is possible. Its expense makes it somewhat objectionable and if carried up in a conspicuous place it is unsightly. The necessity of good ventilation has already been mentioned.

Under whose supervision should the maintenance of sewers be placed? This can not be answered by the man's municipal title. He should not only be competent to design and construct but he should have had experience in it. A knowledge of the theoretical and the practical are most desirable qualifications for supervision of maintenance. He should not only be capable of reading drawings but of making them. He should know when to make them and of what. He should be most familiar with the system and should be able to decide quickly what should be done for the difficulties that are likely to arise. He should attend to a clear and concise record of the work done kept in a form convenient for reference. Finally he should be able to establish a cooperation with his men and a condition of mutual confidence. At the same time he must be master of the situation and must see that his orders are obeyed.

Residential Septic Tanks.

Paper presented by Burton J. Ashley to the American Society of Municipal Improvements.

In the year 1890 the writer moved into one of the suburbs of the city of Chicago, where there was neither water nor sewer service. To the securing of a good sanitary condition of things on and about the premises, we at once directed our attention. The dwelling which was to be occupied had been provided in its construction with all the modern improvements so far as the plumbing was concerned, but these appliances could in no way be of any use without the accessibility of such services as have been mentioned. Water service was therefore provided by pumping storm water from a cistern to a tank which was constructed in the attic.

Sewer service was secured through the construction of a 4-inch vitrified pipe main which emptied into the vault of an outdoor privy which had been previously constructed as a primary expedient, and which in turn was provided with a common 4-inch tile outlet leading to a small slough about 200 feet away. This privy vault was afterwards cut out of the course and the 4-inch drain made to run continuously from near the house to the end of its outlet. Near the house and on the line of this 4-inch sewer there had been constructed a catchbasin 4 feet deep and 3 feet square, with about 2 feet of this unsuspicious though worthy receptacle lying below a trapped outlet. The inlet was not trapped and therefore found ventilation through the soil pipe above the roof. The overflow of the storm water cistern above alluded to was also turned into this catch-all for the purpose of affording, as we thought, necessary flushing accommodations. Nearly two years then elapsed before we heeded a long existing conscious call to clean out this catch basin, and we confess that up to that time for some months we had felt guilty of having been grossly neglectful in not having attended to the matter earlier.

The cleansing process was then commenced in earnest, but when the labors were finished there came over us a sort of sinking feeling likened unto disgust; not because of the nauseous contents that had been removed, however, but because of the discovery of the fact that the receptacle had not needed cleaning, and that our labor had been in vain. Two more years rolled around and another attempt was made to do what seemed to be the necessary thing, but the results were identically the same as before. We were perplexed, but perplexity was soon relieved through forgetfulness, as we had not the time to look into the unexplainable conditions which had been found to exist.

Some time later as we were perusing the current copy of a well known technical journal, a short article beneath an unusual heading came before our eyes and we read it and became interested. We read several succeeding articles from time to time on the same subject before our suspicions were aroused to the fact that we had had in excellent operation for more than six years, a septic tank. The wastes that had been entering this tank were of the ordinary kind produced by a household which in this case consisted of from three to five persons. This crude appliance has now been in successful operation for twelve years and during the period has not been cleaned out to exceed five times, and then each time with the same result, namely, that the sludge found to have collected in the bottom was of such insignificant quantity as not to require removing. Without elaborating further on our experience with this much reviled receptacle of corruption and since our awakening to this exceedingly interesting subject, we have been to a greater or less degree watching the progress and development of the septic tank idea with an ever increasing interest.

Somewhat recently it became our lot to design and assist in building a city to cover ten square miles of territory, two square miles of which at the present time has largely been built upon. One of the controlling factors in our design of the land was the matter of drainage and future sewer service. Therefore, a study of the complete reticulation of the seven sewer systems in the case was gone into concurrent with the design of allotment. The future purification of the sewage as it would be controlled by the topography of the area, as a matter of course came in for a fair share of attention. We have concluded upon adopting the separate system of sewers as being the most rational one for the needs and shall therefore carry this design out as largely as consistent with the physical conditions with which we have to deal. In concluding upon this system, we had not forgotten our experience with the septic tank at our residence as hereinbefore related.

Many farm drains course more or less frequently through the territory and are temporarily available for the drainage of the many cellars that have been built and are being constructed. A demand for entrance into these and other available outlets very soon sprang up, which was granted and finally encouraged so far as these outlets had the capacity, and in following this came a stronger appeal for sewer service, which because of the greater need for improvements of much greater importance was necessarily denied, but we advised the construction of these small septic tanks where drainage was available and permitted the effluent from them temporarily to enter the drains just spoken of. These tanks, when permitted, were required to be constructed after plans made by us and under the supervision of the chief engineer.

The plan of tank adopted is circular, 3 feet in diameter and for the most part 3 feet from the under side of the outlet to the bottom of the tank. Inlets and outlets to these tanks are placed on opposite sides to each other, are made 4 inches in diameter, are placed on the same elevation and enter the tank with a downturned elbow, that the flushing in of the wastes from the soil pipe or laundry or the discharge of the effluent may not disturb the scum. The bottom of the tank is made of concrete, the walls of brick and are finished at the top of the ground the same as is an ordinary sewer manhole. The interior below the discharge pipe is washed with four coats of pure cement wash.

The capacity of the tanks are varied according to the number of people whose wastes pass into them, but for the most part contain about 160 gallons which, compared to the service reputed to be rendered by the city's tank at Champaign, Ill., would be sufficient to accommodate the wastes produced by from eight to twelve persons.

The first residential septic tank constructed in Zion City was made the size above described and served the household of twelve persons for a short time when the construction of an office building on the immediate lot required it to further serve ten more persons, but who only occupied this building during the day, and from which there came no wastes into the tank save from the lavatories and water closets. We at once feared this tank would be over-capacitated and therefore immediately set up a close watch on its action.

At the end of about six weeks after the tank had been put to use, a scum about 2 inches in thickness had formed and septic action was going on in a satisfactory way. At this writing the tank is still doing duty with a good healthy scum about 4 inches in thickness and emits scarcely any odor. The sludge has not been examined and of it we cannot speak.

Other similar tanks in the city are, under more favorable conditions, operating very satisfactorily. We have also designed and constructed two tanks of the oblong type for the use of a factory that will soon employ about a thousand hands, but owing to the limited requirements of them as yet, the tanks are not in good working order.

Taking a position which is largely based on our own experience, we have determined in the building of the city to require the universal construction of residential septic tanks, believing the effluent therefrom will be sufficiently liquefied and made incoherent by the bacterial action as to render the sewers into which it flows immune from greasy incrustations which are so much deplored by the sanitary engineer, as well as to decrease the demand for the installation of flush tanks at the upper ends of small laterals. Gradients, we believe, can also be reduced under this arrangement of things below what is now considered to be the minimum in the design and construction of the general class of sewers.

We believe in case there should ever arise a demand for further purification than what is secured by the residential septic tanks, then the cost of providing such a plant for further treating the sewage of the city at one place in one volume would be greatly minimized.

One of our most eminent English sanitarians advocates increasing the liquefaction of sewage by means of a septic tank and finishing the process by means of an anaerobic bacteria bed which he says should always be kept full of sewage. It is not probable when he advocated this scheme that he referred to tanks smaller than such as would be sufficient to care for the combined wastes of an ordinary sized town; but if this plan is an advisable one, we do not see why it may not be equally advisable to use this diminutive septic tank as the initial agent of purification through putrefaction.

In the universal adoption of this diminutive receptacle as a means of initial partial purification, it must be admitted that the costs of further purification will be very materially reduced if not in some instances wholly eliminated. Taxation for the construction and maintenance of an expensive purification plant, and for the scraping and cleaning out of the sewers, would scarcely be required or at least be materially lessened in the case at Zion City where the effluent has nearly a mile to flow in an open channel before it reaches the waters of Lake Michigan.

Of course offsetting this will be the cost of the periodical inspection of the tanks, while a triennial or quadrennial cleaning could be secured at a less cost we believe than through the means of a municipal purification plant. There is no rational means sufficiently reliable to assist us at this stage in estimating the difference in cost of such maintenance, but we feel fully justified in the course taken and hope in the future to offer something more definite as regards this scheme we have adopted and for which we have no precedent.

For designing, allocating and constructing these tanks, during the early days of our city building, the following ordinances and rules have been adopted and are strictly adhered to:

"Sec. 16 (city ordinance).—No septic tank shall be established except after plans approved by the City Engineer and countersigned by the Commissioner of Health.

"Rules Regulating the Disposition of Household Wastes.—Whenever and wherever sewers or drains from residences or other private properties are built and constructed with a view to obtaining an outlet in any other storm water drain, subsoil drain or sewer, the same shall be so constructed that its uses may be limited to the following services:

"First—No wastes from kitchen sinks, water closets, bath tubs, laundry tubs, lavatories, nor wash waters nor waste waters of any description shall be permitted to enter directly into such sewer or drain without having first been discharged into a properly constructed septic tank located in a suitable position upon the premises.

"Second—No storm waters of any description shall be permitted to enter directly or indirectly into such sewer, drain nor septic tank.

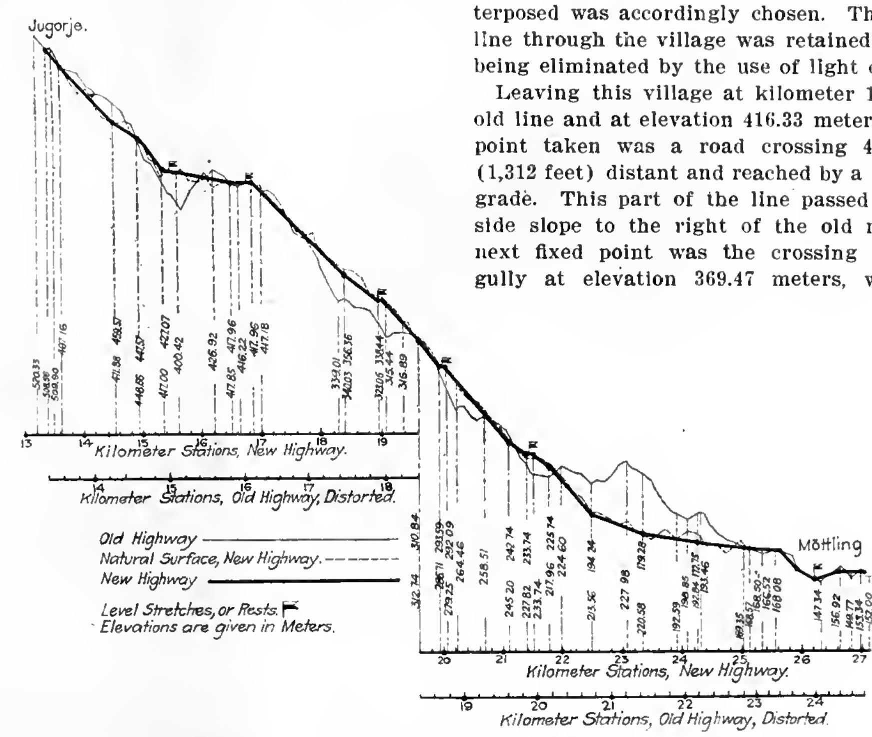
"Third—Cellar drainage will be permitted to enter such private sewer or drain providing it has no connection in any way with the interior of said cellar, and must be so constructed that no scrub waters, slops nor residential nor private wastes can possibly enter the same, nor must this drain be connected with the septic tank, but must enter the private drain at a point beyond the connection of said sewer with the septic tank.

"Fourth—The planning and building of all septic tanks are now regulated by city ordinances and under the control of city authorities."

The Coal Consumption of the Marseilles, France, street railways power plant, which contains five 1,000-kilowatt generating sets, is 2.29 pounds of dry coal per kilowatt at the switchboard.

Improvement of a Mountain Highway in Austria.

The improvement of what is known as the Karlstädter highway between Jugorje and Möttling, Austria, under the direction of Mr. Karl Grünhut, an engineer in the Imperial Austrian service, was undertaken as a continuation of a larger system of improvements carried on in the Carniola or Krain province during the preceding ten years. These improvements were largely local easings of grade. The work on this section of the Karlstädter highway called for the replacing of about 12 kilometers (about 7½ miles) of the old road, at an estimated cost of about $119,000. The total drop in elevation from the starting point to the end of the proposed improvement was 379.4 meters (1,245 feet), while the intermediate upgrades amounted to 87.2 meters (286 feet). Moreover about one-fifth of the length of the old road had grades varying from 9 to 15 per cent., making it necessary to employ extra horses in surmounting them with heavy loads. The following notes on the work have been condensed from a paper by the engineer in charge, which appeared some time ago in the "Oesterreichische Monatschrift für den Oeffentlichen Baudienst."



Profile of Highway, Jugorje to Moettling, Austria.

The old Karlstädter highway was probably first projected in 1808, but seems to have been constructed by the French for strategic reasons during their occupation of Illyria. The old alignment of the highway was first mapped out in 1832 by Lieutenant Colonel Loschan. Its profile shows such a succession of hills and valleys that it is almost impossible to obtain a clear idea of the slope of the country. Observations of the actual conditions of traffic on the road showed that the up-trips were made with a full load, the teams as a rule returning on the down grade empty. It was therefore desirable in improving the highway to make the grades as slight as possible, and incidentally to prevent the succession of up and down grades on the old roadway.

As a preliminary to the improvement, a line of benches was established on the kilometer stones along the existing highway. These levels proved the necessity of giving up the plan of simply shifting parts of the existing road, for in that case it would not be possible to do away with the vexatious counter grades. In laying out the new line two limitations added to the difficulties of the situation. The maximum grade fixed by law was 5 per cent., and official orders stated that the highway was not to enter the neighboring province of Croatia at any point along the route. Were it not for this last restriction, the new road at the upper end might have been built on a grade easily within the limit and by a much more direct route than the one finally adopted. In laying out the preliminary line grade stakes were placed every 20 meters (65.6 feet) apart.

The first 1,900 meters (6,230 feet) of the line as originally staked out for the new road was on a down grade having a total difference in elevation of 87.5 meters (287 feet), which would have resulted in a grade of 4.6 per cent. if carried straight through. However, several road crossings determined the elevations of intermediate points, so that the preliminary grades for this stretch were 4.75, 4.25, 3.00, and 5.00 per cent. respectively. To reach the next village from the last point on this stretch, it was seen that an upgrade could be avoided by making use of a cut and fill, the latter not exceeding 4 meters (13.1 feet) in height. A 1 per cent. grade with several level stretches interposed was accordingly chosen. The existing line through the village was retained, upgrades being eliminated by the use of light cuts.

Leaving this village at kilometer 16.2 of the old line and at elevation 416.33 meters, the next point taken was a road crossing 400 meters (1,312 feet) distant and reached by a 4 per cent. grade. This part of the line passed along the side slope to the right of the old road. The next fixed point was the crossing of a deep gully at elevation 369.47 meters, which was reached with a 3.4 per cent. grade. The personal interests of some of the inhabitants led to a petition asking that the proposed line over these last two stretches be changed somewhat. As the changes they proposed would have required a large loop in order to keep within the 5 per cent. grade limit, the petition could not be considered.

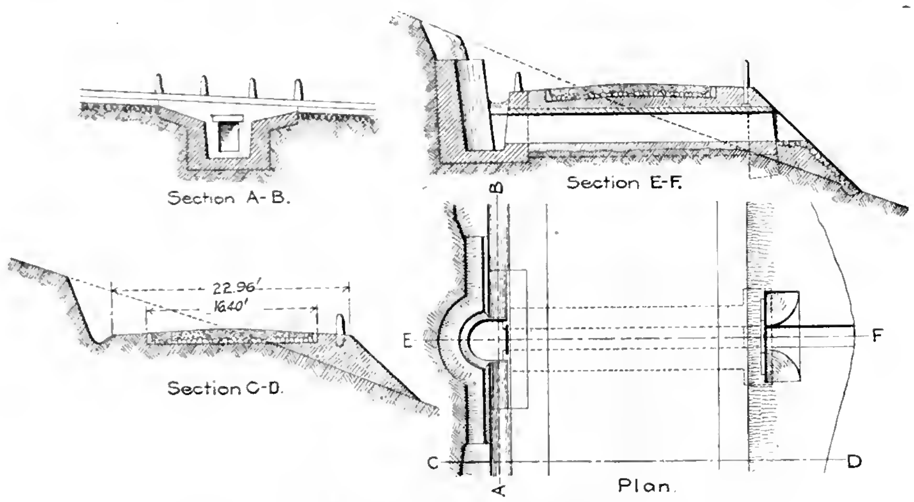
After crossing the gully previously mentioned, the line was carried 950 meters (3,116 feet) down the mountain side at a slope of 3.4 per cent. to a pass between it and a neighboring hill. A road crossing fixed the next point at elevation 312.75 meters, which was reached with a 3.6 per cent. grade. A 4 per cent. grade was used to the next village, 500 meters (1,640 feet) distant. At this point the geological formation changes from chalk to dolomite and in some places to loess. The topography also changes and instead of the succession of mounds and hollows found on the upper part of the line, from here on it follows a well defined valley with gentle side slopes.

Both slopes of this valley were considered before deciding on the final location of the line. The left slope would have given a better connection with the existing road and a shorter line, but in order to avoid introducing upgrades, such heavy masses of cut and fill would have been necessary as to have made the cost greater than that of the other line. The right slope allowed a very gradual fall toward a typical mountain stream which had to be crossed, and presented a better point of crossing it. It also permitted a much better line beyond this crossing than the left slope. Moreover, it gives a direct communication with two villages which had previously been without such communication.

From the point where the dolomite formation begins a 3.8 per cent. grade was staked out for 1,400 meters, followed by a 1.9 per cent. grade for 500 meters, and then a 3.9 per cent. grade for 950 meters brought the line to a stream crossing at elevation 193.1 meters. A variation of this last 1,400 meters (4,593 feet) of the line was considered, which would have saved 200 meters (556 feet) in length and given lighter grades, but the extra cost for cut and fill caused it to be rejected. From the last described point further determinations of grade were unnecessary, as the rest of the road into Möttling followed the comparatively easy slope of a stream.

Along the entire line as staked out, a tachymetric survey was made and enough levels taken on both sides to allow for a lateral movement of the line, and to enable cross-sections to be made for the detailed plans without further field work. About 400 levels per kilometer (about 650 per mile) were taken. The accompanying profile of the road shows heavier grades than those just described as staked out on the preliminary line. The latter provided for a minimum of earthwork without regard to length, whereas in the final location the curves were straightened as much as possible, and horizontal stretches introduced to serve as rests after long stretches of heavy grades. The profile also shows in a distorted scale of lengths the profile of the old road. The increase in the length of the new highway over that of the old was 2,200 meters (7,220 feet), the new having a total length of 13,600 meters. The total cost of the work was $106,850, or about $12,300 per mile. Places were provided alongside the road at intervals of 100 meters (328 feet) for depositing road material, to be used for repairs and maintenance.

By means of some elaborate equations and computations, it was found that the minimum cost of transportation, including the cost of the empty return trip, would be attained with a load of 937.5 kilograms (about 2,060 pounds) of useful load per horse. In making these computations, the length of road between the beginning of the improvement and the summit of the divide where the road begins to descend into the next valley, was included, in order to obtain the efficiency of the road as a whole. This total length is 16,615 meters (54,497 feet), and the elevation of the summit is 110 meters (360 feet) above the beginning of the reconstruction just described. The cost of transportation of the load of 937.5 kilograms (about 2,060 pounds) per horse for the whole distance, including the empty return, was taken as about $1.41 per ton of 2,000 pounds. The highway was found to be equivalent to a level road 2.77 times as long.



Typical Sections of Karlstaedter Highway at Culvert.

The Development of the Bituminous Macadam Pavement.

Abstract of a paper presented to the American Society of Municipal Improvements, by Fred. J. Warren.

The name bituminous macadam may be considered too nearly descriptive to be controlled by any one interest or to be a trade name but, so far as the writer is aware, it was coined for use in connection with letters patent governing methods and proportions of mixing various size mineral ingredients with bitumen, for paving purposes, and in noting the development the writer will confine himself to the experiences of Warren Brothers Company, who control these patents. The name was selected by the promoters of the pavement as descriptive of its construction, combining, as it does, the best features of the asphalt or bituminous pavement and macadam. In some respects, however, the selection of the name is an unfortunate one, as it has given the impression, in some cases, that it is a cheap pavement and, in others, that it is like macadam, which in some localities is very unpopular. Extreme cheapness is not claimed to be one of the advantages of the pavement and it is being presented to the public on its merits and not as a cheap pavement. In appearance it is not, on casual observation, materially different from asphalt, but on close examination the particles of stone which afford the more secure foothold can be seen on the surface but held firmly in place by the bituminous cement.

As explained in a paper read before the Boston Society of Civil Engineers early this year by the writer: "The principle on which the bituminous macadam pavement wearing surface is combined is the reverse of the principles on which the ordinary asphalt pavement is built. In the present asphalt or tar pavement the bituminous cement is used to support fine mineral grains, such as sand, which in themselves have no firmness to sustain traffic, in such a way that the fine mineral grains will be held or supported by the bituminous cement so that the mortar or mastic will, at all atmospheric temperatures, sustain the weight of traffic and, at the same time, resist abrasion. The bituminous macadam is built on the principle that, independent of the bituminous cement, relatively coarse and fine mineral grains should be combined in such a way as to have a firmness in themselves to sustain the weight of traffic. The bituminous cement is supported or held in place by the proper arrangement, as to size, of stone particles. The bituminous cement is used solely for the purpose of preventing attack on the stone from water and weather, and to bind the particles together sufficiently to prevent abrasion from traffic at all atmospheric temperatures and, at the same time, provide an elastic bituminous cement or cushion between the mineral particles which will deaden the jar and prevent the wearing effect caused by friction from the movement of its integral parts."

Something over two years ago, after an experience covering a period of twenty years in the refining of asphalt, manufacture of bituminous cement and the laying of asphalt pavements, the idea occurred to one of the Warren Brothers that by combining the essential principles of the most improved asphalt or bituminous and the most improved macadam pavements, a result could be reached which would: (a) Give a pavement with greater durability than asphalt. (b) Provide a foothold for horses equal to macadam and, at the same time, maintain the relative or general smoothness of an asphalt surface. (c) Overcome the necessary muddy or dusty condition of macadam and provide a pavement that, while having the density of solid stone, at the same time have great elasticity.

The theories on which the construction is based are:

First—That, with a solid, well rolled subfoundation, a thoroughly rolled base of crushed stone, such as is used in the most improved macadam pavement, is practically as good as any foundation. No one ever heard of a well laid macadam pavement failing because of the foundation.

Second—That, with a rough crushed stone base, coated with hot bituminous cement and a scientifically prepared wearing surface of bituminous concrete made of crushed stone and bituminous cement, the shifting or rolling of the ordinary asphalt pavement can be overcome. This shifting is due to two principal causes: (a) Rolling on the smooth concrete base. (b) Rolling on each other of the particles of fine sand used in the wearing surface of the ordinary asphalt pavement during hot weather when the bitumen or asphalt is in a semi-plastic and fluid condition. This tendency to shift limits the amount of bitumen which can be successfully used in an asphalt pavement to 10 per cent. or less.

Third—That by using for the mineral aggregate of the wearing surface angular particles of the hardest available crushed stone varying in size from about 2 inches to an impalpable powder in such proportion that the succeeding sizes will fill the coarser voids in the larger sizes, a far greater density could be secured than had previously been attained in either macadam or asphalt pavement construction. To secure the best results it is essential that the crushed stone after heating be separated into several sizes and then mixed by machinery in definite proportions by weight.

Fourth—That, by increasing the density and thus decreasing the voids and, by having the bulk of the mineral aggregate composed of coarse angular particles of stone, the voids can be thoroughly filled with bituminous cement and, by using a bituminous cement which is unaffected by water, a thoroughly waterproof wearing surface of bituminous concrete can be produced.

Fifth—That particles of carefully selected, crushed hard stone, held firmly in place by an elastic bituminous waterproof cement, would provide for the wearing surface of a pavement, one of the most durable substances known and a sufficiently rough surface to give an ideal foothold for horses.

In inverse ratio, the percentage of voids in the mixture of different sizes of stone used indicates its density or specific gravity. Uniform size particles of any shape or size contain approximately 40 per cent. of voids. Ordinary sand contains from 30 per cent. to 38 per cent. of voids; very seldom as low as 30 per cent. The most carefully prepared mixture of several grades of sand used in the most modern asphalt pavement mixture contains 25 per cent. of voids. The using of graded stone reduces the voids in the mineral mixture and the rigidness of the stone permits of the use of a softer bituminous cement than can be used with sand.

It is owing to minimizing the exposure of the bitumen and the use of a softer bituminous cement which would require more exposure to render it inefficient that it is believed the cement itself will retain its binding or cementing properties longer than would be possible in sand mixtures.

By using crushed stone varying in size from a maximum of two inches to an impalpable powder in exact proportions, as above described, we are able to reduce the voids to 10 per cent. and, by using enough of the bitumen to thoroughly coat all the particles and fill all the voids, can get a thoroughly waterproof wearing surface. We do not mean by this that it is advisable to wet the pavement excessively. Any paving material will wear longer if dry than wet. Continual moisture and mud on a pavement, combined with the abrasion of steel wagon tires, produces the condition which is employed to saw and plane stone and other hard substances. The bituminous macadam does not entirely overcome this, but by filling the voids with an elastic bituminous cement, which is absolutely unaffected by water, it does reduce the effect to a minimum. Like other forms of pavement, bituminous macadam is in better condition for horse and foot traffic when dry and clean than when wet and dirty. It should, therefore, be frequently cleaned the same as other forms of pavement.

The bituminous macadam surface is so dense and the particles of stone so firmly held in place by the bituminous cement that, even when made of the hardest trap rock, a section of the pavement when chilled and broken will fracture through the stone. In other words, the stone will break before it will cleave from the cement.

With the assistance of an able chemist of large experience in the study and practical use of bitumens and bituminous construction and, by devising considerable entirely new apparatus found necessary, the first nine months of the history of this pavement were devoted to diligent laboratory work to determine the best ingredients and the best combination of them to carry out the theory of the proposed construction. This brought us to the Spring of 1901, when the prospects of success seemed sufficiently sure to warrant the seven Warren Brothers (all of whom had devoted their business lives and training in the several branches of the bituminous and asphalt paving business) in dropping their other interests and assisting in the development. During the first year we succeeded in getting small contracts aggregating something less than 25,000 square yards in seven cities of the United States, five of which are within fifty miles of Boston. Laid with inadequate equipment and crude ideas of detail some of this work, while generally satisfactory, does not fairly represent the possibilities of construction.

The attention attracted by the samples laid in 1901 was far beyond the expectations of anyone and early this year it was realized that much trouble would be encountered in executing work contemplated, and orders were placed in January for seventeen plants of an entirely improved pattern and with a capacity of 1,500 yards a day each. These plants were all of a modern type of rotary drums, elevators, elevated screens and bins which would separate the stone into six different sizes and scales which would weigh each separate size of stone. The work of getting the plants out of the shop as fast as desired was an impossible undertaking and the wet weather of early Spring and Summer made it impossible to have work well under way until after August 1. It became evident early in the present year that, to cope with the demand, a large increase in capital, equipment and practical working force was essential. The result has been that the work constructed and contracted for during the present year amounts to 620,900 square yards in 39 cities.

In one respect the development has been a disappointment to its promoters and that is in the matter of cost of construction which proves to be as great as, and in some localities greater than, that of asphalt. This does not warrant the taking of more contracts at the prices of some of the earlier contracts taken. The bituminous cement and stone in the bituminous macadam base cost practically the same as the hydraulic cement and stone in the hydraulic concrete foundation of the asphalt pavement, so that the only saving in cost of foundation is the sand and part of the labor employed in mixing concrete. The crushed stone used in the wearing surface generally costs twice and sometimes three times as much as the sand used in asphalt pavement construction. The bituminous and stone mixture used in the wearing surface of the bituminous macadam is so much more dense and tough than the sand mixture of the asphalt pavement that the time, labor and power required to properly mix the ingredients and handle the mixture on the street is, with bituminous macadam, fully double that of asphalt. This is a condition which we did not foresee. Like all forms of construction the cost varies, very much depending upon the local cost of labor and materials, size of contract and other local conditions.

One important thing which has been developed to a certainty is that bituminous macadam can be laid with special design to provide a rough surface so as to afford a good foothold for horses on very steep grades. In the city of Pawtucket, R. I., the pavement has been in successful use since May, 1901, on a street with a grade of 12 per cent. and has received the unanimous endorsement of engineers and practical road builders who have critically examined it. The Massachusetts Highway Association devoted its quarterly meeting held in May last to the examination and consideration of this pavement. I take the liberty of quoting from the remarks of Mr. J. E. McClintock, of the Massachusetts Highway Commission, made at that meeting: "It has unquestionably solved the problem of pavement for steep grades and, if its cost were double what is asked for it, it would be the most economical pavement for such conditions."

Several Sewer Stoppages occurred during 1901 in Jacksonville, Fla., according to the annual report of Superintendent R. N. Ellis, caused by defective work by plumbers in making house connections. In the worst case the sewer was choked with sand for over 100 feet. The sewer was about 10 feet deep at that point, and the ground was thoroughly saturated with water.

The Proportions of Centrifugal Fans.

An interesting account of a method for determining the proportions of fans for setting up the movement of air against low pressures is given in a recent paper on mechanical draft read by Mr. F. R. Still, of Detroit, Mich., before the Western Engineers' Club and printed in that society's "Journal." Except for a detailed comparison that is made between the chimney and this type of fan as related to mechanical draft, the paper is practically treated in full in the following abstract.

The author describes briefly the forces at work in the discharge from a blower, and to facilitate his explanation refers to three diagrams which are combined in the one reproduced herewith. For his purposes in the definition of these forces, he starts with the dynamic pressure and the static pressure, the one of which always works against the other, with the result of practically producing a third pressure, which pressure he names air velocity pressure. His analysis of the fan action is as follows: the pressure and movement of the air is due entirely to the centrifugal force produced by the air sliding off the fan blades. The centrifugal force is in direct ratio to the square of the number of revolutions. With a fan wheel of given proportions the centrifugal force holds a direct ratio to the peripheral velocity. For comparison he creates a fourth pressure, a peripheral velocity pressure, based on an assumption that if the air were moving at the same velocity as the fan tips, a pressure

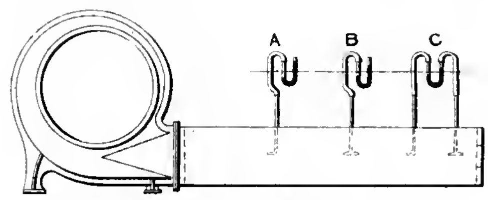


Diagram of Fan Discharge Pressure.

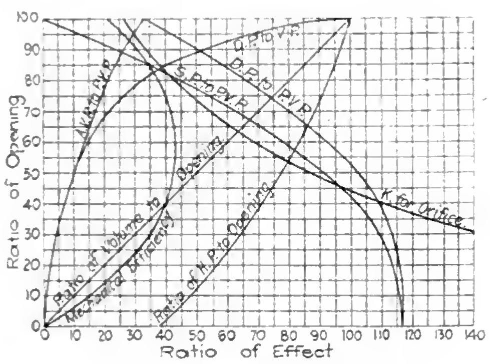
equivalent to the peripheral velocity pressure would be produced.

An accompanying diagram shows a blower discharging into a pipe 6 or 8 feet long with U-tubes or water gauges for measuring the pressure. A is the dynamic pressure tube and B, the static, the former attached to a bent pipe that faces the air current and the latter to a pipe which is at right angles to it. Concerning the behavior of the water gauges, the author explains that if the end of the discharge pipe is open there will be no difference in the level of the water in the two legs of B, as there is no resistance to the air current and therefore no static head. That in this case, A gives the combined reading of dynamic pressure and velocity pressure. That if a diaphragm is inserted in the end of the discharge pipe, reducing the outlet area, say 50 per cent., the water in A rises higher than in the previous case and the reading of B is almost the same as it was in A. That by ascertaining the difference between the present readings of A and B, or rigging up a tube as shown at C, the velocity pressure is obtained. That from this pressure can be determined the quantity of air passing through the pipe. That if the discharge pipe is entirely closed, the water rises higher in both A and B than before and both are alike. The author thought these points were not fully understood by many engineers and believed it explained the large capacities sometimes ascribed to blowers, owing to the assumption that a Pitot tube, designated by the author as the dynamic tube, gave the pressure due to the velocity of the air.

With regard to the relative capacities of fans under different conditions of service, the author presented the accompanying chart of curves, these applying to steel-plate fans, although the difference, he says, is not very great for any type of centrifugal fan. His discussion of the curves is as follows:

"The length of the fan blades and the speed have more effect than anything else. The longer the fan blades, the greater the centrifugal force at a given speed. Again, the greater the peripheral velocity up to about 6,600 feet per minute, the higher is the mechanical efficiency. Above 6,600 feet it begins to fall off very rapidly, much the way it does when the outlet is entirely closed. The ratio of opening at the left might be taken as the ratio of resistance. It is the percentage of opening in the discharge as compared with the total discharge area. The ratio of effect is the relative effect produced on the different elements of the fan by restricting the discharge.

"Supposing we have a fan with an unrestricted inlet and outlet that will deliver 25,000 cubic feet of air per minute at a head of 0.33 inch, with a given peripheral velocity, requiring 6.16 horse power. If we close the discharge outlet to 50 per cent. of the full area it will deliver only 12,500 cubic feet. The pressure will be increased to 1.03 inches, and the power to drive will drop to 4.8 horse-power. If we still further reduce the outlet to 20 per cent. of the full area, the capacity will drop to 5,000 cubic feet. The pressure will increase to 1.15



CURVES FOR STEEL PLATE FANS.

inches, and the power will be decreased to 3.45 horse-power.

"To determine exactly how a fan will perform is almost impossible, as all the conditions incident to its installation can never be foreseen. But we can get very close to it, as a rule. It is customary, when little is known about the plant the fan is going into, to assume that the resistance is equivalent to restricting the discharge outlet 25 per cent. This has always proved sufficient in the average mechanical draft plants we have put in. Some very large plants, with very large economizers, long smoke flues and other obstructions, have to be treated differently, the friction being figured up and added to the velocity head to determine the dynamic pressure."

For purposes of illustration the author assumed the case of a 1,000-horse-power boiler plant involving a consumption of 3,253 pounds of coal per hour. Allowing 18 pounds of air per pound of coal, 5 per cent. for ash and 5 per cent. for leaks, the author calculates that the fan will have to handle about 65,000 pounds of gases per hour at 500 degrees, or 27,250 cubic feet per minute. Continuing, he says: "We want a draft of 1 inch at the inlet, and having allowed for leaks in the above capacity, we can expect the same at the bridge wall. By adapting Murgue's formula for equivalent orifice, $A = KQ \div \sqrt{P}$ to obtain the inlet area, we find on the chart that $K = 0.485$; A is the area in square feet; Q is the quantity in thousands cubic feet; P is pressure in inches. Thus $A = 0.485 \times 27.25 \div \sqrt{1} = 13.2$ (square feet; that is, 49¼ inches in diameter). The area of the inlet should not exceed 40 per cent. of the area of the side of the wheel. Thus $13.2 \div 0.40 = 33$ (square feet, or 66 inches equal to 5 feet 6 inches, diameter).

"The velocity due to 1 inch pressure at 500 degrees is $81.5\sqrt{1} = 81.5$ feet per second, or 4,890 feet per minute. Referring to the chart, we find the ratio of dynamic pressure to peripheral velocity pressure is 0.73." The author then figures that the velocity of the fan wheel will be $8.15 \sqrt{1.37} = 95.5$ (feet per second) $= 5{,}730$ feet per minute, 1.37 being the reciprocal of 0.73, or the peripheral velocity pressure. The air velocity is thus about 85 per cent. of the peripheral velocity.

To find the blast area of the fan wheel he proceeds as follows: $27{,}250 \div 5{,}730 = 4.76$ (square feet). Multiplying by 3, an arbitrary constant established by experiment, an area of $4.76 \times 144 \times 3 = 2{,}055$ square inches is obtained. With a free discharge the author says the constant is 2.2 on fans of this type. The diameter of the wheel being 66 inches, the width at the periphery in inches is $2{,}055 \div 66 = 31.2$ inches.

From this point the author says different makers have ideas of their own, founded on no particular reasons as regards total width of fan. The only reason for beveling the side of the fan blades, as is the universal practice, is, he believes, to give strength and stiffness to the wheel with light material, the side plates forming a circular cone and acting as a truss between each blade, much stronger than if the side plates were flat. The correct principle, he asserts, is to make the circumference at the inlet multiplied by the breadth equal to the circumference at the periphery multiplied by the breadth at that point. To facilitate manufacture and do away with special patterns, the bevel is made 20 degrees, the tangent of which is 0.3639. The length of the blades is made 8⅜ inches and the overall width at inlet will be 37¼ inches. The width of the housing is taken 38 inches. As the inlet has 1,900 square inches area, the outlet will be $1{,}900 \div 38 = 50$ inches, that is, 38 inches wide by 50 inches high.

The speed of the fan will be $5{,}730 \div (5.5 \times 3.1416) = 332$ revolutions per minute. The power required to drive will be $(27{,}250 \times 5.2) \div (33{,}000 \times 0.40) = 10.75$ brake horse-power. The factor 5.2 is the number of pounds draft per square foot, equivalent to 1 inch water gauge, and the factor 0.40, the efficiency of the fan. If the fan engine required 50 pounds of steam per horse-power per hour, it would amount to 538 pounds of steam or 1⅝ per cent. of the evaporating capacity of the boilers. With this fan the author believes it would be advisable to put on a stack 5 feet in diameter, so as to reduce the resistance as much as possible. He stated in the discussion that if a chimney is high enough to produce, say an air velocity of about 1,200 feet, whereas a fan at a given speed would produce only 1,100 feet, then the chimney would help the fan; but that if the case was reversed, and the chimney produced only 1,100 feet velocity, the higher the chimney, the greater is the load on the fan. That is, there is a friction that would have to be overcome. He explained, for example, that if a 130-foot stack failed to produce sufficient draft for a case in hand, if a fan were used, the chimney was an obstruction and it would be better to cut off the stack from the fan.

Fire Test of a Lock-Woven Metal Concrete Floor.

Early this year a fire test was made by Mr. W. W. Ewing, at that time engineer of tests of the Bureau of Buildings of Manhattan, New York, on a "lock-woven metal concrete" floor built under the designs of W. N. Wight & Company. The object of the test is stated as follows in Mr. Ewing's report: "To record the effect of the continuous heat of a wood fire below the floor system, averaging not less than 1,700 degrees Fahr. for not less than 4 hours, the filling between the two beams being loaded with a distributed weight of 150 pounds per square foot of its area and all carried by such filling; the fire being extinguished at the end of the test with a stream of water directed against the bottom of the platform and discharged through a 1⅛-inch nozzle under 60 pounds pressure for 5 minutes, flooding the top of the platform with water under low pressure and then again applying the stream of water through the nozzle under the 60 pounds pressure to the bottom of the platform for 5 minutes." After this test the floor was loaded to 600 pounds per square inch and then unloaded gradually.

The test was made at a special brick house built for the purpose on the East River front. It measured 14x14 feet inside, and was 10 feet high. Two and a quarter feet above the ground there was a grate covering the entire area, with openings through the walls below it, while above it there was a door in one wall with a window directly opposite. The roof was the floor arch to be tested. Four 10-inch 35-pound steel beams, 5 feet apart on centers and well tied together, formed the framing for the roof. The latter is designed in accordance with a principle stated as follows in the report: "When galvanized steel wires, meshed in continuous sheets, are incorporated in the lower section of a high-grade Portland cement cinder concrete flat arch construction as a reinforcing element, spanning the distance between the upper flanges of standard I beams, the beams being haunched and protected with similar concrete, the effect of the combination is to afford a suitable means of fire protection for the beams and space above, and also for carrying the ordinary loads met with in common practice while subjected to serious fire and water test."

The roof was laid on a temporary center. The lower 5 inches of the concrete was mixed in the proportion of one part of Saylor's Portland cement, two parts sand and five parts steam ashes, and the lock-woven fabric was imbedded in it. The top of this course was 1¾ inches above the tops of the beams, which were protected on their bottom flanges as shown in the diagram. The fabric was made of No. 9 wires running across the beams every four inches and No. 10 wires running parallel with the beams and spaced 6 inches center to center. The wires were knotted together by the patented process controlled by the company. This course of concrete was laid on January 7 and 8. On January 25 it was covered with 3 inches of concrete filling, made of one part Victor Portland cement, two parts of sand and ten parts of steam ashes. The centers were removed the day before this top finish was laid, and it was then found that the protection of the lower flanges of the beams was not complete. The defective places were accordingly filled with a mortar of equal parts of Portland cement and sand. The ceiling of the center bay was plastered on January 30 and 31 with half an inch of King's No. 1 browning mortar.

On January 8 the temperature was 31 to 33 degrees. During the entire period of construction of the lower or principal course of concrete, the weather was stormy, and light snow, sleet or rain fell during the whole time of laying the concrete. A low coke fire was maintained in the building during the period of setting of the arch, and after the plaster had been put on, thereby facilitating the setting and drying of the materials.

The fire test was begun at noon, February 4, when the temperature was 16 degrees. The roof was loaded to 150 pounds per square foot, with brick. Pine and mixed cord wood was used for fuel, and the flames were accelerated at the start with kerosene. The temperature inside the house was measured by a LeChatelier pyrometer; at 2 p. m. it was 1,688 degrees Fahrenheit; 2:30, 1,967; 3:00, 1,553; 3:30, 1,877; 4:00, 1,733; 4:30, 1,688; 5:00, 1,796; 5:15, 1,472. At 5:18 a stream of water was thrown on the ceiling from a hose connected to a fire-boat, and this stream was continued for 5 minutes. Water was then flooded over the top of the roof for 6 minutes, and finally a stream was again played on the ceiling. On February 5 the roof was unloaded. The level readings showed that the defections at the center of the north and south beams and the arch between them were as follows:

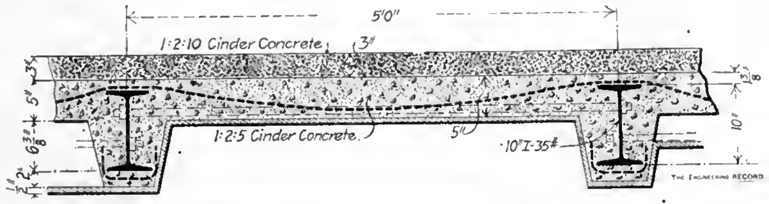
Time.	N. Beam.	Arch.	S. Beam.
12.48	0.02	0.01	0.005
2.37	0.39	0.19	0.14
3.45	0.42	0.11	0.11
4.30	0.66	0.43	0.78
After cooling	0.195	0.435	0.11
After cooling and unloading	0.13	0.425	0.09

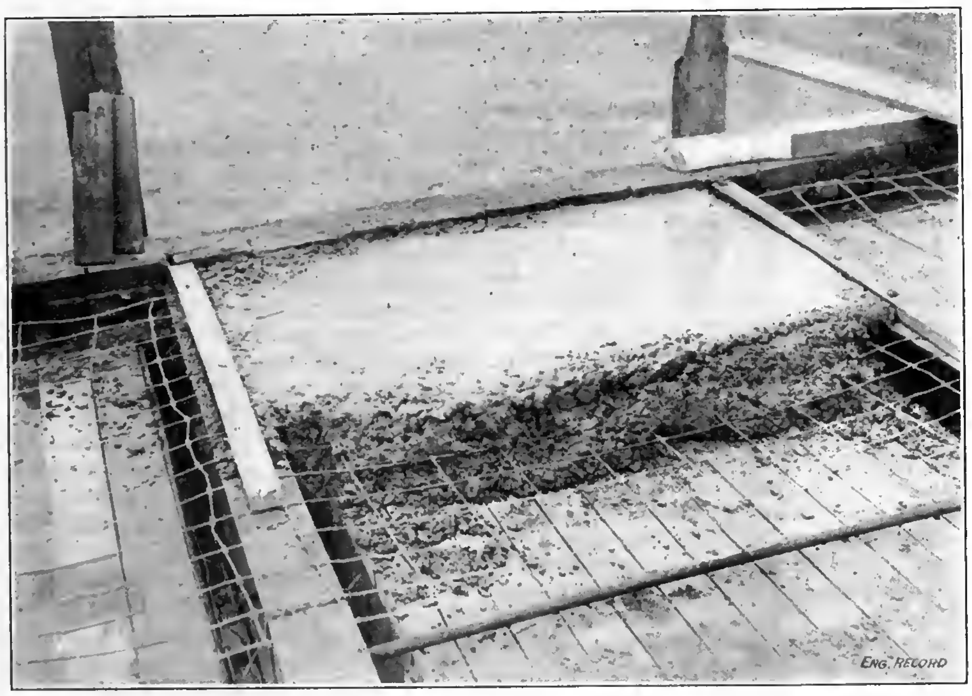
The examination of the arches was made on February 6, and the results are stated as follows in the report: "The plaster applied to the ceiling was practically all destroyed by the fire and water. The metal ceiling of the south bay was also destroyed. The tie-rods of the south bay were found in good condition. The tie-rod in the north bay, east of the center, showed a slight distortion. The tie-rod east of the center in the principal arch was exposed almost its entire length. About seven meshes of the metal fabric were exposed next the latter tie-rod; otherwise, the center and north and south arches were found in good condition. The beam protection, except in a few places where the cinder concrete had not been placed, was found in good condition."

The heavy loading test was begun on February 7, but as sufficient brick for the purpose could not be obtained on that date the full weight was not placed on the arch until about noon on February 8. This load remained in place 48 hours, and was then removed. The log of the test is substantially as follows, the deflections being at the center points of the beams and arch, and the loads in pounds per square foot.

Feb.	Hour	Load lbs.	Deflection, inches N. Beam.	Arch.	S. Beam.
7	10.30 a. m.	None.	0.000	0.000	0.000
7	12.15 p. m.	150	0.045	0.004	0.055
7	3.00 p. m.	300	0.095	0.035	0.120
7	4.30 p. m.	300	0.125	0.055	0.140
8	8.30 a. m.	300	0.127	0.067	0.131
8	11.00 a. m.	450	0.154	0.070	0.145
8	1.00 p. m.	600	0.195	0.115	0.190
10	1.00 p. m.	600	0.195	0.120	0.197
10	2.30 p. m.	450	0.165	0.107	0.180
10	3.30 p. m.	300	0.141	0.092	0.128
10	4.25 p. m.	150	0.082	0.070	0.070
10	5.04 p. m.	None.	0.034	0.035	0.011

The final opinion of Mr. Ewing on all these experiments is as follows: "The concrete forming the floor was but slightly damaged by the test. The beam protection was effective. The beams suffered no material permanent set. No fire or water passed through the floor arches, and they carried the loads safely as provided by law."





The Flooring System Forming the Roof of the Test Building.

The Placing of Water Meters and a system of close inspection in Grand Rapids, Mich., resulted in a decrease in the amount of water pumped of 200,000 gallons per day over that of the previous year, according to the latest report of the Board of Public Works. For the year ending April 30, 1902, the number of scheduled services was 8,818, and the number of metered services, 2,248. The number of house inspections made during the year was 8,437, and 1,331 leaks were found. Five inspectors were employed, two reading meters.

Book Notes.

No one acquainted with the manufacture and erection of steelwork in buildings can fail to deplore the waste of money which is often caused by designers of such material in their endeavor to pare down sections to a minimum. The large proportion of the total cost due to unnecessary expense in the shop and field is sometimes astonishing. With the best intention in the world to save any waste of a client's money, the failure to understand shop and erection requirements leads to designs theoretically economical but practically expensive. Steelwork detailing ought to be very largely routine work, following standard designs wherever possible and conforming to reasonable shop rules. Consequently great credit is due the Engineering Department of the American Bridge Company for a volume of "Standards for Structural Details" it has recently compiled. It is a collection of tables, detail drawings and rules for draftsmen embodying the results of many years' experience and adopted for all shops of the company. With its assistance any architectural draftsman with sufficient knowledge of steelwork to be placed in charge of such design should be able to turn in good plans from the manufacturer's as well as architect's point of view. At the present time, when an architect's steelwork plans are received at a shop, they have to be entirely redrawn and redetailed so as to make construction possible. A large part of this work would be saved were the original drawings properly prepared in the first instance, and this good result will follow the intelligent use of the book in question. The publication of the book has been very largely a free contribution by the company to the literature of good architectural engineering, and Messrs. Schneider and Wolfel have placed the profession under a considerable obligation by carrying the task through to such an excellent completion. The book is for free distribution to parties who can show reason for receiving it.

Mr. Hugo Feldmann, head instructor at the Nienburg industrial school, has collected 525 sketches of chimney tops which are published at $1 by the Helwingsche Verlagsbuchhandlung at Hanover. The sketches are well executed and printed, and many seem admirable, but there are a few which were not designed with proper regard to draft and a few which apparently record the nightmare visions following a prolonged affenbummeln. But it is hard to bring together 525 chimney pots all pleasing to every one's taste, and with such an extensive field for a choice the work ought to prove useful to all designers.

A book which ought to interest a large circle of American readers who have country estates is Prof. Vittorio Niccoli's "Costruzione ed Economia dei Fabbricati Rurali." The author is one of the faculty in the Royal Agricultural School at Milan, which is taking an important place in the rehabilitation of Italian agriculture. The book explains the principle which should govern the location and construction of farm buildings, their drainage, and the details of various sheds, vaults and other structures employed in making wine, extracting olive oil and storing the products of the farm. The work in Italy is all of a permanent character which would meet with little favor in the United States, yet it is none the less interesting. The book is published at 70 cents by Ulrico Hoepli, Milan, in his well-known series of manuals. The "Magnetismo e Elettricità" of Prof. Francesco Grassi, in the same series, has just reached a third edition. It is a book of over 600 pages of fine type, well printed and profusely illustrated, and is sold at $1.10. It is an elementary work, but has been revised so close to date that the electrical plant of the Manhattan Railway in New York, and the various wireless telegraph systems, are briefly explained.

One of the best collections of hydraulic diagrams issued for some time is an atlas of eleven plates measuring 8x5 inches and showing the relation, according to the Kutter formula, of the slope of a conduit or channel, its hydraulic radius and the mean velocity of uniform motion within it. A diagram is given for each of the following coefficients of roughness: 0.009, 0.010, 0.011, 0.012, 0.013, 0.015, 0.017, 0.020, 0.025, 0.030, 0.035. Both the horizontal and vertical scales have logarithmic divisions, the abscissas being slopes and the ordinates velocities. The curves, which are very nearly straight lines, are for hydraulic radii of 0.1 to 25 feet, and show very clearly the peculiarities of the formula. Owing to the uncertainty usually attending the choice of a proper coefficient of roughness, it is fruitless to observe great accuracy in employing the Kutter formula, and these diagrams will serve most purposes. Their accuracy is assured by the fact that they were prepared by Prof. Irving P. Church. They are published by John Wiley & Sons, New York.

Few books bear the mark of more painstaking revision and improvement in succeeding issues than the "Text-Book on Roofs and Bridges" of Professors Merriman and Jacoby. Part III. of this work, on bridge design, has just been revised for the fourth time, and its new form, while somewhat smaller than that of the first edition published eight years ago, is a marked advance over it. The changes in bridge design in eight years have been very great. Wrought iron has given place to steel, live loads have increased surprisingly, rolling mills are furnishing a large variety of shapes, and machine tools have been made larger and more efficient, while, on the other hand, standardization has been making great changes in detailing, and technical education is supplying a better grade of assistants for the designing office. The effect of these influences has been such an alteration in bridge design that the authors of this work have entirely rewritten it, although preserving the general plan of the treatment. Examples of details no longer good practice have been superseded by others showing current designs, so that a large part of the illustrations are also new. A particularly good feature is a list of references to the leading articles on bridge design in the technical press. The book is one of which the authors—and the engineering profession—may be justly proud. It is published at $2.50 by John Wiley & Sons, New York.

No matter how good may be the design of a machine, its value is diminished if the material of each part is not chosen for its particular service. This fact is so evident that the absence of a concise handbook on the selection of materials for machinery has been noticeable. Prof. Albert W. Smith has at last filled this need by a small volume entitled "Materials of Machines," published at $1 by John Wiley & Sons, New York. Its clearness of statement is noteworthy, and its value as a reference book is high.

What becomes of all the surveying instruments has been a favorite engineering conundrum, for they are turned out in a steady flood every year which should apparently glut the market very soon. Just the same thing is true of books on surveying, particularly in Germany; in the United States there is more moderation in production, and the appearance of a new work is a pretty fair indication that some one has found a new treatment of old subjects sufficiently useful to warrant a publisher to produce it. Accordingly the "Plane Surveying" of Prof. Paul C. Nugent, published at $3.50 by John Wiley & Sons, New York, has been examined with more than usual interest to see what news the author had about such an old story. Briefly stated, the novelties must be sought in the careful presentation of the subject from a teacher's point of view, in which respect some of the sections are particularly well developed. Strangely enough the most striking feature is the discussion of the well-threshed subject of instrument adjustments; the novelty lies in the introduction of the methods of descriptive geometry in explaining the operations.

Among the volumes issued in connection with the bicentennial anniversary of Yale University was a large octavo by Prof. A. Jay Dubois on "Kinematics, Statics, Kinetics, Statics of Rigid Bodies and of Elastic Solids," forming the first part of a series dealing with the applications of mechanics to engineering problems. In a very general way the book may be said to be an amplification of the author's three-volume "Elementary Principles of Mechanics," but many of the discussions are more direct and the applications are varied and useful, particularly those involving the principle of least work. The book is sold at $7.50. Another volume of the series is a twelfth edition of the author's "Stresses in Framed Structures." The general form and arrangement of the earlier editions are preserved, but a number of improvements in some sections have been made. It is to be hoped that some of the antiquated details and examples of work will be replaced by more modern types, affording equally good instruction to students, in the next edition. The book is sold at $10.

The "Proceedings" of the third annual convention of the American Railway Engineering and Maintenance-of-Way Association have appeared in a well-printed pamphlet of 500 pages. This association was formed to supply a much-needed organization for the civil engineers engaged in railway work. The details of railway engineering are so special that their discussion by the general engineering societies has not been a success; and the system of committee investigations, which has proved so useful in collecting and collating information on single topics, can be best carried on in specialized societies. The "Proceedings" of the association above named demonstrate fully the importance of its opportunities for doing good, particularly in standardizing structural work, a service which the associations of master mechanics and car builders have already performed in their branches.

It has doubtless drifted in upon the horizon of many of the readers of this journal that there has been a tremendous recent change in the ideas of up-to-date mathematicians concerning elementary geometry. Until lately we have basked in the light of demonstrations scintillating coldly down the halls of time from the age of Alexandria's splendor. In our boyhood, Euclid was a name revered, but, sad to say, there are few mathematicians who now fear to shy a stone at his work. They say he is illogical, that his axioms are as reliable as tips on the stock market, and his work fairly creditable for old Egypt, but not up in the van of modern progress. So, Lindemann, Hermite, Dehn and many others have built up a new geometry, beautifully logical when understood, but so very, very hard to understand. The great work on the subject, by Lindemann, has not appeared yet in English, although it is understood that the authorized translation by Dr. J. Brace Chittenden has been practically finished. That is a monumental treatise, however, and for readers who desire a shorter outline the Open Court Publishing Co., Chicago, has brought out at $1 a translation by Dr. Townsend of the scholarly address on "The Foundations of Geometry," delivered by Prof. David Hilbert at the unveiling of the Gauss-Weber monument at Göttingen three years ago. The book is one of the most important recent short contributions to mathematical literature.

A fourth edition of Prof. R. C. Carpenter's "Heating and Ventilating Buildings," has been issued by Messrs. John Wiley & Sons, New York. The matter has been considerably revised, and, besides three new chapters, includes much additional information. This relates to the determination of carbonic acid gas, the anemometer and its calibration, the theory of the flow of air through orifices, pipes and by the force of the heated column, the transmission of heat through building materials, superheated steam in radiators, tests of blower systems, the condensation in radiators, house heating boilers, a summary of approved methods for the design of steam and hot water systems of heating, various patented systems of heating and the arrangement and proportions of furnaces for hot air heating. The new chapters are devoted to the fan or blower for moving air, to mechanical systems of heating and ventilation and to school house heating and ventilation. A number of tables have been added and the index has been improved. The book has 562 pages, an increase of over one-third over the former volume, and sells for $4.

A publication entitled "American Art in Bronze and Iron," edited by Mr. William Donald Mitchell, has been undertaken by John Williams Bronze Foundry, 556 West 27th Street, New York. Its purpose is to illustrate the best designs of architects, decorators and sculptors as exemplified by the company's work, which is too well known for variety and quality to need comment here. The initial number is devoted to memorial tablets, and it contains a large number of excellent engravings of examples by eminent designers. Succeeding issues will illustrate bronze entrance doors and grilles, bank counter screens, lamp standards and lanterns, sculpture in bronze, and miscellaneous metalwork of architectural, decorative and ecclesiastical character. The value of such a publication is evident to all architects, and the fact that it is for reasonable free distribution places it within the reach of all.

Another publication for free distribution is a pocket edition of lists of spirit levels and bench marks along the New York State canals. It has about 90 pages and a large folding map, and is reprinted from the 1901 report of Mr. Edward A. Bond, State engineer and surveyor. The manner of running the levels is fully explained and there is a historical sketch of other important leveling in the same district.

It is France which has been setting the pace of late in new methods of travel, and that land is as far ahead of others in the new art of dirigible ballooning as in automobile running. It is not strange, therefore, that Ch. Béranger, 15 Rue des Saints-Pères, has published a 350-page work, "Les Dirigeables," by M. H. André, a member of the Société des Ingénieurs Civils, for the interest in the subject has already led to the appearance of several healthy journals devoted to aeronautics and numerous monographs and less ambitious books. The new book is in three parts, the first on the design and construction of balloons, the second on means of propulsion, and the third on the historical aspect of the subject, from the project of Meusnier in 1783 to the experiments of

Zeppelin and Santos-Dumont. The book seems to be a serious study of a subject which few people consider very seriously in the United States. It is published at $2.50.

Meeting of the American Society of Municipal Improvements.

The ninth annual convention of the American Society of Municipal Improvements was opened in the Chamber of Commerce, Rochester, N. Y., Tuesday afternoon, with addresses of welcome by Mayor A. J. Rodenbeck, and Secretary John M. Ives, of the Chamber of Commerce. The response was by the Society's second vice-president, Mr. G. M. Ballard, of Newark, N. J. Under the regular order of business, which was then proceeded with, the following applicants were elected to membership in the association: John Rowson and Edgar S. Kiefer, members Board of Public Works, Grand Rapids, Mich.; J. B. Nelson, city engineer and Edwin D. Logsden, member, Board of Public Works, Indianapolis, Ind.; Augustus P. Eggers, commissioner and J. Crowell Mundy, superintendent, Board of Public Works, Newark, N. J.; Leon D. Conkling, city engineer, Elmira, N. Y.; G. A. Parker, superintendent Kenney Park, Hartford, Conn.; Edward J. Johnson, city engineer, Nashua, N. H.; William S. Crandall, editor "Municipal Journal and Engineer," New York city; William N. Radenhurst, assistant engineer of water-works, John F. Skinner, assistant engineer of water-works, William J. Stewart, first assistant city engineer, Joseph E. Putnam, consulting electrical engineer, J. Y. McClintock, commissioner, and Thomas Nevill, deputy commissioner, Board of Public Works, Rochester, N. Y.; Frederick A. Snyder, city engineer, Williamsport, Pa.; Clarence D. Pollock, assistant engineer, Bureau of Highways, Brooklyn, N. Y.; William Pierson Judson, deputy State surveyor, Oswego, N. Y.; F. H. Woods, chairman, and J. Crane, member, Board of Control, Toronto, Canada; N. J. Kerr, city engineer, Ottawa, Canada; John R. Barlow, city engineer, Montreal, Canada, and L. Y. Cochran, Supt. of Highways, Allegheny, Pa.

In his annual address, President Edwin A. Fisher spoke of the need of organized effort on the part of municipal officials in order to bring about better and more economical methods of construction and maintenance in municipal works. It was to be regretted that a large number of such officials did not recognize the work this society was undertaking and unite with it in its efforts to promote the public good. The work of the society was, he said, grouped into eleven sub-divisions under the following heads: street paving electric street lighting, sewerage and sanitation, disposition of garbage and street cleaning, water works and water supply, municipal data, park development and maintenance, taxation and assessment, city government and legislation, and municipal franchise and review. Inasmuch as there were other associations devoting attention to one or more of these subjects, such as the American, New England and Central States Water Works Associations, the League of American Municipalities, the International Association of Municipal Electricians, etc., the question has often suggested itself whether there was need of so many kindred societies and whether better work could not be accomplished by a consolidation of some of them. It was true, he stated, that in the matter of water supply, street lighting, park development and the legislative functions of municipalities, excellent work was being done by other organizations; but upon the subjects of street paving, sewage, disposition of garbage and street cleaning, the papers and discussions of the annual conventions of this society comprised the most valuable contributions yet offered. He recommended that the question of co-operation or affiliation with societies having purposes in common with this be referred to the executive committee for consideration and recommendation to this convention.

The reports of Secretary George W. Tillson, of Brooklyn, and of Treasurer F. J. O'Brien, of Oswego, were then presented. The latter showed a total expenditure during the year of $568.80 and a balance on hand of $165.95.

The following resolution was submitted by Mr. Charles Carroll Brown, of Indianapolis, and referred to the executive committee: Whereas, The American Society of Municipal Improvements has learned with interest of a movement, started at the Boston meeting of the American Park and Outdoor Art Association last August, which looks to the ultimate alliance and co-operation of the various national societies now engaged in an effort to ameliorate civic conditions, and Whereas, such a movement, if generally participated in, and promising economy of administration with an increase of influence and authority, would have the cordial sympathy of this society, provided that no destruction were contemplated of the autonomy of each of the federating societies; therefore be it Resolved, that the American Society of Municipal Improvements appoint its retiring President, Edwin A. Fisher, as its representative on the national committee now forming for the consideration of the subject; and be it further Resolved, that he may, at his discretion, commit this society to such appropriation, pro rata to its annual income, as may be agreed to by the representatives of the other participating societies, toward the expense of the federation effort.

The report of the committee on "Uniformity in Municipal Accounting and on National Statistics" was next presented by the chairman, Charles Carroll Brown. With the exception of a few unimportant modifications, the forms recommended were the same as those which have been before the society for a number of years and have twice been printed in its proceedings. It was finally voted to adopt the forms which applied to streets and sewers, with the modifications suggested, and to accept and approve the blank form for water works adopted by the New England Water Works Association at its last meeting. It was also voted that this committee be instructed to collect municipal statistics and confer upon the subject with the Department of Labor at Washington.

The report of the committee on "Municipal Franchises," which was next in order, was not presented owing to the absence of Chairman Robert E. McMath, of St. Louis. It was announced that this report would appear in the printed proceedings of the convention. Mr. William S. Crandall, of New York, a member of this committee, submitted data bearing on this subject which had been secured by correspondence with mayors of fifty-three cities. The information obtained showed that several cities receive no compensation whatever from franchises granted to public corporations; others receive small amounts in the shape of a percentage of a state tax, an annual license on each street railway car or an annual tax on telegraph and telephone poles, while still others receive larger returns for the privileges voted to such companies. There was absolutely no uniformity in the manner in which different cities taxed their holders of franchises and the speaker thought this field an excellent one for investigation by the society.

At the Tuesday evening session several papers were read descriptive of Rochester and its public works. These were for the most part accompanied by stereopticon views. A paper on "Parks and Park Development" was read by Mr. G. A. Parker, Superintendent of Parks, Hartford, Conn. Resolutions on the death, which occurred Monday, of Mr. George A. Hotchkin, Superintendent of the Rochester Water Works and a member of the society, were read by Mr. Morris R. Sherrerd, of Newark, N. J., and were adopted. Mr. Hotchkin had prepared a paper on "Specifications, Testing, Installation and Care of Water Meters," which he was to have presented on Thursday. It was announced by President Fisher that this paper would appear in full in the report of the convention.

There was no session on Wednesday morning, the members being taken to points of interest in Rochester and to adjacent sections where roads are now being constructed by the state. The first business transacted at the afternoon meeting on Wednesday was the reading of a paper on "Municipal Sanitation" by Prof. A. Prescott Folwell, of Easton, Pa. This was in the form of a report of the committee on "Sewerage and Sanitation" of which Mr. Folwell is chairman.

A paper on "Residential Septic Tanks," by Mr. Burton J. Ashley, of Chicago, and one entitled "Practical Operation of Sewage Purification Plants," by Mr. John W. Alvord, of Chicago, were to have been presented at this session, but owing to the absence of these gentlemen it was voted to dispense with their reading and to print them in the published proceedings. Mr. John N. McClintock, of Boston, next read a paper on "The Biological System of Sewage Disposal." This was a description of the Glore system of bacterial sewage disposal. "Sewer Maintenance, under Whose Supervision and Why?" was the title of a paper presented by Mr. John H. Emigh, city engineer of North Adams, Mass. Mr. Emigh, as chairman of the committee on "Disposition of Garbage and Street Cleaning," also submitted a report which consisted of a contribution on the subject from Mr. Ernest Adam, city engineer of Newark, N. J., who had prepared statistics of the methods and cost of various systems employed by different cities in the United States.

The election of officers for the ensuing year was then taken up and resulted as follows: President, Charles H. Rust, Toronto, Canada; first vice-president, G. M. Ballard, Newark, N. J.; second vice-president, A. Prescott Folwell, Easton, Pa.; third vice-president, Edward D. Logsden, Indianapolis, Ind.; secretary, George W. Tillson, Brooklyn, N. Y.; treasurer, F. J. O'Brien, Oswego, N. Y.; finance committee, Emmet J. Steece, Burlington, Iowa, Frederick Giddings, Atchison, Kansas, and J. M. McCartin, Birmingham, Ala. Indianapolis, Ind., was chosen as the next place of meeting.

On Wednesday evening the members were given a banquet.

At the Thursday morning session Mr. Charles H. Rust, of Toronto, presented a report of the Committee on "Electric Street Lighting," of which committee he is chairman. This report consisted in part of statistics copied from Bulletin 4284 of the General Electric Co., giving the average hours per year, cost of coal per ton, contract price per lamp per year, cost to city per lamp per hour, and watts per hour per one cent in the different States. It was to be observed from this bulletin that the use of the enclosed arc lamp is rapidly supplanting the open lamp, and also that the use of the term "candle power" is replaced by the expression, "watts at lamp terminals." The Committee thought that franchises for street lighting should not be granted for too long a period, that wires in all large cities should be placed underground, lamp posts should be made of iron and of ornamental design, and that all work should be done under the direction of an electrician to be appointed by the corporation. Frequent tests should be made to ascertain if the lamps are giving the light provided for in the agreement. Municipal ownership of electric lighting plants was advocated by the Committee, but in case of private ownership, the city should receive a percentage of the gross receipts. A paper, entitled "Electric Street Lighting," by Mr. Alexander Dow, of Detroit, Mich., was read by Mr. Rust.

"The Economic Theory of Municipal Lighting" was the title of a paper which was to have been presented by Mr. Nicholas S. Hill, Jr., of New York. Mr. Hill sent word that it was impossible for him to attend the convention, but that he had prepared data upon this subject. It was voted to request Mr. Hill to forward this paper to the secretary of the Society, that it might be printed as a part of the proceedings of the convention. Mr. A. S. Hatch, president of the International Association of Municipal Electricians, was down for a paper on electrical government, but owing to the fact that the annual convention of that society is being held this week at Richmond, Va., it was not possible for him to attend this meeting. This paper will also be printed in the report of the convention.

A report of the Committee on "Water Works and Water Supply" was read by Mr. George H. Benzenberg, of Milwaukee, Wis. After referring briefly to the phases of waterworks development which have recently been the subject of the principal discussions in associations devoted exclusively to waterworks affairs, Mr. Benzenberg concluded his report as follows: "Another subject which has lately occupied the attention of waterworks associations is that of the preparation of standard specifications for cast iron pipe. The suggested form of specifications adopted by the New England Waterworks Association at its September meeting is a step in the direction of obtaining uniform joint dimensions in the manufacture of cast iron pipe and specials of different weights, but of same diameters, and is recommended for the consideration of the members of this association in the preparation of specifications for this class of work. No decided step, however, was taken towards improving the character of the pipe. In our opinion some modification of these specifications, particularly in regard to the method of cleaning the pipe and the character of the coating to be applied to the same, may prove of advantage and an investigation of this phase of the subject is suggested for the consideration of our successors on this Committee, who will probably also have the benefit of a trial of the standard specifications as adopted by the New England Waterworks Association. We are also of the opinion that the time has come when a much smoother interior surface of the pipe, possibly secured by vitrified coating, should be required; thereby improving the efficiency of the pipe system, as well as its permanent protection, and would suggest it as a subject worthy of the investigation of the new committee."

Mr. J. W. Howard, of New York City, read a paper entitled "Pavements Injured by Water; How to Minimize the Injury." He gave comparative data showing the amount of traffic in congested streets in some of the more important European and American cities. He pointed out that whereas the travel in certain streets in London, Paris, Berlin, etc., was greatly in excess of that in the busiest American thoroughfares, yet the pavements in these foreign cities often outwore many times those of American centers. This was due almost entirely to the manner of laying the material and of maintaining it, foreign cities taking into account more carefully the damaging effects of water. In the opinion of the speaker this was a subject of vital importance to all municipalities and he advocated the insertion in specifications for city pavements of a clause providing for water absorption and damage tests. He gave the results of tests made by himself showing the percentages of absorption of different paving materials, such as brick, trap rock, wood, asphalt, granite, etc. These amounts ranged from 0.85 to 30.10 per cent., certain stones showing the least and untreated wood the greatest degree of absorption.

The Thursday afternoon session was opened by the reading of the report of the committee on "Street Paving," by Mr. Nelson P. Lewis, of New York City, chairman. He was followed by Mr. Edward A. Bond, New York State Engineer and Surveyor, who described the "Work of the New York Highway Commission." Mr. W. E. McClintock, chairman of the Massachusetts Highway Commission, also spoke of the work being done under his supervision. He was followed by Mr. Emmet J. Steece, city engineer, of Burlington, Iowa, who read a paper entitled "Cost of Pavements and Roads in Small Towns." The remaining sessions of this very successful convention were to be held after this journal goes to press and it is therefore impossible to report their proceedings in this issue.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvii, xviii and xxvii.

WATER.

Bridgeport, Conn.—The Bd. of Health has reported to the Bd. of Aldermen on the subject of filtration for the city's water supply; the estimated cost of sand filtration is given as about $26,000 per acre; 3½ acres would be required for a population of 70,000.

Newburyport, Mass.—This city is about to purchase 40 (6-in. streamer and 2 hose outlets) hydrants.

Gloucester, Mass.—The City Council has passed an order for the issue of $50,000 bonds for water mains in Annisquam, Bay View, Bass Rock, and other sections of the city, also an order for bonds to the amount of $310,000 to be expended as follows: $250,000 on Haskell's pond, $50,000 on a double pipe line to the city, and $10,000 plus premium not exceeding $10,000 on a pipe line from Dikes' meadow to the pumping station.

Norwich, Conn.—Press reports state that this city has decided to expend $45,000 in raising the dam at its reservoir.

Worcester, Mass.—The City Council Com. on Water has voted to recommend an order providing for the construction of a new dam on Mann's reservoir, on the Kettle brook system, at an estimated expense of $120,000.

Springfield, Mass.—Ex-Mayor N. D. Winter, Harlan P. Stone and O. M. Baker are stated to have been appointed as members of a special commission of citizens to investigate the whole problem of a better water supply for the city.

Pittsburg, Pa.—The Sub-Com. on Water Supply & Distribution has endorsed the ordinance which provides for additional 10-in. mains in the downtown district. Estimated cost $182,000.

Port Washington, L. I., N. Y.—A petition has been filed asking the Town Bd. for the establishment of a water supply district with street hydrants for fire protection.

Philadelphia, Pa.—Dir. of Pub. Wks. Haddock, Oct. 2, awarded the contract to construct preliminary filters at Lower Roxborough plant to the Maignen Filtration Co. for $49,800.

Hagerstown, Md.—It is proposed to organize a company with $25,000 capital to build a reservoir on the mountain at Pen-Mar, from which to supply the hotels and cottages at the resort. Geo. A. Finch, of Baltimore, Geo. W. Albaugh, of Westminster and Walter D. Wilson, of Hagerstown, are the prime movers in the project.

Syracuse, N. Y.—Local press reports state that work will soon be commenced by the Syracuse Rapid Transit Co. in the erection of a big basin at the power house to furnish water independent of the canal. A well will be sunk near the basin to furnish the water supply.

Allentown, Pa.—The estimated cost of constructing the new basin at Schantz's Spring is $15,000. The work includes 4,450 yds. of rock and 8,850 yds. of earth excavation.

Newark, N. J.—An appropriation of $20,000 has been granted for water extension for the new annexed district which was Clinton Township.

Black River, N. Y.—Jas. P. Brownell, of Carthage, has about completed a survey of Drake Creek, from which it is proposed to take water for the village system. The survey shows a daily flow of 750,000 gal.

Yonkers, N. Y.—The contract for furnishing and erecting a pump of 8,000,000 gal. capacity in 24 hours is stated to have been awarded to Henry R. Worthington for $25,800.

Oakland, Md.—H. G. Frederick, of Millersburg, Pa., has received from the Council a 25-year water works franchise.

Annapolis, Md.—See "Government Work."

Garfield, N. J.—Boro. Clk. F. E. Kane writes that it is proposed to construct water works, estimated to cost $40,000. Colin R. Wise, of Passaic, N. J., Engr. in charge.

Lancaster, Pa.—Improvements contemplated by the Susquehanna Water & Power Co., will not be made for some time, as property must be acquired and plans perfected, which will take several months.

Fultonville, N. Y.—The Fultonville Water Works Co. has been incorporated, with a capital of $300,000. David Gring, Pres.; J. D. Landers, Sec'y-Treas.

Mercersburg, Pa.—The Mercersburg Water Co., of Mercersburg, has been incorporated, with a capital of $20,000.

Savannah, Ga.—Bids are wanted Oct. 25 for a Corliss pump, pipes, valves, etc., as advertised in The Engineering Record.

Ft. McRee, Fla.—See "Government Work."

Richmond, Va.—Reuben Shirreffs, C. E., 219 E. Grace St., may give information regarding the proposed plan to furnish water from Swift Creek to this city by a company composed of John C. Robertson and others from Swift Creek.

Ft. Myer, Va.—Bids are wanted Oct. 20 for extending the water mains. Capt. W. F. Clark, Q. M.

Lancaster, O.—City Engr. John N. Wolfe writes that a vote is to be taken in Nov. on the proposition to issue bonds for water works improvements. Geo. Cunningham, Clk.-Sec'y to Water Wks. Trus.

Toledo, O.—Willis F. Brown, Law Bldg., Toledo, is making extensive surveys in connection with the special pure water commission, appointed to secure better water for this city.

Cleveland, O.—The contract for furnishing and erecting in boiler house at Kirtland St. pumping station, 6 water tube boilers has been awarded to Aultman & Taylor Machinery Co., Mansfield, O., for $37,495.

Chicago, Ill.—Bids are wanted Oct. 14 for constructing water service pipes. John A. May, Sec'y.

Somonauk, Ill.—An ordinance has been passed providing for the issue of $5,000 bonds for building a water tower.

Mineral City, O.—Bids will be received by the Bd. of Water Wks. Trus. until Oct. 27 for constructing the extension of the city water works system. W. F. Walter, Pres. of Bd.

Belleville, Ill.—The East St. Louis, Edgemont & Belleville Water Co., of Belleville, has been incorporated by M. M. Stephens, W. N. Horner and L. D. Turner. Capital, $2,500.

Truman, Minn.—It is stated that bids are wanted Oct. 14 for $5,800 water works bonds. O. N. Steenstrup, City Recorder.

Anderson, Ind.—The city is reported to be considering the matter of a better water supply; the question is whether deep water wells or filtered water from White River should be used. J. J. Netterville, Pres. Water Wks. Com.

Kiester, Minn.—Recorder C. W. Teubner writes that $5,000 bonds have been voted for water works. Geo. P. Hawley, Fairmount, Minn., is said to have been engaged to prepare plans for the proposed system.

Lima, O.—The City Council has passed the ordinance authorizing the issue of $150,000 water works reservoir bonds. Riggs & Sherman, of Toledo, have made surveys and estimates for proposed reservoir.

Burgin, Ky.—A stock company is reported as being organized here to establish water works. The company will have a capital of $14,000.

Lawton, Okla. Ter.—Bids are wanted Nov. 5 for constructing water works to include development of a supply, the construction of a storage reservoir, stand-pipe, pumping station and 9 miles of system pipe distribution. D. A. Jacobs, City Clk.; W. S. Shields, Designing Engr., Marquette Bldg., Chicago, Ill.

Sherman Heights, Tenn.—It is proposed to construct water works for this place; estimates not yet made.

Geary, Okla. Ter.—Bids will be received Oct. 27 for $27,000 bonds voted for the construction of a system of water works. J. M. Waterman, City Clk.

St. Louis, Mo.—Local press reports state that the Bd. of Pub. Improv. has voted to reject the filtration ordinance, and that the Water Com. has decided to try the plan of clarifying the water supply of the city by using alum to coagulate the sediment.

Miami, Ind. Ter.—W. L. McWilliams, Pres. of the Miami Artesian Water & Electric Light Co., writes that said company will receive bids about Nov. 1 for the construction of a system of water works, estimated to cost $30,000. Jas. K. Moore, Miami, Secy. of Co.; Thos. V. Hall, So. McAlester, Ind. Ter., Engr. in Charge.

Ft. Scott, Kan.—City Clk. J. O. Brown writes that no new franchise for water works will be granted until Jan. 1, 1903.

Ardmore, Ind. Ter.—The citizens are reported to have voted to issue $150,000 bonds for water works.

Johnson City, Tenn.—An amendment to the charter of the Johnson City Water Works Co., increasing its capital stock to $60,000, has been granted by the Secretary of State.

Leesville, La.—The stockholders of the Leesville Light & Water Works Co., Ltd., has decided to raise the capital stock from $40,000 to $100,000.

Medford, Okla. Ter.—Water works bonds to the amount of $25,000 are reported to have been sold.

Holdenville, Ind. Ter.—Bonds to the amount of $25,000 have been voted for a water works system.

Dallas, Tex.—The Council has approved the contract with Chester B. Davis, of New York City, to act as supervising and consulting engineer for the proposed water works improvements.

Lake Charles, La.—Press reports state this place proposes to construct a system of water works. Address May Poe.

Beaumont, Tex.—Geo. J. McManus, Gen. Mgr. of the McManus Irrigation Co., writes that it is proposed to irrigate, for rice, 2,100 acres, with 21 8-in. wells, 180 ft. deep, which flow above surface. Probable cost of engines, boilers, shafting, etc., 21 centrifugal pumps and fittings, $10,500, exclusive of wells, pipe and pits and housing. The incorporators of the company are: G. J. McManus, of Beaumont; A. E. McManus, of Duluth, Minn., and Chas. M. Lowe, 428 N. 1st St., Minneapolis.

W. F. Monahan, Dir. of the Texas Land & Irrigation Co., writes that it is proposed to construct an irrigation system.

Lexington, Miss.—A system of water works will be put in here at once to be owned and operated by G. W. Stigler and H. S. Hooker, of this town.

Purcell, Ind. Ter.—A franchise is said to have been granted to the Purcell Water Co. to put in a water system.

Decatur, Tex.—The City Council has made a contract with A. R. Whitehead, whereby it leased from him for a term of 5 years his water works plant.

Welsh, La.—S. A. Spencer and A. A. Shear, of Jennings, have made a proposition to erect an electric light, ice and water works plant for the town, provided the citizens would take $10,000 of the capital stock of the company, which is to be capitalized at $25,000.

Webster Groves, Mo.—Consulting Engr. Wm. H. Bryan, St. Louis, writes that the following bids were opened Oct. 6 for cast-iron pipe and special castings; prices are per net ton: Bidders—A, Am. Car & Fdy. Co., St. Louis Mo.; B, Dimmick Pipe Co., Birmingham, Ala.; C, M. J. Drummond & Co., New York; D, Chas. Miller & Son Co., Utica, N. Y.; E, U. S. C. I. Pipe & Fdy. Co., Chicago, Ill.; F, West St. L. Const. Co., St. Louis, Mo.; G, R. D. Wood & Co., Philadelphia, Pa.

	Cast-Iron Pipe			
Bidders.	330 tons. 12"-10"-8"	260 tons. 6"	350 tons. 4"	Specials. 12½ tons.
A	$42.00	$42.00	$42.00	$62.00
B	32.35	34.25	35.50	55.00
C	34.70	35.70	36.95	60.00
D	37.00	38.00	39.00	59.00
E	35.00	36.75	38.75	65.00
F	34.25	36.00	38.00	60.00
G	37.00	37.00	....	60.00

Golden, Colo.—Local press reports state that the City Council has rejected all bids for the construction of a gravity water works system and that new bids will be asked.

Montcloir, Colo.—The Town Council has under consideration a resolution which provides for the employment of an engineer to advise in regard to the proposed water and irrigation systems.

Phoenix, Ariz.—E. J. Bennett, J. C. Adams and others have been appointed a committee to investigate the advisability of establishing a city water works.

Denver, Colo.—Local press reports state that the Arkansas Valley Sugar Beet & Irrigation Co. proposes to build a dam 500 ft. wide and headgate for the Amity Canal. W. M. Wiley, of Holley, Colo., Mgr. of the Co.

Palo Alto, Cal.—Bonds to the amount of $40,000 are reported to have been sold to pay for extending the water and light system.

Crescent City, Cal.—The Crescent City Light, Water & Power Co. has been incorporated with a capital of $50,000. Incorporators: Nellie M. Duncan, T. B. Coulter and others.

Ft. Morgan, Colo.—Bonds to the amount of $40,000 are reported to have been voted for water works.

Mountainhome, Idaho.—Articles of incorporation of the Mountainhome Irrigation, Light & Power Co. have been filed. The corporation was organized in Utah and W. J. Turner has been appointed the resident agent of the Co. at Mountainhome. Capital stock $300,000. Geo. L. Nye of Salt Lake City, Pres.; W. J. Turner, of Mountainhome, Vice-Pres.; F. P. Sears, of Salt Lake City, Sec'y; A. G. Smith, of Mountainhome, Treas.

Lincoln, Neb.—The Elkhorn Valley Irrigation Co. has incorporated with a capital stock of $300,000. The incorporators are F. M. Widner, of Corning, Ia., and T. G. Foster, H. S. Rand and E. S. Huston, all of Burlington, Ia.

Randsburg, Cal.—The Evergreen Land & Water Co. has been incorporated. Principal place of business, Randsburg. Directors: G. W. Lloyd, C. G. Dillingsworth, G. J. McDivitt and others. Capital stock, $500,000.

La Habra, Cal.—The La Habra Water Co. has been incorporated. Directors: Geo. Chaffey, Edw. Records, O. L. Baldwin, C. W. Gould, W. W. Stowell. Capital stock, $300,000.

Greeley, Colo.—The proposition to issue $200,000 bonds for a mountain water supply for the city, will probably be voted upon by the people.

Searcy, Ark.—This city will build a system of water works and an electric light plant to cost $30,000. Estimates, plans and specifications are being prepared. The work is in the hands of a local Bd. of Improvement composed of P. A. Robertson, Chmn.; Emmet Snipes, Sec'y, and Henry Patterson. Owen Ford, Consulting and Supervising Engr., 710 Security Bldg., St. Louis, Mo.

De Smet, S. D.—City Aud. J. C. Gibson writes that on Sept. 27 bonds to the amount of $13,500 were voted for water works and $6,500 bonds were voted for gas lighting; the City Council will receive bids on Oct. 27 for the sale of said bonds.

Brigham City, Utah.—Bids are wanted Oct. 14 for constructing about 5,700 ft. of 30-in. wooden stave pipe for a water power plant in Box Elder Creek Canyon. Heber C. Boden, Mayor.

Lidgerwood, N. D.—W. I. Gray & Co., of Minneapolis, have secured the contract for the water works plant complete, at $8,865. J. J. Flatcher, Engr., Minneapolis, Minn.

Bremerton, Wash.—See "Government Work."

Denver, Colo.—The Farmers' Reservoir & Irrigation Co. has been incorporated, with a capital of $1,000,000 by Jos. Standley, of the Adams Hotel, Milton Smith, an attorney, and others.

Hamilton, Ont.—Bids are wanted Oct. 31 for boring an artesian well or wells to furnish the Insane Asylum a daily supply of about 70,000 gals. of water. R. Christie, Inspector of Prisons and Pub. Charities, Toronto.

SEWERAGE AND SEWAGE DISPOSAL.

Hudson, Mass.—Town Clk. D. W. Stratton writes that the proposition to construct a sewerage system has been referred to a committee for investigation.

Medford, Mass.—The Comrs. of Sewers have ordered the construction of a common sewer on Grove St., to be built under the direction of City Engr. Wm. Gavin Taylor.

Westfield, Mass.—Local press reports state that Town Engr. O. E. Parks is receiving bids for the construction of the southerly section of the surface drainage system.

Boston, Mass.—The following bids were opened Oct. 1 by the Metropolitan Water and Sewerage Bd. for building Section 45 of the High-Level Sewer in Quincy: A, Harry P. Nawn, Boston, $90,350; B, John Cashman, Quincy, Mass., $78,110; C, E. W. Everson & Co., Providence, R. I., $71,930; D. Wm. H. Ellis, Boston, $71,620; E, Latta & Terry Co., 801 Drexel Bldg., Philadelphia, Pa., $68,372 (awarded). For detail bids see accompanying table.

Bidders.	Rock or earth excav. and refill. 135"x150" sewer. 970 Lin. Ft.	Brick Mas. Portland. 600 Cu. Yds	Concrete Mas. American. 100 Cu. Yds.	Concrete Mas. Portland. 3,500 Cu. Yds.
A	$50.00	$19.00	$7.00	$8.50
B	38.00	18.00	7.00	8.50
C	39.00	15.00	6.00	7.00
D	36.00	17.50	6.50	7.30
E	30.10	16.50	7.50	8.15

Bids received at the same time for Section 78 High-Level Sewer in Roxbury: E. W. Everson & Co., $34,750; Latta & Terry Co., $27,930; H. P. Nawn, $24,340; Metropolitan Cont'g Co., $23,637; C. E. Trumbull & Co., $23,390; H. A. Hanscom Co., $22,690; Patrick McGovern, $18,360; Chas. Linehan, $17,820. The contract was awarded to Patrick McGovern, Boston, at his bid, which was as follows: Earth excavation and refilling in trench, 78x84-in. sewer, 600 lin. ft., $9; brick masonry, American, in trench, 100 cu. yds., $13; brick masonry, Portland, in trench, 450 cu. yds., $14; concrete masonry, American, in trench, 100 cu. yds., $6; concrete masonry, Portland, in trench, 400 cu. yds., $7; spruce piles in place, 7,000 lin. ft., 22 cts.; spruce lumber in trench in place, 12 M. ft. B. M., $35.

Erie, Pa.—Ordinances are being introduced in the councils for an extensive intercepting sewer system.

Scranton, Pa.—Ch. Engr. Jos. P. Phillipa writes that the contract for constructing sewers in the 19th Dist. has been awarded to Ruch & Miller, 1345 Arch St., Philadelphia, their bid being as follows: Sewer complete with stone cover basin and full lining in tunnel, at $2.88 per lin. ft.; sewer complete with Pierce or other casting covered basins and full tunnel lining, at $2.77¾ per lin. ft. (accepted); extra basins (stone cover) $95 each; extra basins (casting cover) $65 each; extra manholes, $50 each; extra house connection, 50c. per lin. ft.; tunnel arch lining, $2.75 per lin. ft. The work includes 64,805 ft. of 8-in. to 63-in. pipe and brick sewers with 364 manholes, 165 catch basins, and 26,100 ft. of 6-inch pipe house connections; the trench to average 11 ft. in depth and be excavated 20 per cent. in rock and 80 per cent. in earth. Bids were opened for above work on Oct. 6 by Dir. of Pub. Wks. John E. Roche.

Millburn, N. J.—Bids are wanted Oct. 20 for building a sewerage system for this township, as advertised in The Engineering Record.

Binghamton, N. Y.—Bids are wanted Oct. 28 for the construction of a sewer in De Forest St., also for a sewer in Green St. I. C. Hull, City Clk.

Lancaster, Pa.—The City Council has passed an ordinance appropriating $15,563 for sewers and macadamizing.

Patchogue, L. I., N. Y.—Sewer bonds to the amount of $10,000 were sold by the Village Trus., Oct. 8.

Allentown, Pa.—Local press reports state that bids will be received by the Mayor until Oct. 21 for constructing a sewer on portions of Allen St.

Avalon, N. J.—Bids are wanted Oct. 17 for furnishing materials and laying about 5,000 ft. of terra cotta sewer pipe. Gilbert S. Smith, Mayor.

Oneida, N. Y.—City Engr. Vedder has prepared plans for 2 8-in. sewers on West St.

Philadelphia, Pa.—The Bd. of Health has recommended that the City Council make appropriations for the immediate construction of sewers in Dickinson, Greenwich, Flora, Etting and De Kalb Sts.

Niagara Falls, N. Y.—The contract for constructing Chasm Ave. tunnel trunk sewer has been awarded to W. W. Read & Co., for $22,891.

Phoenixville, Pa.—The Town Council is considering an ordinance which provides for the construction of sanitary sewers.

Corinth, N. Y.—The Bd. of Health has recommended that sewers be extended on Main St.

New Castle, Pa.—The Council has passed bills providing for the construction of sewers on several streets.

Newark, N. J.—The contract for constructing Section 4 of the Joint Outlet Sewer, has been awarded to John P. Hall, of Jersey City, for $47,553.

Brooklyn, N. Y.—Bids are wanted Oct. 29 for constructing sewers in proposed street through northern portion of Dyker Beach Park and in 92d St.; the engineer's estimate calls for brick sewers 159-in. to 30-in. in diameter, vitrified stone water pipe sewers, 24-in. to 12-in. in diameter, with 65 manholes, 26 catch basins, planking, sheeting, etc. Amount of security required $335,000. J. Edw. Swanstrom, Comr., Pres. Boro. of Brooklyn.

Cape Charles, Va.—City Clk. I. J. Burbage writes that the Town Council intends to put in a sewerage system this fall, at a probable cost of $7,000.

Ft. McKee, Fla.—See "Government Work."

La Grange, Ga.—The following bids were opened Sept. 29 for the construction of 49,300 ft. of 6 to 18-in. pipe sewers, with 96 manholes and 18 flush tanks; the trench to average 7½ ft. in depth and be excavated in clay and loam. Roy Dallis, of La Grange, Engr. Bidders: A, Williams & Wadley, Macon, Ga.; B, A. L. Patterson & Co., Durham, N. C.; C, Geo. W. Waring, Columbus, S. C.; D, W. H. Harris & Co., Jacksonville, Fla.; E, Thos. Wagner, Mobile, Ala.; F, Howard Neely, Chattanooga, Tenn.; G, Frederic Minshall, Greenwood, S. C.; H, W. C. Porter, Greenville, Miss.; I, Moore & McCrary, Atlanta, Ga. (awarded at a total of $21,196); J, R. E. Boggs, Spartanburg, S. C.

Items and Quantities.	A	B	C	D	E	F	G	H	I	J
Furnishing and laying pipe:										
18-in. pipe	$0.60	$0.45	$0.57	$0.65	$0.52	$0.47	$0.50	$0.46	$0.40	$0.51
15-in. pipe	.45	.34	.45	.50	.38	.34	.38	.36	.30¼	.39
12-in. pipe	.35	.25	.31	.35	.25	.25	.265	.25	.225	.29
10-in. pipe	.25	.18	.24	.28	.20	.19	.20	.21	.165	.22
8-in. pipe	.22	.14	.18	.15	.15	.13	.16	.16	.118	.18
6-in. pipe	.18	.09	.12	.12	.10	.09¾	.125	.115	.087	.12
Excav. and fill., 0 ft. to 5 ft.	.23	.12	.16	.18	.20	.09	.17	.18	.12	.27
Excav. and fill., 5 ft. to 7 ft.	.45	.14	..17	.22	.20	.14	.23	.195	.16	.36
Excav. and fill., 7 ft. to 9 ft.	.55	.17	.22	.29	.32	.20	.31	.25	.20	.43
Excav. and fill., 9 ft. to 11 ft.	.65	.23	.30	.39	.50	.30	.42	.36	.29	.56
Excav. and fill., 11 ft. to 13 ft.	.90	.28	.40	.58	.75	.45	.56	.50	.42	.73
Excav. and fill., 13 ft. to 15 ft.	1.05	.42	.55	.75	.95	.60	.75	.65	.55	1.00
Rock trench per cu. yd	5.00	3.00	1.00	3.00	4.50	3.00	2.40	4.00	2.00	7.50
Manholes, 8 ft. deep	65.00	32.00	35.00	33.00	38.00	30.00	33.00	28.00	30.00	43.00
Lampholes	5.00	5.00	20.00	5.00	7.00	5.00	10.00	5.25	5.00	10.00
Flushtanks	75.00	44.00	50.00	40.00	45.00	40.00	35.00	37.50	40.00	60.00
M. H. and F. T., combined	110.00	60.00	65.00	75.00	80.00	65.00	82.00	46.50	65.00	80.00
For each additional ft	5.00	3.00	8.00	1.50	2.00	3.00	2.25	2.50	5.00	5.00
Iron pipe laid with lead joints:										
15-inch	...	4.00	...	2.90	2.75	2.50	2.50	2.50	2.25	5.00
12-inch	...	3.00	...	1.95	1.95	1.50	1.66	1.50	1.52	6.00
10-inch	...	2.30	...	1.30	1.19	1.05	1.15	1.30	1.07	6.00
8-inch	...	2.20	...	1.05	.89	.85	.93	1.00	.875	3.50
6-inch	...	1.80	...	.78	.74	.65	.67	.75	.665	3.00
Brick work, per M	23.00	20.00	14.50	18.00	15.30	14.00	13.50	16.00	15.00	20.00
Concrete, per cu. yd	7.00	10.00	5.50	7.00	7.00	5.00	6.50	6.50	6.00	10.00
Extra for drop manholes	2.50	2.00	*.40	2.00	5.00	3.00	*.30	3.50	3.00	8.00

*Per ft. drop. Williams & Wadley bid $40 per ton on all sizes of iron pipe laid with lead joints, and Geo. W. Waring bid cost + 10% on all sizes of iron pipe laid with lead joints.

Warsaw, N. Y.—City Clk. C. H. Hain writes that on Sept. 29 it was voted to issue bonds for repairing streets and improving the sewerage system.

Corning, N. Y.—City Clk. E. J. Kelly writes that the proposition to install a sewerage system in the Fifth Ward, at a cost of $30,000, is under consideration, pending the engineer's report.

Newark, N. J.—Local press reports state City Surveyor Adam has been authorized by the Bd. of Wks. to perfect and put into operation plans for working out the Badger Ave. sewer problem.

Newark, N. J.—An addition of $43,000 is to be made to the $600,000 the city has agreed to pay as its share of the cost of elevating and depressing the Lackawanna R. R. tracks on account of the sewer that is to run inside the railroad retaining wall from Morris Canal west through Roseville to the city line.

Ironton, O.—City Engr. J. R. C. Brown writes that the contract for 18 and 12-in. sewers, with 34 manholes, in Dist. No. 4, has been awarded to I. B. Black, of Ironton, for $6,054.

Cincinnati, O.—Local press reports state that the various villages, interested in the proposed construction of a sewer through Mill Creek Valley, from Glendale to the Ohio River, through a committee appointed from their various Bds. of Health, have turned the entire matter over to the State Bd. of Health, and that body is now having the creek surveyed.

Elkhart, Ind.—Bids are wanted Oct. 22 for the construction of a sewer in Crawford, Christiana and other streets. Emil V. Anderson, City Clk.

Wabash, Ind.—Bids are wanted Oct. 27 for the completion of the local sanitary sewer in Main St. Fremont McLees, City Clk.

Cleveland, O.—Bids are wanted Oct. 16 for the reconstruction of a culvert across Woodland Hills Ave.; bids are also wanted Oct. 30 for the construction of a sewer in Petrie St. Chas. P. Salen, Dir. of Pub. Wks.

Toledo, O.—Bids are wanted Oct. 20 for constructing a circular brick sewer 24-in. inside diameter and a 12-in. pipe sewer in the alley between Walbridge Ave. and Colton St. Chas. H. Nauts. City Clk.

Indianapolis, Ind.—Bids will be received by the Bd. of Co. Comrs. until Oct. 18 for constructing a sewer at the Co. Poor Asylum. John E. McGaughey, Chmn. Comrs.

Dayton, O.—Robt. H. Ferguson, City Compt., writes that the lowest bid received Oct. 3 for the construction of sewers in 4 streets, was from Wm. Hilt of Dayton, at a total of $5,090.

Des Moines, Ia.—Bids are wanted Oct. 17 for constructing an 8, 9 or 12-in. sewer from the McKinley school to Des Moines River. Theo. F. Grefe, 219 4th St., Chmn. Com. on Bldgs. and Grounds.

Columbus, O.—Local press reports state that contracts are about to be let for the construction of the West Side main trunk sewer system.

Pendleton, Ore.—The City Council is reported to be considering the construction of a sewerage system.

St. Louis, Mo.—Bids are wanted Oct. 14 for constructing pipe sewers in N. 2d St. and in Clarendon Ave., Sewer Dist. No. 5. Hiram Phillips, Pres. Bd. of Pub. Improv.

Lake Charles, La.—Parish Surveyor John W. Rhorer writes that plans and estimates are now being received for the proposed sewerage system; it is the intention to order an election for a bond issue after estimates are in. John H. Poe, Mayor.

Birmingham, Ala.—The City Council has passed an ordinance providing for the construction of storm water sewers in the vicinity of Ave. H and 12th St. Estimated cost, $26,000.

Nashville, Tenn.—It is stated that bids are wanted Nov. 6 for constructing a 9 to 11-ft. brick sewer about 1 mile in length, requiring about 17,000 cu. yds. excavation and 5,000,000 brick. Wm. W. Southgate, City Engr.

Ensley, Ala.—The citizens are stated to have voted on Oct. 6 to issue $75,000 bonds for a sewerage system.

Rapid City, S. D.—Bids are wanted Oct. 23 for furnishing material for constructing an extension to the Rapid City School sewer system. Address W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

Seattle, Wash.—Bids will be received by the Co. Bd. of Drainage Comrs. until Oct. 25 for furnishing material for constructing drainage ditches in drainage Dist. No. 1. Robt. Bridges, Chmn.

Toronto, Ont.—City Engr. C. H. Rust writes that the proposed separate sewerage system for the East End Dist. is estimated to cost about $50,000.

St. Boniface, Man.—Cass & Couture are stated to have secured the contract for constructing sewers on La Verandyre St. for $7,494.

BRIDGES.

Hooksett, N. H.—The Manchester Electric Co. (C. H. Farrell, Supt., Manchester) will replace the wooden bridge over its canal at Hookset, with an iron structure.

Boston, Mass.—The following bids were opened Oct. 3, and taken under advisement, for building six masonry piers at the Atlantic Ave. bridge: Bidders all of Boston: Lawler Bros., $58,794; W. H. Ellis, $69,700; Holbrook, Cabot & Rollins, $73,500; Patrick McGovern, $74,900; Jones & Meehan, $75,800; Wm. L. Miller, $84,618; Norcross Bros., $112,300.

The following bids for the steel superstructure of sections A and B of the Broadway bridge were opened Oct. 8, at the office of the City Engr.: Section A includes that portion of bridge on South Boston side of Fort Point channel, extending from Foundry St. abutment to the draw span, and will consist of 14 plate girder and I-beam spans having a total length of about 574 ft., measured along center line, and a width of 60 ft. between street lines. Section B includes that portion of bridge on Boston side of Fort Point channel between the draw span and the Lehigh St. abutment; it will consist of 6 deck plate girder and I-beam spans, having a total length on center line of about 338 ft.: Boston Bridge Wks., Boston, $112,874; King Bridge Co., Cleveland, O., $119,500; Variety Iron Wks. Co., Cleveland, O., $119,000; Canton Structural Co., Albany, N. Y., $130,000; American Bridge Co., New York City, $123,300; W. H. Keepers & Sons, Portsmouth, N. H., $121,950; Berlin Const. Co., Berlin, Conn., $128,000; Eastern Bridge & Structural Co., Worcester, Mass., $116,450; New England Structural Co., Boston, $113,900. The bids were taken under advisement. The contract calls for the completion of the work on or before Oct. 1, 1903.

Binghamton, N. Y.—State Supt. of Pub. Wks. Chas. S. Boyd has awarded the contract for constructing a bridge over Erie Canal at James St., to the Owego Bridge Co., Owego, N. Y., for $17,445.

Meadville, Pa.—The middle span, 130 ft. long, of the Erie Ry. bridge over French Creek, at Buchanan Junction, is reported to have collapsed Oct. 5.

Principio, Md.—Press reports state that the Pennsylvania R. R. has decided to replace the culvert at Principio, on the Phila., Baltimore & Washington Div., with a large stone arched bridge. Jos. T. Richards, Engr. Maintenance of Way, Philadelphia.

Northeast, Md.—Cecil Co. Comrs., Elkton, have accepted an offer of the York Bridge Co. to prepare plans for new masonry and an iron superstructure 120 feet long, with 18 ft. driveway and a 6 ft. walk on either side, over North East Creek at Northeast.

Reading, Pa.—The County Comrs., Engr. Dreibelbis and Bridge Inspector Moser have visited Sunday's mill to inspect the site for the bridge over the Tulpehocken connecting Jefferson and North Heidelberg townships.

A bridge about 600 ft. long is to be built in the lower section of the city to extend over 2 railroads and the Schuylkill River.

New Castle, Pa.—It is proposed to build a county bridge 264 ft. wide to connect West Pittsburg and Cascaskee. Estimated cost $20,000.

Erie, Pa.—City Clk. F. Hanlon writes that the city of Erie, the Erie Electric Motor Co., and the P. & E. R. R. Co., are considering the proposition to jointly construct a $54,000 bridge over Buffalo road crossing.

Harrisburg, Pa.—W. H. Brown, Ch. Engr. Pa. R. R. Co., Philadelphia, writes that the work of building a subway under the tracks at Herr St., has not yet been placed under contract.

Hempstead, L. I., N. Y.—A bridge to cost $8,000 is to be built across the track at the West Hempstead grade crossing, the L. I. R. R. and the Mineola, Hempstead & Freeport Traction Co. having agreed to divide the expense.

Sullivan, Ind.—Bids are wanted Oct. 24 by the Bd. of Comrs. Vigo and Sullivan counties for constructing Allen bridge, 50 ft. span, 14 ft. roadway, and Dwyer bridge, 40 ft. span, and 14 ft. roadway. J. M. Laug, Aud. Sullivan Co.; Jas. Soules, Aud. Vigo Co.

Shelbyville, Ind.—The Bd. of Co. Comrs. will receive bids Oct. 18 for the construction of an iron bridge over Dry Fork.

Indianapolis, Ind.—Bids are wanted Oct. 16 for constructing the east approach to bridge over White River at Crow's Nest. Harry B. Smith, Aud. Marion Co.

Bids will be received by the Bd. of Co. Comrs. until Oct. 18 for constructing a bridge over Lick Creek. John McGregor, Chmn. Comrs.

The Bd. of Wks. has been informed by the Big Four R. R. that it will begin immediately the construction of a new viaduct over its tracks at Noble St.

The Bd. of Pub. Wks. has decided that it will be impossible to repair the Pleasant Run bridge at Ohio St., and a new bridge will probably be built in the near future.

Oshkosh, Wis.—The Council has made an appropriation for plans to be prepared by Erickson & Lehman for a 60-ft. span bridge to cross Sawyer Creek.

Detroit, Mich.—The Michigan Central, the Lake Shore and Grand Trunk R. R.'s are said to be considering the construction of a bridge across the tracks at Junction Ave.

Welch, Minn.—The contract for building a bridge across Vermilion River has been let by the Bd. of Co. Comrs. and the Town Bds. of Welch and Burnside to W. E. Hewitt & Co., of Minneapolis, for $5,100.

Youngstown, O.—To relieve congestion of traffic at the Holmes St. and North Ave. crossings of the Erie R. R., plans have been prepared for a viaduct to cross the tracks. Cost for superstructure about $75,000, the major portion of the expense to be borne by Erie R. R. and Mahoning Valley Electric Ry.

Wooster, O.—Co. Comr. Harrison estimates that it will cost $8,000 to repair bridges destroyed by recent storm.

Columbus, O.—The County Comrs. have ordered plans for the bridges to be built on the Taylor road in Madison township over Big Walnut and Alum Creeks. One bridge is to be 216 ft. long and the other about 148 ft. long.

Brazil, Ind.—By the terms of a recent agreement the Vandalia R. R. Co. is to build a steel bridge 100 ft. span across Birch Creek on the line dividing Sugar Ridge and Jackson township, and the Bd. of Co. Comrs. is to build a steel bridge, 60 ft. span, on the highway located 1 mile south of Hoosierville.

Minneapolis, Minn.—It is stated that bids will be received by the Co. Comrs. until Oct. 20 for rebuilding 6 county bridges. Hugh R. Scott, Co. Aud.

Lawton, Okla. Ter.—The Canton Bridge Co., of Canton, O., has received the contract for constructing 5 bridges at prices ranging from $2,000 to $5,000.

Cordova, Ala.—Bids will be received by the Co. Comrs. until Nov. 5, for constructing a steel bridge over Cone Creek. J. W. Shepperd, Judge of Probate.

Austin, Tex.—Local press reports state that work will soon be started on the bridge to be built across Colorado River at Austin for the International and Great Northern R. R. A. L. Bowers, Supt. of Const., and J. D. Trammel, Ch. Engr., Palestine, Tex.

Berclair, Tex.—The iron bridge over Miller's Creek, belonging to Goliad County, is reported to have been swept away by floods.

Beeville, Tex.—Local press reports state that the Southern Pacific R. R. Co.'s steel bridge over the Blanco River has been destroyed by floods.

St. Louis, Mo.—Local press reports state that bids will be received Oct. 24 by the Bd. of Pub. Wks. for the superstructure work on the 18th, 21st and Grand Ave. bridges.

Lexington, Neb.—The proposition to issue bonds for the construction of a bridge across Platte River was carried. Address the County Clk., Lexington.

San Francisco, Cal.—See "Railroads."

Marysville, Cal.—Local press reports state that the Southern Pacific R. R. engineers have concluded the preliminary work looking to the construction of a steel railroad bridge across Feather River at Marysville, and also of a bridge to cross Sacramento River at Knight's Landing.

PAVING AND ROADMAKING.

Killingly, Conn.—Highway Comr. Macdonald has awarded to the town of Killingly contracts for improving the following roads in said town: A section of gravel on Elmsville road at 45c. per lin. ft.; a section of gravel on Williamsville road at 65c. per lin. ft., and a section of macadam on Five Mile road at $1.20 per lin. ft. About 6,000 ft. of highway is to be improved at a cost of $5,200.

Reading, Mass.—The State Highway Comrs. have awarded to Ferranti & Maguire, of Worcester, the contract for building a state road in Reading, for $6,334.

Warsaw, N. Y.—See "Sewerage and Sewage Disposal."

Cohoes, N. Y.—Local press reports state that the Pub. Improv. Com. has awarded the contract for paving alley between Congress and Lancaster Sts., with sheet asphalt, to the Barber Asphalt Paving Co., at $2.35 per sq. yd. Bids for paving Rock alley will be received Oct. 15.

Newton, N. J.—Bids are wanted Oct. 20 by the Bd. of Chosen Freeholders of Sussex Co., for macadamizing sections of the following roads: Sparta and Newton road, Stanhope and Newton road, also Sussex and Newton road. A. H. Konkle, Co. Engr., Newton. Emmett H. Bell, Dir. Bd. of Chosen Freeholders.

Philadelphia, Pa.—Bids are wanted Oct. 14 for grading, repaving, etc., portions of several streets, also for repaving country roads with broken stone. Wm. C. Haddock, Dir. Dept. of Pub. Wks.

Brooklyn, N. Y.—The Bd. of Estimate on Oct. 6 authorized the paving with granite block of Nostrand Ave., from Malbone St. to Flatbush Ave., at a cost of $123,300, and of Rogers Ave., between the same Sts., at a cost of $109,600.

West Hoboken, N. J.—Demott St. property owners have petitioned the Council to reject all bids for bituminous macadam paving on that street, the lowest bid, which was $19,430, being considered excessive.

Pittsburg, Pa.—Bids for paving numerous streets with asphalt were opened Oct. 1, the lowest bid having been received from the Pittsburg Asphalt Co., at prices ranging from $1.79 to $1.95 per sq. yd.

New York, N. Y.—Bids are wanted Oct. 14 for regulating and repaving with asphalt and granite, on present pavement and concrete foundation, the roadway of Park Ave., from 111th St. to 133d St.; estimated quantities—61,200 sq. yds. of asphalt pavement, including binder course; 2,400 sq. yds. granite block pavement; 61,500 sq. yds. of old stone pavement relaid as foundation; 7,600 lin. ft. old blue stone curbstone, etc. Bids are also wanted at the same time for 3,190 sq. yds. of asphalt pavement in 117th St., from 5th Ave. to Lenox. Jacob A. Cantor, Boro Pres.

Atlantic City, N. J.—County Engr. J. J. Albertson, Magnolia, N. J., writes that the following bids were opened Oct. 1, for constructing the proposed elevated gravel road across the meadows, between Pleasantville and Atlantic City, a distance of about 4 miles, to include bulkheading, bridging and pumping sand for filling: John B. Hess & Co., Atlantic City, $83,306 (awarded); The Construction Co., Atlantic City, $124,000.

White Plains, N. Y.—Bids are wanted Oct. 14 for furnishing all material and labor to lay a 4-ft. flag walk, set stone, pave and curb gutters in numerous streets and avenues. Peter Paulding, Village Clk.

Washington, Pa.—The Boro. Council has sold street improvement bonds to the amount of $150,000.

Lancaster, Pa.—See "Sewerage and Sewage Disposal."

Buffalo, N. Y.—Bids are wanted Oct. 21 for paving portions of Hamburg Turnpike 36 ft. wide; also for repaving portions of Louisiana St. Francis G. Ward, Com. Pub. Wks.

Petersburg, Va.—Local press reports state that this city contemplates expending about $100,000 for further improvement of the streets; it is believed that brick or asphalt will be used.

Connersville, Ind.—City Engr. Karl L. Hansen writes that contracts for sidewalks, etc. (bids opened Oct. 1) have been awarded to Chas. & Roy Williams, of Connersville, as follows: 125,000 sq. ft. of cement walk at 8.7c. per sq. ft.; 4,000 lin. ft. curb and gutter, at 64c. per lin. ft.; 500 ft. 12-in. sewer, at 70c. per ft.

Vincennes, Ind.—Bids for the construction of the Vincennes Township gravel roads will be opened at the County Auditor's office, on Nov. 3.

Lafayette, Ind.—City Engr. G. H. Stevenson writes that about 49,000 sq. ft. of cement sidewalk will be let Oct. 13.

Canton, O.—City Engr. Philip H. Weber writes that on Oct. 20 bids will be received for improving Linden Ave. and Summit St., the approximate quantities being respectively as follows: Grading, 15,400 cu. yds. and 2,150 cu. yds.; straight curb, 4,500 lin. ft., and 2,000 lin. ft.; circular curb, 225 lin. ft., and 200 lin. ft.; flagging, 22,000 sq. ft., and 8,850 sq. ft.; crosswalks, 264 sq. yds., and 150 sq. yds.

Alton, Ill.—City Engr. E. E. Rutledge writes that a petition is being circulated for the paving with brick of Henry, Suspension, Liberty and Grove Sts., about 300 ft. long.

Terre Haute, Ind.—Bids are wanted Oct. 23 for improving 10th St. by paving the sidewalk with cement concrete and curbing the roadway with stone. S. C. Beach, Sec'y Bd. of Pub. Wks.

Indianapolis, Ind.—Bids are wanted Oct. 17 for certain street work, including brick paving and cement sidewalks. Harold C. Megrew, Clk. of the Bd. of Local Improv.

Chicago, Ill.—Bids are wanted Oct. 14 for improving certain streets by grading, curbing, paving, etc. John A. May, Sec'y.

Des Moines, Ia.—Bids are wanted Oct. 24 for paving with one course No. 1 vitrified brick upon a 6-in. concrete foundation with Portland cement top filler. State St., about 1,961 sq. yds., and certain alleys, about 1,009 sq. yds. J. E. Stout, Chmn. Bd. of Pub. Wks.

Bids are wanted Oct. 22 for paving with asphalt, E. Walnut St., about 20,300 sq. yds.; E. 12th St., about 22,789 sq. yds.; E. 5th St., 4,856 sq. yds., and E. Maple St., 1,727 sq. yds. Bids are also wanted Oct. 23, for curbing with Portland cement W. 15th St., about 1,284 lin. ft.; 10th St., about 2,098 lin. ft.; N. 14th St., 1,282 lin. ft.; W. 16th St., about 1,678 lin. ft., and W. 12th St., about 4,620 lin. ft. J. E. Stout, Chmn. Bd. of Pub Wks.

Eau Claire, Wis.—Bids are wanted Oct. 15 for the construction of cement sidewalks upon several streets. J. C. Fennessey, City Clk.

Elmwood Place, O.—Bids will be received by the Village Council, Oct. 22, for furnishing material for improving portions of Township Ave. H. G. Schaefer, Clk.

Carthage, O.—Bids are wanted Oct. 20 for the improvement of Boake alley. Clinton Cowen, Village Engr.

Dayton, O.—Bids are wanted Oct. 14 for improving the sidewalks, by paving with cement, in numerous streets. Robt. H. Fergnson, City Compt.

Cincinnati, O.—The County Comrs. are stated to have awarded the contract for improving Carthage Pike with granite, to J. A. Eberhardt for $421,195.

St. Paul, Minn.—The contract for paving with asphalt on Crocus Hill Place, has been awarded to the Barber Asphalt Paving Co., at $2.20 per sq. yd., total, $9,645.

The estimated cost of paving Mississippi St. is $13,132 for brick; $15,372 for asphalt, and $17,292 for sandstone; the estimated cost of asphalt on Nina Ave. is $4,649, and on Capitol Boul., $8,149.

Milwaukee, Wis.—The contract for paving on Jackson St., 4,141 sq. yds., with asphalt, has been awarded to the Western Paving & Supply Co., at $2.39 per sq. yd.

Property owners on Fond du Lac Ave. are considering the proposition to have the street repaved with asphalt.

Bonds to the amount of $450,000 are reported to have been sold; of this amount $100,000 will, it is stated, be used for street improvements.

Sidney, O.—The Council is said to be considering plans for paving prepared by Riggs & Sherman of Toledo.

Ft. Dodge, Ia.—The City Engr. has been instructed to prepare specifications for asphalt paving on 12th St. and 2d Ave. N.

Merrill, Wis.—The Bd. of Pub. Wks. has recommended that $12,000 be levied for streets and bridges.

Bloomington, Ill.—Property owners on South Center St. are said to desire a new pavement on that street.

Columbus, O.—Local press reports state that bids are wanted by the Bd. of Pub. Wks. for 450,000 paving bricks.

Carthage, Ill.—Bids will be received Oct. 14 by the Bd. of Local Improv. for grading, curbing with stone, and paving with brick, several streets in said city.

Pontiac, Mich.—Bids are wanted Oct. 20 for $10,000 paving bonds. Fred O. Thompson, City Clk.

Jerseyville, Ill.—City Clk. Albert H. Foster writes that it is proposed to pave N. State St. with brick at an estimated cost of $4,779. Engr. in Charge Walter Hansell.

Orange, Tex.—An issue of $15,000 street improvement bonds is reported to have been sold.

Clinton, Tenn.—Anderson County has under consideration the expenditure of $100,000 for the improvement of pike roads.

Memphis, Tenn.—Local press reports state that Tennessee St. is to be paved with granite block from Huling to Butler Sts.

Nashville, Tenn.—Mayor Head has approved the bill appropriating $2,200 for the purchase of a portable steam crusher.

Topeka, Kan.—A petition is now in circulation for the improvement of Polk St., by the construction of a 30-ft. brick pavement with limestone curbing.

St. Louis, Mo.—Bids are wanted Oct. 24 for paving with vitrified brick in a large number of streets. Hiram Phillips, Pres. Bd. of Pub. Improv.

Birmingham, Ala.—Ordinances before the City Council provide for the paving of several streets with brick, and several streets with bituminous macadam.

Covington, Ky.—The Bd. of Aldermen has passed an ordinance providing for the issue of $100,000 bonds for street improvements.

Pasadena, Cal.—The Street Com. is said to be receiving bids for a road machine.

Lincoln, Neb.—City Engr. Campen places the estimated cost of 4,200 yds. of brick paving with curbing, etc., in Paving Dist. No. 14, at $4,706.

Omaha, Neb.—The City Council has passed ordinances to pave and curb portions of Woolworth Ave., Mason and Dodge Sts.

Toronto, Ont.—Local press reports state that the Grand Trunk R. R. has consented to aid in the paving of Esplanade St., estimated cost of paving with macadam $20,000; if paved with granite the cost would be $96,000.

The contract for paving on Simcoe St. with asphalt has been awarded to the Constructing & Paving Co. for $11,375.

POWER PLANTS, GAS AND ELECTRICITY.

Turners Falls, Mass.—The Directors of the Turners Falls Water Power Co. are stated to have voted to increase the water power. The head gates will be enlarged, doubling the capacity, the canal widened and extended below the Griswold mill.

North Oxford, Mass.—Weise & Nichols write that they intend to install a 300 light, 16 c. p. dynamo in their mills at North Oxford; contract let to H. D. Temple of Worcester.

New York, N. Y.—The New York Edison Co. was the only bidder for furnishing, maintaining and illuminating about 1,625 street sign boxes on electric light poles (bids opened Oct. 7). Its bid was $10 and $12.50 each per year, depending on the style of box. The boxes are to remain the property of the company if the bid is accepted.

For furnishing about 800 sign boxes without illumination, Joseph N. Early was the lowest bidder Oct. 7. His bid was $16.98 and $18.98, according to the style of box.

Patchogue, L. I., N. Y.—Irvy Myers, of North Paterson, N. J., is stated to have petitioned the Village Trus. for a franchise to lay mains in the streets of Patchogue for the purpose of supplying gas.

Syracuse, N. Y.—Local press reports state that the Syracuse Light Co. will, next spring, expend about $250,000 for a new power plant. John J. Cummings, Vice Pres. and Treas.

Cape Vincent, N. Y.—The City Council is stated to have employed an expert to make a survey to determine the cost of putting in an electric light plant.

Elmira, N. Y.—The Chemung County Gas Co., of Elmira, has been incorporated with a capital of $500,000, to make gas and electricity for use in Elmira, Elmira Heights, Horseheads and the surrounding territory. Directors: Denman Blanchard, of North Andover, Mass.; Mathias H. Arnot and William S. Carr, of Elmira.

Gowanda, N. Y.—The Consolidated Electric Light & Power Co., of Gowanda, has been incorporated; capital, $50,000. Directors: Edwin C. Fisher, Chas. S. Phelps, and Geo. I. Lincoln, Gowanda.

Johnstown, Pa.—The Mayor has signed the ordinances granting franchises to the Consumers' Light, Heat & Power Co., and to the Citizens' Light, Heat & Power Co.

New Castle, Pa.—Bids are wanted Oct. 13 for furnishing Welsbach gas or self-generating street lights for lighting such streets and public places as may be authorized. C. D. Duff, City Clk.

Oakland, Md.—See "Electric Railways."

Bainbridge, Ga.—The Nussbaum Light & Ice Co. is in the market for an engine of 250 H.-P.

Rome, Ga.—Mayor J. D. Hanks writes that this city proposes to construct a $15,000 electric light plant; bids will probably be received about Jan. 15.

Columbus, Ga.—Judge Butt is stated to have granted a charter to the Coweta Power Co., which is organized to develop the Chattahoochee River for a number of miles in the upper part of Muscogee County. A series of dams will be built all the way to the Harris County line, and a number of manufacturing enterprises will be established to utilize this power.

Marianna, Fla.—Robt. J. Boone writes that the company, of which he is Bus. Mgr., is now receiving bids for the construction of an electric light plant estimated to cost about $10,000.

Kershaw, S. C.—It is stated that bids are wanted Oct. 14 for constructing an electric light system. Address J. F. O'Brien, Mgr. of the Kershaw Oil Mill.

Zanesville, O.—See "Electric Railways."

Norwalk, O.—The City Council is stated to have granted the Logan Natural Gas & Fuel Co. a franchise to pipe the streets and alleys for natural gas.

Marion, Ind.—The Manufacturers' Fuel & Gas Co. is stated to have petitioned the Co. Comrs. for a franchise for a pipe-line to carry gas from the field in the northern part of the county.

The Marion Light & Htg. Co. is stated to have purchased a site along the Big Four R. R., on which it will erect a mammoth heating and lighting plant.

Taylorville, Ill.—Arthur Stookey, of Belleville, is stated to have secured the contract for constructing the municipal electric light plant, for $18,210.

Belleville, Ill.—The St. Clair Gas & Electric Co., of Belleville, has been incorporated, with a capital of $2,500 by M. M. Stephens and L. D. Burner.

Ecorse, Mich.—The Township Bd. is stated to have granted a franchise to the Wyandotte Light & Fuel Co., to operate a gas plant in the township.

Negaunee, Mich.—The U. S. Steel Co. is to install an electric lighting plant at the "Queen" mines, near Negaunee.

Grand Rapids, Mich.—Wm. T. Hess, of Grand Rapids, writes that 4 or 5 propositions of $400,000 each are under consideration for the development of the water power from Muskegon River below Big Rapids. Rights have already been secured complete for 40 ft. of a 150 ft. fall, with 60,000 cu. ft. of water per minute. A. C. Sekeel, 124 Louis St., Grand Rapids, Engr. in charge.

St. Paul, Minn.—The St. Anthony Hill Electric Co. has been incorporated with a capital of $50,000, by Alanson P. Lathrop, Kenneth Clark and Elbert A. Young, to furnish electricity to St. Anthony Hill.

Hector, Minn.—It is reported that $6,000 bonds have been voted for a light plant.

Ferndale, Minn.—J. C. Robertson, of St. Paul, is reported to be the lowest bidder for the electric light plant, at $6,699.

North Amherst, O.—City Clk. F. E. Kaser writes that on Oct. 6 it was voted to issue $10,000 bonds for the construction of an electric light plant.

Decatur, Ill.—The Decatur Gas Co. is stated to have petitioned the City Council for a franchise for a steam heating plant; about $60,000 will be expended on the plant.

Chicago, Ill.—A press report states the Schoenhofen Brewing Co. will construct a power and lighting station in connection with its plant at 18th St. and Canalport Ave. It will occupy an area of about 10,000 sq. ft. and will be equipped with 2,000 H. P. boilers; cost estimated at $100,000.

Canton, Mo.—The citizens are reported to have voted to issue $10,000 electric light bonds.

Cape Girardeau, Mo.—See "Electric Railways."

Newport, Ky.—The Bd. of Aldermen is stated to have passed a resolution instructing the City Clk. to secure bids for an exclusive franchise for furnishing electricity for heating, lighting and other purposes for a period of 15 years.

Sparta, Tenn.—The Sparta Electric Light & Power Co. is reported to have secured the Judd mill property and will begin installing a plant at once.

Norman, Okla. Ter.—Bids are wanted Oct. 18 for furnishing all material and installing an electric lighting plant for the Univ. of Oklahoma. D. L. Larsh, Sec'y Bd. of Regents.

Searcy, Ark.—See "Water."

Covington, Tenn.—The city is reported to have purchased the electric light plant. An expert electrician will at once be employed to thoroughly overhaul the plant and put it in first-class condition. John Craig, Supt.

Baton Rouge, La.—Bids are wanted until Nov. 1 for furnishing 100 arc lamps to light the city, as advertised in The Engineering Record.

Birmingham, Ala.—The Birmingham Ry., Light & Power Co. has petitioned the Council for a franchise to construct a steam heating plant at its power plant and to lay pipes to houses in the neighborhood of the plant to supply steam heat. G. H. Harris, Ch. Engr., Birmingham.

Ensley, Ala.—The City Council is stated to have granted B. R. Pegram a gas franchise.

Hartford, S. D.—The Hartford Electric Light & Telephone Co. (K. Mueller, Mgr.) is about to install an electric light plant.

Crescent City, Cal.—See "Water."

Salt Lake City, Utah.—J. M. Herbert, of Denver, Colo., Mgr. of the Rio Grande Western R. R., is stated to have authorized J. H. Young, of Salt Lake City, Div. Supt., to consult with R. F. Hayward, an Electrical Engr., with regard to the construction of an electric power plant to be erected on 6th W. St.

Santa Fe, N. M.—A press report states that the Santa Fe Water & Light Co. is to develop the water power on Nambe River, 17 miles north of the town. Edgar L. Street, 44 Wall St., N. Y. City, N. Y., is the Engr.

Phoenix, Ariz.—The Great Eastern Light & Power Co. is reported incorporated by Wm. A. McNaughton, Julian Pinto and Edwin B. Cushman, with principal place of business Phoenix; branch office, San Francisco, Cal.; capital, $1,000,000; to deal in mines, mining claims, water and electrical power plants.

Palo Alto, Cal.—See "Water."

Santa Cruz, Cal.—A press report states that the Hiler Co. contemplates constructing an electric light plant to supply this city and Capitola.

De Smet, S. D.—See "Water."

Denver, Colo.—Bids are wanted Oct. 14 for the erection and installation of a new electric lighting plant in the engine room of the Arapahoe Co. Court House. Julius Aichele, Co. Clk.

Oroville, Cal.—A press report states that the Big Bend Tunnel, one of the famous properties of this county, has been sold to the Western Power Co., lately organized for the purpose of generating the water power of the north fork of the Feather River, near Big Meadows, in Plumas County. It is understood that a plant of 50,000 H. P. will be built, with San Francisco as the objective point.

Magnolia, Ark.—J. L. Davis, Pres. of the Columbia Light & Power Co. writes that bids are wanted on the electric light plant of about 600 to 1,000 lights, which it is proposed to install.

Welsh, La.—See "Water."

Kemp, Tex.—The Kemp Electric Light Co., of Kemp, has been incorporated; capital $3,000. Incorporators: Roy R. Reierson, P. H. Crook and Dodge Mason.

ELECTRIC RAILWAYS.

Auburn, Me.—The State R. R. Comrs. are stated to have received a petition for the approval of the articles of association for the Auburn, Mechanic Falls & Norway St. Ry. The proposed road is 24 miles in length and is to run from Auburn through Minot, Poland, Mechanic Falls and Oxford to Norway. It is to be run by compressed air or electricity; the capital is placed at $700,000. Directors: Fredk. H. Wilson, Brunswick; Frank E. Southard, Bath, and others.

Clarksburg, Mass.—The Selectmen are stated to have granted a franchise to the Hoosic Valley St. Ry. Co. W. T. Nary, Mgr., North Adams.

Boston, Mass.—The State R. R. Comrs. are stated to have approved the issue by the Old Colony St. Ry. Co. of additional capital stock, to the amount of $948,700, of which amount $446,900 is to pay floating indebtedness, $301,600 for additional rolling stock and electrical equipment; $116,300 for additional power plant equipment, and the balance for building an extension in Quincy and the requisite car houses there. C. F. Bancroft, Ch. Engr., Boston.

The Comrs. also approved an increase of the capital of the Boston & Northern St. Railway Co. to the amount of $1,797,300, for the purpose of paying off floating indebtedness, increasing its equipment, and also the erection of power stations in Lowell and Woburn, car houses in Danvers and Lawrence, and certain extensions of its lines. E. C. Foster, Mgr., Boston.

West Springfield, Mass.—The Selectmen are stated to have granted the Springfield St. Ry. Co. locations for extending its double tracks in Elm and Westfield Sts., Westfield road and Riverdale St. G. W. Cook, Supt., Springfield.

Worcester, Mass.—The State R. R. Comrs. is stated to have passed an order approving an issue of $500,000 bonds by the Worcester & Southbridge St. Ry. Co. for funding floating indebtedness, for construction and equipment of the road, and for the acquisition of real and personal property necessary for its operation. H. W. Culver, Ch. Engr., Worcester.

Pittsfield, Mass.—The State R. R. Comn. is stated to have granted the Berkshire St. Ry. Co. location in Pittsfield, Lee and Great Barrington. E. S. Breed, Supt., Pittsfield.

Ambler, Pa.—A charter has been granted to the Montgomery Traction St. Ry. Co., with a capital of $40,000, to construct an electric railway 4 miles in length in Royersford and Limerick Townships. J. H. Johnson and L. S. Moore, both of Ambler, are among the incorporators.

Avondale, Pa.—The Boro. Council is stated to have granted a franchise to the West Chester St. Ry. Co. C. V. Mills, Supt., West Chester.

Little Valley, N. Y.—The Village Trus. are stated to have granted a franchise to the Salamanca & Little Valley Trolley Co.

Oakland, Md.—The Town Council is stated to have granted Edw. A. Sincell, attorney, representing Robt. A. Ravenscroft, Marshall W. Wilson and associates, a franchise for the building of an electric road through Oakland, and also for an electric lighting, heating and power plant.

Elizabeth, N. J.—The City Council is stated to have passed on second reading an ordinance granting the Essex Cross Country St. Ry. Co. permission to run through the northwestern part of the city.

Zanesville, O.—The Zanesville Ry., Light & Power Co., of Zanesville, has been incorporated, with a capital of $1,000,000, by Geo. H. Warrington, John Ross, Geo. M. Finch, and others, all of Cincinnati.

Celina, O.—The People's Rapid Transit Electric Ry. Co., of Toledo, O., is reported to have petitioned for a right of way and franchise for building its road through Celina. The line will be from 150 to 200 miles long and will connect 7 county seats. It commences at Toledo, runs through Napoleon, Defiance, Paulding, Van Wert, Celina and Greenville.

Lisbon, O.—The Pittsburg, Lisbon & Western R. R. Co., of Lisbon, has been incorporated with a capital of $10,000, by R. W. Tayler, Geo. B. Harvey, and others, to acquire, own, lease and operate a steam or electric line having Ashtabula Harbor, Steubenville Salem and Marion for terminals.

Sciotoville, O.—The Ohio Valley Traction Co., of Sciotoville, is reported to have amended its charter, so as to extend its line from Sciotoville to Ironton.

Cleveland, O.—The Ohio & Pennsylvania Traction Co., of Cleveland, has been incorporated with a capital of $10,000, to operate an electric railroad from Cleveland, O., to Sharon, Pa. Incorporators: Frank L. Krause, Chas. L. Gilbert and others.

Sullivan, Ind.—The Town Bd. is stated to have granted a franchise to the Indianapolis Southern Ry Co.

Jeffersonville, Ind.—The Southern Indiana Interurban Ry. Co. has been incorporated, with a capital of $300,000, to construct a line through the counties of Clark and Floyd, a distance of 45 miles. Incorporators: N. A. Street, C. R. Taylor, M. L. Liscomb and others.

Creston, Ia.—The Jas. H. Collins Co., of Chicago, Ill., is stated to have secured the contract for constructing and equipping the electric railway from Creston to Winterset for the Creston Light, Heat & Power Co.

Mt. Ayer, Ia.—The Des Moines, Mt. Ayr & Southern Electric Ry. Co. has been incorporated, with a capital of $600,000, to construct an electric railway from Creston to Mount Ayr. Incorporators: F. E. Sheldon and J. F. Wall, of Mt. Ayr; Lyman Waterman, of Omaha, Neb., and others.

Cape Girardeau, Mo.—The Cape Girardeau & Jackson Ry. Co. is reported organized here by local and St. Louis capitalists, to take over the present street railroad company here and extend the line to Jackson. It also will have the contract for lighting the city. The whole length of the line will be about 18 miles.

Cleveland, Tenn.—A. A. Campbell, of Ducktown; J. H. Hardwick, of Cleveland; C. E. James, of Chattanooga, and others, have applied for a charter to construct an electric railway from Cleveland to Ducktown, by way of Bristol, a distance of about 46 miles.

Scranton, Miss.—L. S. Anderson is reported to have petitioned for a franchise for an electric railway from Moss Point to Pascagoula.

Ft. Worth, Tex.—The Northern Texas Traction Co. is reported to be considering the matter of extending its present South Side line to a point further south. S. Horn, Ch. Engr., Ft. Worth.

Phoenix, Ariz.—It is reported that the Phoenix Ry. Co. will at an early date begin construction of a power house at the falls on the Arizona Canal. B. N. Pratt, Supt., Phoenix.

Fresno, Cal.—The Fresno Inter-Mountain Ry. Co. has been incorporated with a capital of $500,000, by S. N. Griffith, L. L. Gray, and others to construct an electric railway from eastern terminus of the Fresno City R. R., 6 miles east of town, to Clovia and Letcher postoffice.

Santa Ana, Cal.—W. S. Collins, Pres. of the Newport Beach Co. is reported to be securing the right of way from Santa Ana to Newport Beach for an electric railway.

San Jose, Cal.—The Saratoga & San Jose Electric Ry. Co. is stated to have secured all franchises and rights of way, the surveys are also nearly completed and work on the construction will soon begin. Jas. W. Rea, Pres.; F. S. Granger, Mgr.

RAILROADS.

Whippany, N. J.—The Whippany & Passaic River R. R. Co. has been incorporated, with a capital of $375,000, to build a railroad seven miles long from Whippany to Essex Falls, N. J. Incorporators: Edw. M. Shepard, Brooklyn, N. Y.; Herman Behr, Morristown; Richard W. McEwan, of Whippany, and others.

Buffalo, N. Y.—Grade crossing bonds amounting to $121,411 have been sold by the City Compt.

Blueridge, Ga.—A charter has been granted to the Tennessee, Georgia & South Carolina R. R. Co. to construct and operate a line from Blueridge, Ga., to Charleston, Tenn., a distance of 200 miles. Merrill Skinner, Blueridge; J. A. Butt, Blairsville; W. D. Smith, Morgantown, are among the incorporators.

Portsmouth, O.—The Norfolk & Western R. R. Co. has appropriated about $519,000 for the construction of terminal facilities, round house, shops, offices and tracks at this city. J. B. Conners, Div. Supt., Portsmouth.

Mitchell, Ind.—The Mitchell, West Baden, French Lick & Jasper R. R. Co. has been incorporated with a capital of $100,000, to construct a line from Mitchell through the counties of Lawrence, Orange and Dubois to Jasper, a distance of 42 miles. Incorporators: Sam'l A. Reavis, of Princeton, Ind.; G. W. Clawson, of St. Louis, Mo., and others.

Des Moines, Ia.—The Chicago, Burlington & Quincy R. R. Co. is reported to be surveying for a line from Des Moines to Sioux City. W. L. Breckenridge, Ch. Engr., Chicago, Ill.

Davis Junction, Ill.—The Rochelle & Southern Ry. Co. has been incorporated, with a capital of $100,000, to construct a railroad from Davis Junction to McNab, through Rochelle, Amboy, Mendota and Peru. Principal office to be in Chicago. L. Carton and W. R. Morrison, of Chicago, are among the directors.

Birmingham, Ala.—It is reported that the Louisville & Nashville R. R. Co. is preparing to build a branch 27 miles in length from a point on the main line 7 miles north of Birmingham, Ala., to Coalburg, Mary Lee, and other mining camps. The cost of the branch will be about $750,000. The survey has been practically completed. R. Montfort, Ch. Engr., Louisville, Ky.

San Antonio, Tex.—Locating Engr. Walters, of the Mexican Central, with a party, is reported to be about to start out from San Antonio, locating a line for that road from this city to Rio Grande. Lewis Kingman, Ch. Engr., City of Mexico, Mex.

Chattanooga, Tenn.—Local press reports state that the Nashville, Chattanooga & St. Louis Ry. Co. is considering the proposition of building a belt railway around and through Chattanooga. Hunter McDonald, Ch. Engr., Nashville.

Benton, Ark.—The Directors of the Pine Bluff & Western Ry. Co. are stated to have decided to extend the line to Benton. W. T. Radford, Ch. Engr., Pine Bluff.

Granger, Tex.—It is stated that the Missouri, Kansas & Texas Ry. Co. is to construct a line from Granger, via Georgetown to Austin, a distance of about 40 miles. J. W. Petheram, Ch. Engr., Dallas.

Raton, N. M.—Thos. B. Harlan, of St. Louis, Mo., and Jeremiah Leahy and Chris. Blackwell of Raton, are stated to have incorporated the New Mexico & Pacific R. R. Co. to construct a line from Raton to the Pacific coast, following the 37th parallel. Work has already begun on the road from Raton to Elizabethtown, 80 miles, and surveyors are now in the field for the extension of the road.

San Francisco, Cal.—The Bd. of Pub. Wks. has approved and forwarded to the Superv. the report of City Engr. C. E. Grunsky on the application of the Southern Pacific R. R. Co., for a franchise for its Bay Coast Road. Among the numerous bridges contemplated in connection with this improvement is one 4,000 ft. long from Brannon to Kentucky street. Wm. Hood, Ch. Engr., San Francisco.

Nebraska City, Neb.—The Nebraska City & Northwestern R. R. Co. is reported incorporated, with a capital of $25,000, to construct a railroad in Otoe and Cass Counties. W. A. Wilson, John W. Steinhart and Logan Enyart are among the incorporators.

Oakland, Cal.—Thos. B. Russell, of San Leandro, is reported to have taken charge of the surveying party in the field for the San Francisco Terminal & Ferry Co., which has applied for a steam railroad franchise through Oakland to the water front.

Toronto, Ont.—A. R. MacDonell is stated to have secured the contract for constructing 110 miles of railroad for the Temiskaming & Northern Ontario Ry. Co. (Ontario Government Ry.). P. E. Ryan, Sec'y-Treas.

PUBLIC BUILDINGS.

Medfield, Mass.—Bids are wanted Oct. 16 for the erection of a building for the Medfield Insane Hospital. Park & Kendall, 8 Beacon St., Boston, are the architects.

Raybrook, N. Y.—Contracts for erecting the State Tuberculosis Hospital have been awarded as follows: building to E. H. Denniston & Co., Syracuse; heating, H. C. Petersen & Co., Utica, and plumbing, Dean & Havens, Olean; total cost about $60,000.

Pittsburg, Pa.—Bids are wanted Oct. 20 for erecting shelter houses and houses of public comfort in Shenley and Highland Parks. J. Guy McCandless, Dir. Dept. Pub. Wks.

Munhall, Pa.—Bids will be received by Rieger & Currier, Archts., 310 Smith Block, Pittsburg, until Oct. 21, for erecting a municipal building to cost about $30,000; also for erecting an engine house. W. W. Mechling, Pres. Boro Council.

New York, N. Y.—Bids are wanted Oct. 21 for the completion of the heating and ventilating, and the providing of judges' chambers and toilet rooms and the completion of existing toilet rooms of the Criminal Court Bldg. Amount of security, $15,000. Jacob A. Cantor, Boro Pres.

Jersey City, N. J.—The Bd. of Finance is stated to have passed a resolution providing for an issue of $50,000 bonds for the proposed free bath house.

Bids will be received by the Bd. of Chosen Freeholders until Oct. 20 for $54,000 Co. Lunatic Asylum bonds. John P. Egan, Clk.

New York, N. Y.—Bids are wanted Oct. 15 for all materials and labor required to complete the alterations, additions and repairs to the Dept. Bldg. at 55th St. and 6th Ave. Bids are also wanted at the same time for labor and materials necessary to complete alterations, additions and repairs to the buildings at the Riverside Hospital, North Brother Island. Ernst J. Lederle, Ph. D., Pres., Dept. of Health.

Plans have been filed for a new hospital and dormitory to be erected on 165th St., near Boulevard Lafayette, by the New York Institution for the Instruction of the Deaf and Dumb, on ground adjacent to its present buildings. The new structure will be 84x154 ft., and will cost $100,000. Architect, Henri Fouchaux, Bway, cor. W. 162d St.

Bids are wanted Oct. 14 for general repairs and renewals required for 6 hydraulic passenger elevators in the Criminal Court Bldg., Borough of Manhattan. Jacob A. Cantor, Boro Pres.

Bids were opened Oct 7 by Jacob A. Cantor, Pres., Manhattan Boro, for repairs and alterations to interior of City Hall, Manhattan, as follows: N. W. Ryan, 106 E. 23d St., $29,863; John R. Sheehan & Co., $33,400; Robt. R. Fox, $38,600, and Pat'k Sullivan, $45,760.

Bids were opened Oct 7 by Jacob A. Cantor, Pres. Manhattan Boro, for general repairs and alterations to hot blast and steam heating, plumbing and gas fitting and electric wiring in the N. Y. City Hall, as follows: E. Rutzler, $16,500; United Htg. Co., $16,973; Blake & Williams, $23,488, and Walker & Chambers, 50 E. 20th St., $15,900.

Plans have been filed for the Broadway Tabernacle, to be erected on Bway and 56th St., to cost about $350,000. Architects, Barney & Chapman, 44 W. 34th St.

Bids will be received Oct. 21 by John W. Brannan, Pres. of Bd. of Trus., for erecting a dormitory in the Medical College Bldg., on Bellevue Hospital grounds.

Brooklyn, N. Y.—Bids will be received by J. Edw Swanstrom, Boro Pres., until Oct. 22, for furnishing material and erecting an interior public bath building.

Utica, N. Y.—Bids will be received by the State Com. in Lunacy, Capital, Albany, until Oct. 18, for rewiring and fixtures at the Utica State Hospital as advertised in The Engineering Record.

New York, N. Y.—Bids were opened Oct. 7 by Jacob A. Cantor, Pres. Manhattan Boro., for the erection of public baths, as follows: A, at 243 to 247 E. 109th St.; B, at 133 to 135½ Allen St.; C, at 347 and 349 W. 41st St.:

Bidders.	A	B	C
Alfred Nugent & Son...	$125,000	......	......
Alfred Beinhauer......	124,383	$104,822	$106,816
Louis Wechsler........	128,000	112,000	116,000
Thos. B. Leahy........	127,895	109,321	111,289
Thos. Cockerill & Son...	118,900	97,000	103,500
Walter Reid & Co......	118,000	99,500	104,750
P. J. Carlin & Co......	119,000	104,000	108,000
Kelly & Kelley........	......	102,770	116,930
Murphy Bros., 489 5th Ave.	108,630	91,528	91,528
P. Gallagher	......	......	103,543

New Bids are wanted Oct. 21 for the public bath building at 347-349 W. 41st St.

Bryan, O.—Deputy Co. And. W. H. Buehrer writes that all bids received Oct. 3, for a hot water heating plant for the Court House, have been rejected as too high.

Anderson, Ind.—The following bids are stated to have been received for the erection of the Carnegie Library: Herbert C. Wright & Co., Anderson, $61,673; Wm. H. Maxwell, Elkhart, $57,672; Pulse & Porter, Greensburg, $56,611, and Thompson & Millspaugh, Anderson, $52,863.

Granite, Ill.—G. W. Niedringhaus is reported to be organizing a company to erect a $50,000 hospital.

Marinette, Wis.—Bids will be received by the Bd of Pub. Wks. until Oct. 16 for erecting an armory, including a council chamber and an office for the City Clk. D. J. Madigan, Clk. of Bd.

La Crosse, Wis.—Bids are wanted Oct. 29 for erecting a Court House, to cost about $135,000. Schick & Roth, of La Crosse, are the Archts. J. K. Johnson, Co. Clk.

St. Ignace, Mich.—The Congregational Society is stated to have decided to erect a $45,000 edifice.

Anadarko, Okla. Ter.—Co. Surveyor Chas. H. Jones writes that the contract for cell work on the jail has been let to the Champion Iron Co., of Kenton, O., for $4,175.

St. Louis, Mo.—Bids are wanted Oct. 24 for plumbing the Isolation Bldg., East and West Octagon Bldgs., Surgical Bldg., Power House and Laundry and Kitchen Bldg., for constructing boiler plant and for constructing elevators for the new City Hospital. Hiram Phillips, Pres. Bd. of Pub. Improv.

Manhattan, Kan.—City Clk. H. W. Hungerford writes that on Aug. 12 it was voted to issue $15,000 bonds for a City Hall.

Grand Forks, N. D.—Balles & Perkins, 314 Alpha Ave., is stated to have secured the contract for erecting the Carnegie Library, for $18,970.

Moose Jaw, N. W. Ter.—Bids will be received by Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont., until Oct. 16, for a hot water heating system at Court House, Moose Jaw.

BUSINESS BUILDINGS.

Portland, Me.—Spier & Rohns, Chamber of Commerce Bldg., Detroit, Mich., are stated to be preparing plans for a $70,000 depot for the Grand Trunk Ry. Co.

Holyoke, Mass.—The Harmonins German Aid Society, of Holyoke, is about to erect a $70,000 building on Park and Adam Sts., size 120x140 ft., 4 stories, buff brick, with limestone trimmings, elevator, etc. Architects, G. P. B. Alderman & Co., 380 High St.

Fitchburg, Mass.—A $15,000 brick business block is to be built on Putnam St. Owners, the J. Cushing Estate.

Boston, Mass.—Plans are being prepared for an 11-story steel-frame fireproof office building at 18-24 Milk St., 60x80 ft., for the Penn. Mutual Life Insurance Co., of Philadelphia, the building to be completed by Jan. 1, 1904.

Plans have been filed by M. D. Safford, Archt., 274 A St., for a 3-story brick building, 40x100 ft., for light storage for the Boston Wharf Co., to be located at 329 A St., So. Boston.

Plans have also been filed for a 1½-story brick building to be used as a Telephone Exchange by the New England Telephone & Telegraph Co., to be located on Seavern's Ave. Estimated cost, $12,000.

Manchester, N. H.—Chickering & O'Connell, 1037 Elm St., have prepared plans for a brick engine house for this city; bids for construction are about to be received.

Lancaster, Pa.—C. Elmer Urban, Trust Bldg., is the architect for a $25,000 5-story brick manufacturing building for Follmer, Clogg & Co., of this city.

Pittsburg, Pa.—The Pennsylvania R. R. Co. is reported to be having plans prepared by D. H. Burnham & Co., Rookery Bldg., Chicago, Ill., for a depot for Pittsburg, which, together with other improvements, will cost $2,000,000. W. H. Brown, Ch. Engr., Philadelphia.

Philadelphia, Pa.—John Fraser & Son, 413 Walnut St., are stated to have completed plans for a 12-story store and office building and two 8-story store and office buildings, to be erected in the business section of the city. Location or owners' names not given out yet.

Washington, D. C.—Fredk. B. Pyle, 1003 F St. n. w., is stated to have completed plans for a store and apartment house to be erected on N. Capitol St. and Florida Ave., for Dr. J. D. Coblentz.

Local press reports state that certain architects have been invited to submit plans in competition until Dec. 30 for a Masonic temple, to be erected on New York Ave., 13th and H Sts. n. w., to cost about $250,000. Thos. P. Morgan, Chmn. Bldg. Com. of Masonic Temple Assoc.

Kittanning, Pa.—It is stated that plans are being prepared for a $40,000 theater to be erected on McKain St. Jas. McCullough, Jr., of Kittanning, is reported interested.

Brooklyn, N. Y.—Huberty & Hudwell, 220 S. 8th St., are stated to have completed plans for a 6-story office building to be erected on Fulton St. and Red Hook Lane, to be known as the Nassau Bldg. Owner, David Michel.

Asheville, N. C.—The Asheville Office Building Co., of Asheville, has been incorporated, with a capital of $100,000, to erect an office building.

Richmond, Va.—M. J. Dimmock, State Bank Bldg. is preparing plans for a $50,000 hotel, to be built by John Tyler, of Richmond.

The Richmond Realty Development Co., Leon L. Strauss, of Richmond, Pres., and J. D. Lecky, of Richmond, Secy. and Treas., will erect 9 stores on Main St. and 4 residences on 5th St., to cost in all $100,000. Carl Ruehrmund, 918 E. Main St., Archt.; L. C. Jenkins, Richmond, Contractor.

Norfolk, Va.—It is stated that Arthur G. Glasgow, of London, England, has employed John K. Peebles, of Norfolk, to prepare plans for a $50,000 office building to be erected in Norfolk.

Cleveland, O.—The Broadway Warehouse Co., composed of Benj. Rose, M. W. Kingsley, and others, is reported organized with a capital of $100,000, to erect a warehouse and cold and dry storage producing establishments on Bway.

C. W. Hopkinson, 50 Euclid Ave., is stated to be preparing plans for a store and apartment building to be erected on Euclid Ave. and Doan St. for Mrs. Louisa Southworth, to cost about $100,000.

Durand, Mich.—Spier & Rohns, Chamber of Commerce Bldg., Detroit, are stated to be preparing plans for a depot to be erected in Durand for the Grand Trunk and Ann Arbor Railroads.

Houghton, Mich.—C. A. Pearce, of Hancock, is stated to have prepared plans for a business building to be erected on Sheldon St. for Stephen Karkeet, of Houghton.

H. T. Liebert, of Hancock, is stated to have prepared plans for a business block to be erected on Sheldon St. for J. R. and T. S. Dee, to cost $40,000.

Cincinnati, O.—Werner & Adkins, 77 Mitchell Bldg., are stated to be preparing plans for a building for the Brighton German Bank, to be erected on Harrison and Colerain Aves., to cost $40,000.

Memphis, Tenn.—It is stated that the Nashville, Chattanooga & St. Louis R. R. Co. will erect a freight depot here, to cost about $20,000 W. J. Hill, of Paducah, Ky., is Supt. of Memphis Div.

So. McAlester, Ind. Ter.—It is stated that the Missouri, Kansas & Texas Ry. Co., is to erect a brick depot here, to cost about $40,000. S. B. Fisher, Ch. Eng., St. Louis, Mo.

Kansas City, Mo.—E. C. Nichols is the architect for a $65,000 brick cold storage plant to be erected for the Kansas City Ice & Cold Storage Co., at 8th and Hickory Sts.

Durango, Mex.—Depew & Co., of Durango, are erecting the 3-story bank and office building for the Bank of Durango. Inside work not let. Alfred Giles, of Monterey, Mex., and San Antonio, Tex., Archt. Cost about $200,000.

DWELLINGS.

Pittsburg, Pa.—Local press reports state that Sidney F. Heckert, 341 6th Ave., is preparing plans for an apartment house to be erected by a syndicate at Bellefield, to cost about $600,000.

Bryn Mawr, Pa.—Cope & Stewardson, 320 Walnut St., Philadelphia, are stated to be preparing plans for a country residence at Bryn Mawr for Francis L. Potts, to cost about $70,000. The plans provide for a stone fireproof building, hard wood interiors, open fire places, electric lighting, tile and mosaic work and all other modern conveniences.

Washington, D. C.—Leon E. Dessez, 1421 F St. n. w., is stated to have prepared plans for a 4-story brick and stone apartment house, to be erected on I and 12th Sts., to cost about $35,000.

Chicago, Ill.—It is stated that C. A. Koeffler, Jr., and H. Baumgartner will erect a 4-story flat of 20 apartments on Knapp and Jefferson Sts., to cost about $55,000.

Spokane, Wash.—L. L. Rand, 518 Rookery Bldg., has prepared plans for a 2-story apartment building, to be of brick and terra cotta, with plumbing and heating. Cost, $10,000. Owner, C. G. Hubbard.

SCHOOLS.

Greenfield, Mass.—The School Com. is reported to be considering the question of erecting a high school, at a cost of about $60,000.

Bath, Me.—Bids are wanted Oct. 18 for erecting a high school. Architect, W. R. Miller, Lewiston. Address J. C. Rogers, Bath.

Brooklyn, N. Y.—The lowest bid received Oct. 3 by C. B. J. Snyder, Supt. of School Bldgs., New York City, for heating apparatus and electric lighting plant for Manual Training High School Annex was from the United Heating Co., 366 W. Bway., N. Y. City, at $3,561.

The lowest bid received at the same time for sanitary work at School 139, Boro of Brooklyn, was from Jas. Harley, 288 Flatbush Ave., at $7,840.

Bids will be received Oct. 22 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing ventilating and heating apparatus in School No. 139.

South Orange, N. J.—Bids are wanted Oct. 20 for erecting the South Orange and Maplewood school houses. Chas. Granville Jones, Archt., 280 Bway, N. Y. City, N. Y.; Wm. H. Kemp, Chmn. Com. on Bldgs.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. of School Bldgs., until Oct. 22, for installing ventilating and heating apparatus in School 161.

Allegheny, Pa.—The High School Com. of the Bd. of Controllers of Allegheny is stated to have recommended the issue of $125,000 bonds for the erection of an annex to the High School.

Braddock, Pa.—The American Htg. & Ventilating Co., of Pittsburg, is stated to have secured the contract for the ventilating and heating apparatus for the 1st Ward School, for $12,000.

Baldwin Township, Pa.—Bids are wanted Oct. 16 for the erection of a school. Edw. J. Carlisle & Co., 901 Westinghouse Bldg., Pittsburg, are the architects.

Athens, O.—Bids are wanted Oct. 17 for furnishing material and erecting the main, or central, portion of a Normal School, on site designated at the Ohio University. Archt., Frank L. Packard, New Hayden Bldg., Columbus; L. M. Jewett, Secy. Bd. of Trus., Ohio Univ.

Rice Lake, Wis.—Bids are wanted Nov. 1 for erecting a school in Dist. No. 3. L. M. Kuntson, Clk.

Delray, Mich.—Bids are wanted Oct. 21 for erecting a 15-room brick school on Beaumont Ave. Malcomson & Higginbotham, Archts., 53 Moffat Bldg., Detroit. Hugh Cary, M. D., Sec'y Bd. of Educ.

Holdenville, Ind. Ter.—At a recent election it was voted to construct a $10,000 school.

Ardmore, Ind. Ter.—School bonds to the amount of $25,000 are reported to have been voted at the recent special election.

STREET CLEANING AND GARBAGE DISPOSAL.

Burlington, N. J.—The Burlington Garbage Reduction Co. has been incorporated, with a capital of $60,000, to dispose of garbage. Incorporators: Prescott W. Mills, Albert J. Burchatt and James H. Birch, Jr. Principal office 333 High St.

New York, N. Y.—Bids are wanted Oct. 17 for furnishing all labor and material required for the removal of snow and ice of the Boro. of Manhattan, until Apr. 15, 1903. John McG. Woodbury, Comr. of Street Cleaning.

Reading, Pa.—The contract for the collection and disposal of the garbage and offal of the city has been awarded by the Councils to Chas. C. Fisher, of Reading, at $2.24 per ton for a period of 5 years, beginning with the next fiscal year. For bids opened Aug 25 see The Engineering Record of Sept. 6.

Newark, N. J.—Bids will be received by the Com. of Pub. Markets of the Common Council until Oct. 13 for the removal of garbage and waste matter which may accumulate in and about the grounds of the Centre Market and streets adjoining; also for the removal of snow and ice which may accumulate on the grounds, roofs and sheds of the buildings, for a period of 1 year. Wm. R. Swan, Clk.

Utica, N. Y.—The Common Council on Oct. 3 received two bids for the street sweeping contract, and it accepted the bid of Harry W. Roberts for a period of 3 years at prices which aggregate $33,264 per year.

Evansville, Ind.—W. Edw. Clarke, Clk. Bd. of Pub. Wks., writes that the contract for sweeping and cleaning certain streets for one year, has been awarded to M. S. Gumberts, of Evansville, at 18c. per 10,000 ft.

Topeka, Kan.—Local press reports state that Louis Schneider, representing the U. S. Garbage Reduction Co., has offered to construct a $40,000 garbage disposal plant in this city, if granted a franchise by the Council.

GOVERNMENT WORK.

Boston, Mass.—Bids are wanted Oct. 24 for constructing an addition to the wharf at Ft. Strong, L. I., Boston Harbor. A. M. Palmer, Depot Q. M.

Portsmouth, N. H.—Bids will be received at the office of the Bureau of Supplies and Accounts, Navy Dept., Washington, until Oct. 21, for furnishing a quantity of cement, sand, expanded metal and steel material at the Navy Yard, Portsmouth.

Tompkinsville, N. Y.—Bids are wanted Oct. 17 for furnishing rip-rap stone at the following stations: 600 tons at Cedar Island light station, Gardiner's Bay; 300 tons at Greenport Harbor Beacon; 600 tons at Romer Shoal light station, Lower Bay, N. Y.; 400 tons at Point Comfort light station N. Y., Lower Bay, N. J., and 500 tons at Stuyvesant light station, Hudson River. Bids are also wanted Oct. 24 for rebuilding kitchen and repairs to dwelling at New Dorp light station, S. I. Wm. T. Rossell, Corps of Engrs., U. S. A., Light House Engr.

New York, N. Y.—The contract for building a riprap breakwater at Sag Harbor, N. Y. (bids opened Oct. 6 by Col. S. M. Mansfield, Corps of Engrs., U. S. A.) has been awarded to Peter Lyman, 84 Walworth St., Brooklyn, at $1.37 per cu. yd. in place; total $9,000.

Philadelphia, Pa.—Bids are wanted at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Nov. 1, for constructing a brick and steel extension to building No. 14, angle smithery, at League Island Navy Yard, Pa. Available appropriation $12,500. Mordecai T. Endicott, Ch. of Bureau.

New York, N. Y.—Bids are wanted Nov. 10 at the U. S. Engr. Office for removing a ledge in the North River, as advertised in The Engineering Record.

Separate bids are wanted Nov. 10 at the U. S. Engr. Office, for dredging in Raritan Bay, N. J.; for dredging in Woodbridge Creek, N. J., and for dredging in Lemon Creek, N. Y., as advertised in The Engineering Record.

Washington, D. C.—Acting on the recommendation of General Gillespie, Ch. of Engrs., Secretary Root has approved plans for the improvement of the military reservation known as Washington barracks. Improvements involve an expenditure of $1,260,000, of which amount $900,000 has been appropriated and is immediately available.

Annapolis, Md.—Bids are wanted at the Bureau of Supplies & Accounts, Navy Dept., Washington, D. C., until Oct. 21, for furnishing a quantity of water filters at the U. S. Naval Academy. A. S. Kenny, Paymaster Gen., U. S. N.

Bids are wanted at the Bureau of Navigation, Navy Dept., Washington, D. C., until Oct. 22, for dredging at the U. S. Naval Academy. H. C. Taylor, Ch. of Bureau.

Ft. McRee, Fla.—Bids will be received by W. E. Cole, Q. M. Ft. Barrancas, Fla., until Oct. 28, for water and sewer system at Ft. McRee.

Chicago, Ill.—Bids will be received at the Treas. Dept., Washington, D. C., until Nov. 8 (readvertisement) for the interior finish and completion of the U. S. Post Office, Court House, etc., at Chicago, Ill. Address Henry Ives Cobb, Archt., U. S. Government Bldg., Chicago.

Chicago, Ill.—The contract for pneumatic tube mail service in Chicago is stated to have been awarded to the Illinois Pneumatic Service Co. (a branch of the American Pneumatic Co.) at an annual rental of $141,685 for a route 10 miles long.

Chicago, Ill.—Bids are wanted Nov. 6 for furnishing and delivering a large quantity of galvanized iron roofing, etc. Address Col. E. B. Atwood, Ch. Q. M.

Memphis, Tenn.—Capt. E. Eveleth Winslow, Corps of Engrs., U. S. A., writes that the following bids were opened Sept. 30 for constructing Modoc Loop Levee, about 150,000 cu. yds.: Lowrance Bros. & Co., Friar Point, Miss., 17.24c. per cu. yd.; M. J. Roach, Memphis, 20.90c.; Batt O'Brien, Smithland, La., 18.73c.; Geo. Heck, Helena, Ark., 18.50c.; J. K. Jeffries & Son, Baton Rouge, La., 18.75c.; Geo. R. Lucy, Arkansas City, Ark., 17.44c.; Shutt Improvement Co., St. Louis, Mo., 22c.; Morgan, McCarten & Co., Memphis, Tenn., 17c.; Gilchrist Bros., Memphis, Tenn., 16.89c. (awarded); John G. Sessions, Winterville, Miss., 22.99c.

Jefferson Barracks, Mo.—Bids will be received at the office of Ch. Q. M. John W. Pullman, Omaha, Neb., and by the Quartermaster at Jefferson Barracks, until Oct. 15, for the construction of a brick cavalry stable to replace one recently burned at Jefferson Barracks.

Ft. Meade, S. D.—Bids are wanted at the office of Ch. Q. M. Geo. E. Pond, St. Paul, Minn., until Oct. 18, for the construction of 1 double barrack at Ft. Meade.

San Francisco, Cal.—The following bids were opened Oct. 1 by Col. W. H. Heuer, Corps of Engrs., U. S. A., for dredging in San Pablo Bay, Cal., 2,721,000 cu. yds: Atlantic, Gulf & Pacific Co., 19.75c. per cu. yd., total, $537,397; West Coast Dredging Co., 14.9c., $405,429; Marshall C. Harris, 12c., $326,520; Rudolf Axman, 11.44c., $311,282. Bidders all of San Francisco.

Ft. D. A. Russell, Wyo.—Bids are wanted Oct. 15 (extension of date from Oct. 6) for constructing 5 buildings, officers' quarters, barracks, stable and gun shed. Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, Colo.

Flandreau, S. D.—Bids will be received by W. A. Jones, Comr. of Indian Affairs, Washington, D. C., until Nov. 4, for furnishing material and labor required to install and set up complete 2 boilers for heating purposes in the hospital and school at Flandreau.

San Francisco, Cal.—Bids are wanted Nov. 1 for constructing a pile and concrete quay wall at the Navy Yard, Mare Island; appropriation, $48,500. Mordecai T. Endicott, Ch. of Bureau, Yards and Docks, Navy Dept., Washington, D. C.

Bremerton, Wash.—Bids will be received on Nov. 8 by Mordecai T. Endicott, Ch. of Bureau, Yards and Docks, Washington, D. C., for furnishing and installing 1,430 lin. ft. of 8-in. pipe, with valves, hydrants and connections, Navy Yard, Bremerton, Wash.

Ft. Yates, N. D.—Bids are wanted Oct. 29 for furnishing and delivering at the agency railway station a quantity of building materials. Geo. H. Bingenheimer, U. S. Indian Agent, Standing Rock Agency, Ft. Yates.

Cheyenne River Agency, S. D.—Bids are wanted Oct. 20 for furnishing and delivering at the agency or at Gettysburg, S. D., a quantity of building materials. Address U. S. Indian Agent, Cheyenne River Agency.

MISCELLANEOUS.

Auburn, N. Y.—Bids are wanted Oct. 20 for constructing a steel tower with fire alarm bell and fixtures, as advertised in The Engineering Record.

New York, N. Y.—Bids will be received by the Comr. of Docks, McDougall Hawkes, until Oct. 17, for furnishing material for rebuilding and extending W. 58th St., pier No. 98, N. R., and for dredging thereat, also for dredging on the North River between the Battery and W. 159th St.

Brooklyn, N. Y.—Bids will be received by J. Edw. Swanstrom, Boro Pres., until Oct. 22 for furnishing and delivering 1,200 cu. yds. broken trap rock and 800 cu. yds. trap rock screenings.

Rahway, N. J.—Bids are wanted Oct. 15 for furnishing 1 hoisting engine and boiler of 15 H.-P., with derrick and 2 steel tubs each of ½ cu. yd. capacity, also 1 concrete mixer, for the N. J. State Reformatory. Address Thos. M. Gopsill, Sec'y N. J. Reformatory Comn., Rahway.

Evansville, Ind.—Bids are wanted Oct. 16 by the Vanderburg Co. Comrs. for furnishing 1 boiler at the Co. Poor Infirmary, to riprap fill on the Howard Slough in Union Township, and to construct a ditch and make a fill on Middle Mt. Vernon road in Perry Township. Louis H. Legler, Co. Aud.

Merrill, Wis.—The Cedar Falls Improvement Co., of Merrill, has been incorporated to improve Tomahawk River from its source to the foot of Cedar Falls; capital stock, $3,000. Incorporators, L. N. Anson, Geo. M. Anson and Geo. F. Gilkey.

Lansing, Mich.—Articles of association have been filed with the Sec'y of State at Lansing by the St. Joseph River Improvement Co., with a capital of $25,000, to improve St. Joseph River from Indiana State line to the entrance to Sturgeon Lake.

Chicago, Ill.—Local press reports state that Lincoln Park will be allowed this year $300,000 for the repair of the sea wall.

Pointe a la Hache, La.—The citizens are reported to have voted to authorize the Bd. of Comrs. for the Back Levee Dist. to issue $135,000 bonds for building a levee.

NEW INDUSTRIAL PLANTS.

The Smith & Welte Co., Enumclaw, Wash., proposes erecting a shingle mill to have a daily capacity of 80,000.

The Columbus, Ga., Show Case Co. expects to erect three 3-story buildings 200 ft. long and 100, 80 and 60 ft. wide, besides other smaller buildings. Steam and electricity will be used for power, and the company will be in the market for hand and power elevators and additional machinery.

The Greenville, N. H., Chair Co. is considering rebuilding its recently burned factory. The buildings are 3-stories, 30x90 ft. and 30x40 ft., and the capacity of the power plant about 100 H.-P.

The Cooper Underwear Co., Kenosha, Wis., will erect a 4-story, 175x40 ft. mill to be electrically driven.

The American Grass Twine Co., 204-226 Van Brunt St., Brooklyn, N. Y., has let contracts for buildings having over 250,000 sq. ft. floor space at Glendale, L. I. The capacity of the power plant will be 450 H.-P.

The Waukesha-Minniska Mineral Water Ice Co., 415 Iron Block, Milwaukee, Wis., contemplates erecting at Waukesha a 120-ton ice plant.

J. M. Hunt, Georgetown, Ky., contemplates erecting a 15 to 40-ton ice plant.

The Flournoy Tobacco Co., Paducah, Ky., is preparing to erect a 2-story, 220x60 ft. factory, with a 100x60 ft. ell, to have an annual capacity of 2,000,000 pounds.

The Mitchell County Fertilizer Co., Camilla, Ga., is in the market for an ice plant.

BUSINESS NOTES.

The vault light work at the 59th St. or Grand Circle and the Bleecker St. stations of the New York rapid transit subway, installed by Tucker & Vinton, Inc., 156 Fifth Ave., New York, has been completed. This system, a test of which was described in this journal Sept. 7, 1901, will be installed in all the stations of the subway. The firm has also received contracts for a 93-ft. semi-circular steel-concrete dam in Six Mile Creek at Ithaca, N. Y., and concrete-steel arches and concrete work for the main power house of the New York Rapid Transit Subway Const. Co., at 11th Ave. and 58th St., John Peirce being the general contractor.

The New England Structural Co., Boston, has been awarded the contract for the steel work comprising 1,250 tons for an 11-story building for the State Mutual Assurance Co., Boston.

The Ball Engine Co., Erie, Pa., reports recently selling engines to the following: Blaine Coal Co., Pittsburg; American Tobacco Co., Richmond, Va.; Athens, Tex., Cotton Oil Co., 125-H.-P. engine.

The Coffin Valve Co., Boston, reports receiving a contract from the District of Columbia for a large number of 20 to 48-in. gate valves, a large portion of which are operated by electric motors.

The New York Continental Jewell Filtration Co., 15 Broad St., New York, reports that it is engaged in the erection of extensive filter plants for water works and manufacturing plants, among the most recent being the following: Charleston, S. C., Light & Water Co.; Homestead plant of the Carnegie Steel Co., Munhall, Pa.; Iroquois Apartment House, Pittsburg.

The Snow Steam Pump Works, Buffalo, is building a 132x400-ft. foundry, which will have alongside a traveling yard crane with 70-ft. span and 400-ft. travel. The company is also building a 110x550-ft. machine shop, to be equipped with six 20 and 30-ton electric traveling cranes. The additional power required will be obtained from Niagara Falls.

G. M. Gest, 277 Broadway, New York, has been awarded the contract, amounting to over $25,000, for the underground conduit work to be installed by the Brooklyn Heights R. R. Co. this season.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Oct. 14.	Chicago, Ill.	Oct. 11
Oct. 14.	Wooden pipe, Brigham City, Utah	Oct. 11
Oct. 14.	Colby, Wis. Adv., Eng. Record, Oct. 4.	Oct. 4
Oct. 14.	Tonawanda, N. Y. Adv., Eng. Record, Sept. 27.	Sept. 27
Oct. 15.	Wilbur, Wash.	Oct. 4
Oct. 15.	Troy, N. Y.	Oct. 4
Oct. 15.	Newport, R. I.	Oct. 4
Oct. 17.	Mt. Clemens, Mich.	Oct. 4
Oct. 18.	Washington, D. C. Adv., Eng. Record, Oct. 4.	Oct. 4
Oct. 20.	Ft. Myer, Va.	Oct. 11
Oct. 21.	Filters, Annapolis, Md.	Oct. 11
Oct. 21.	East Dundee, Ill. Adv., Eng. Record, Oct. 4.	Oct. 4
Oct. 22.	El Paso, Tex.	Sept. 6
Oct. 25.	Savannah, Ga. Adv., Eng. Record, Oct. 11.	Oct. 11
Oct. 27.	Mineral City, O.	Oct. 11
Oct. 28.	Ft. McRee, Fla.	Oct. 11
Oct. 29.	Moline, Ill. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 31.	Hamilton, Ont.	Oct. 11
Nov. 1.	Miami, Ind. Ter.	Oct. 11
Nov. 4.	Gueydan, La.	Oct. 4
Nov. 5.	Lawton, Okla. Ter.	Oct. 11
Nov. 8.	Pipe, etc., Bremerton, Wash.	Oct. 11
Nov. 8.	Pumping plant, Brockton, Mass. Adv., Eng. Record, Sept. 27, Oct. 4.	Sept. 27
Dec 1.	Pumps, Seguin, Tex.	July 26

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 14.	St. Louis, Mo.	Oct. 11
Oct. 15.	Cass Lake, Minn.	Oct. 4
Oct. 15.	Hartford, Conn.	Oct. 4
Oct. 15.	Cincinnati, O.	Sept. 27
Oct. 16.	Cleveland, O.	Oct. 11
Oct. 16.	Newark, N. J. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Oct. 16.	Iola, Kan.	Oct. 4
Oct. 17.	West Des Moines, Ia.	Oct. 11
Oct. 17.	Avalon, N. J.	Oct. 11
Oct. 17.	Grand Rapids, Mich. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 18.	Indianapolis, Ind.	Oct. 11
Oct. 18.	Washington, D. C.	Oct. 4
Oct. 20.	Girard, O.	Oct. 4
Oct. 20.	Pipe sewer, Toledo, O.	Oct. 4
Oct. 20.	Brick sewer, Toledo, O.	Oct. 11
Oct. 20.	Millburn, N. J. Adv., Eng. Record, Oct. 11.	Oct. 11
Oct. 21.	Allentown, Pa.	Oct. 11
Oct. 21.	Marion, Ind.	Oct. 4
Oct. 22.	Elkhart, Ind.	Oct. 11
Oct. 23.	Rapid City, S. D.	Oct. 11
Oct. 25.	Seattle, Wash.	Oct. 11
Oct. 27.	Wabash, Ind.	Oct. 11
Oct. 27.	Vincennes, Ind.	Oct. 4
Oct. 28.	Ft. McRee, Fla.	Oct. 11
Oct. 28.	Binghamton, N. Y.	Oct. 11
Oct. 28.	Cincinnati, O.	Oct. 4
Oct. 29.	Brooklyn, N. Y.	Oct. 11
Oct. 30.	Cleveland, O.	Oct. 11
Nov. 6.	Nashville, Tenn.	Oct. 11
Dec. 15.	Montevideo, Uruguay	Sept. 13

BRIDGES.

Oct. 15.	Cleveland, O.	Oct. 4
Oct. 15.	Yellowstone Park, Wyo. Adv., Eng. Record, Sept. 6, 13.	Sept. 6
Oct. 16.	Indianapolis, Ind.	Oct. 11
Oct. 16.	St. Charles, Mo.	Oct. 4
Oct. 18.	Shelbyville, Ind.	Oct. 11
Oct. 18.	Indianapolis, Ind.	Oct. 11
Oct. 18.	Spencer, Ind.	Oct. 4
Oct. 20.	Minneapolis, Minn.	Oct. 11
Oct. 24.	St. Louis, Mo.	Oct. 11
Oct. 24.	Sullivan, Ind.	Oct. 11
Oct. 27.	Victoria, B. C. Adv., Eng. Record, Sept. 6 to Oct. 11.	Sept. 6
Nov. 5.	Cordova, Ala.	Oct. 11
Nov. 5.	Chicago, Ill.	Sept. 6
Dec. 1.	Bigtimber, Mont.	Sept. 27

PAVING AND ROADMAKING.

Oct. 13.	Lafayette, Ind.	Oct. 11
Oct. 14.	Chicago, Ill.	Oct. 11
Oct. 14.	Dayton, O.	Oct. 11
Oct. 14.	New York, N. Y.	Oct. 11
Oct. 14.	Philadelphia, Pa.	Oct. 11
Oct. 14.	White Plains, N. Y.	Oct. 11
Oct. 14.	Cincinnati, O.	Oct. 4
Oct. 14.	Carthage, Ill.	Oct. 11
Oct. 15.	Cohoes, N. Y.	Oct. 11
Oct. 15.	Sidewalks, Eau Claire, Wis.	Oct. 11
Oct. 15.	Lead, S. D.	Oct. 4
Oct. 15.	Cincinnati, O.	Sept. 27
Oct. 17.	Indianapolis, Ind.	Oct. 11
Oct. 17.	Laporte, Ind.	Oct. 4
Oct. 17.	Tiffin, O.	Oct. 4
Oct. 20.	Canton, O.	Oct. 11
Oct. 20.	Carthage, O.	Oct. 11
Oct. 20.	Newton, N. J.	Oct. 11
Oct. 20.	Toledo, O.	Oct. 4
Oct. 20.	Fredericksburg, Va.	Oct. 4
Oct. 20.	Newton, N. J.	Sept. 27
Oct. 21.	Buffalo, N. Y.	Oct. 11
Oct. 22.	Des Moines, Ia.	Oct. 11
Oct. 22.	Elmwood Place, O.	Oct. 11
Oct. 23.	Curbing, Des Moines, Ia.	Oct. 11
Oct. 23.	Terre Haute, Ind.	Oct. 11
Oct. 24.	Des Moines, Ia.	Oct. 11
Oct. 24.	St. Louis, Mo.	Oct. 11
Oct. 28.	Cincinnati, O.	Oct. 4
Nov. 3.	Toledo, O.	Oct. 4
Nov. 3.	Vincennes, Ind.	Oct. 11

POWER, GAS AND ELECTRICITY.

Oct. 13.	New Castle, Pa.	Oct. 11
Oct. 14.	Denver, Colo.	Oct. 11
Oct. 14.	Kershaw, S. C.	Oct. 11
Oct. 14.	Colby, Wis. Adv., Eng. Record, Oct. 4.	Oct. 4
Oct. 14.	San Pedro, Cal.	Sept. 13
Oct. 15.	Castile, N. Y.	Oct. 4
Oct. 15.	Chicago, Ill.	Aug. 23
Oct. 18.	Norman, Okla. Ter.	Oct. 11
Oct. 20.	Michigan City, Ind.	Sept. 27
Oct. 23.	Hanford, Cal.	Sept. 27
Oct. 28.	Chattanooga, Tenn. Adv., Eng. Record, Sept. 13 to Oct. 11.	Sept. 13
Nov. 1.	Baton Rouge, La. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 1.	Miami, Ind. Ter.	Oct. 11
Nov. 1.	Macon, Ga.	Aug. 30
Nov. 15	Norfolk, Va.	Sept. 13
Jan. 15.	Rome, Ga.	Oct. 11

GOVERNMENT WORK.

Oct. 14.	Washington, D. C.	Oct. 4
Oct. 14.	Dover, Tenn.	Sept. 27
Oct. 14.	Ft. Getty, S. C. Adv., Eng. Record, Sept. 20 to Oct. 11.	Sept. 20
Oct. 14.	Aberdeen, S. Dak.	Aug. 30
Oct. 15.	Jefferson Barracks, Mo.	Oct. 11
Oct. 15.	Ft. D. A. Russell, Wyo.	Oct. 11
Oct. 15.	Newport, R. I.	Oct. 4
Oct. 15.	Fog-signal bldg., San Francisco, Cal.	Sept. 27
Oct. 15.	Bldgs., Sheridan, Wyo.	Sept. 27
Oct. 15.	Muskegon, Mich. Adv., Eng. Record, Sept. 20 to Oct. 11.	Sept. 20
Oct. 15.	St. Louis, Mo. Adv., Eng. Record, Sept. 20, 27.	Sept. 20
Oct. 15.	San Antonio, Tex.	Sept. 20
Oct. 15.	Yellowstone Park, Wyo. Adv., Eng. Record, Sept. 6 to Oct. 11.	Sept. 6
Oct. 16.	Philadelphia, Pa. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Oct. 16.	Nadeau, Kan.	Oct. 4
Oct. 16.	San Francisco, Cal.	Sept. 27
Oct. 16.	Tampa, Fla. Adv., Eng. Record, Sept. 6 to 27.	Sept. 6
Oct. 17.	Tompkinsville, N. Y.	Oct. 11
Oct. 18.	Ft. Meade, S. D.	Oct. 11
Oct. 18.	Foundry, Philadelphia, Pa.	Sept. 27
Oct. 18.	Dredging, Boston, Mass.	Sept. 27
Oct. 18.	Wharf, Boston, Mass.	Sept. 27
Oct. 18.	Bldg., Ft. Myer, Va. Adv., Eng. Record, Sept. 20 to Oct. 11.	Sept. 20
Oct. 20.	Cheyenne River Agency, S. D.	Oct. 11
Oct. 20.	Portland, Me. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Oct. 20.	Ft. Riley, Kan. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 20.	San Francisco, Cal.	Sept. 27
Oct. 20.	New York, N. Y. Adv., Eng. Record, Sept. 20 to Oct. 11.	Sept. 20
Oct. 21.	Cement, etc., Portsmouth, N. H.	Oct. 11
Oct. 21.	Filters, Annapolis, Md.	Oct. 11
Oct. 21.	(Conneaut Harbor), Cleveland, O. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 22.	Dredging, Annapolis, Md.	Oct. 11
Oct. 22.	(Ft. Rodman), Newport, R. I. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 22.	(Ludington), Grand Rapids, Mich. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 23.	Watertown, Mass.	Oct. 4
Oct. 23.	(Brunswick Harbor), Savannah, Ga. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 23.	(Savannah Harbor), Savannah, Ga. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 23.	(Chesapeake Bay), Wilmington, Del. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 24.	Tompkinsville, N. Y.	Oct. 11
Oct. 24.	Wharf, Boston, Mass.	Oct. 11
Oct. 25.	Ft. Snelling, Minn.	Oct. 4
Oct. 25.	Los Angeles, Cal. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 25.	Bremerton, Wash.	Sept. 27
Oct. 28.	Ft. McRee, Fla.	Oct. 11
Oct. 29.	Ft. Yates, N. D.	Oct. 11
Oct. 29.	(Ft. Greble) Newport, R. I. Adv., Eng. Record, Oct. 11.	Oct. 11
Oct. 29.	Chicago, Ill. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Oct. 29.	Pier, Manistee, Mich. Adv., Eng. Record, Sept. 27 to Oct. 11.	Sept. 27
Oct. 30.	Wheeling, W. Va. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Oct. 30.	Dredging, Boston, Mass. Adv., Eng. Record, Sept. 20, 27.	Sept. 20
Oct. 31.	Dredging, Norfolk, Va. Adv., Eng. Record, Oct. 11.	Oct. 4
Nov. 1.	Bldg. at Navy Yard, Philadelphia, Pa.	Oct. 11
Nov. 1.	Quay Wall, San Francisco, Cal.	Oct. 11
Nov. 1.	West Point, N. Y. Adv., Eng. Record, Sept. 20 to Oct. 11.	Sept. 20
Nov. 1.	Light-house, Philadelphia, Pa. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Nov. 4.	Htg Hosp., Flandreau, S. D.	Oct. 11
Nov. 4.	Cheyenne, Wyo. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Nov. 5.	Floor in Post Office, New York, N. Y. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 6.	Breakwater, Cleveland, O. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 6.	Entrance to harbor, Cleveland, O. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 6.	Chicago, Ill.	Oct. 11
Nov. 8.	(Ft. Greble) Newport, R. I. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 8.	Completing Post Office, Chicago, Ill.	Oct. 11
Nov. 8.	Water mains, Bremerton, Wash.	Oct. 11
Nov. 10.	La Purchase Expo. Bldgs., St. Louis, Mo. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 10.	(Lemon Creek) New York, N. Y. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 10.	Newport, R. I. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 10.	(Raritan Bay) New York, N. Y. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 10.	(Woodbridge Creek) New York, N. Y. Adv., Eng. Record, Oct. 11.	Oct. 11
Nov. 12.	Denver, Colo. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Nov. 12.	Charleston, S. C. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Dev. 6.	Dredging, Galveston, Tex. Adv., Eng. Record, Oct. 11.	Oct. 11
Dec. 10.	Jetty work, Galveston, Tex. Adv., Eng. Record, Oct. 11.	Oct. 11

BUILDINGS.

Oct. 14.	Court Bldg. elevators, New York, N.Y.	Oct. 11
Oct. 14.	Pub. bldg., boilers, Hartwell, O. Adv., Eng. Record, Oct. 11.	Oct. 4
Oct. 14.	Post Office, Richibucto, N. B.	Oct. 4
Oct. 14.	Jail, Louisville, Ky.	Sept. 27
Oct. 14.	Hospital, Springfield, O.	Sept. 20
Oct. 15.	Hospital, etc., New York, N. Y.	Oct. 11
Oct. 15.	School, Dewitt, Ia.	Oct. 4
Oct. 15.	Bus. bldg., Philadelphia, Pa.	Oct. 4
Oct. 15.	Pub. bldg., Newark, O.	Sept. 27
Oct. 15.	Hospital, Willard, N. Y. Adv., Eng. Record, Sept. 27, Oct. 4.	Sept. 13
Oct. 16.	Armory, Marinette, Wis.	Oct. 11
Oct. 16.	Hospital, Medfield, Mass.	Oct. 11
Oct. 16.	Htg. Court House, Moose Jaw, N.W.Ter.	Oct. 11
Oct. 16.	School, Baldwin Township, Pa.	Oct. 11
Oct. 16.	Pub. bldg., Brooklyn, N. Y.	Oct. 4
Oct. 17.	School, Athens, O.	Oct. 11
Oct. 18.	Hospital, Utica, N. Y. Adv., Eng. Record, Oct. 11.	Oct. 11
Oct. 18.	School, Bath, Me.	Oct. 11
Oct. 20.	House for Park, Pittsburg, Pa.	Oct. 11
Oct. 20.	School, Reedsburg, Wis.	Oct. 4
Oct. 20.	Hospital, Cleveland, O.	Sept. 27
Oct. 21.	Munhall, Pa.	Oct. 11
Oct. 21.	Hospital, New York, N. Y.	Oct. 11
Oct. 21.	School, Delray, Mich.	Oct. 11
Oct. 21.	Htg. Court House, New York, N. Y.	Oct. 11
Oct. 21.	New York, N. Y.	Oct. 11
Oct. 21.	Jail, Jefferson, Ga.	Sept. 13
Oct. 22.	Bath bldg., Brooklyn, N. Y.	Oct. 11
Oct. 22.	Htg. School, New York, N. Y.	Oct. 11
Oct. 22.	Htg. School, Brooklyn, N. Y.	Oct. 11
Oct. 22.	Mill, Tallulah, La.	Oct. 4
Oct. 23.	Court House, Nogales, Ariz.	Oct. 4
Oct. 23.	Pub. bldg., Richmond, Va.	Oct. 4
Oct. 24.	Work on City Hospital, St. Louis, Mo.	Oct. 11
Oct. 24.	School plans, Milwaukee, Wis.	Sept. 27
Oct. 25.	School, Baton Rouge, La.	Oct. 4
Oct. 28.	Court House plans, Walker, Minn.	Oct. 4
Oct. 28.	Pub. bldg., Danville, Ky.	Oct. 4
Oct. 29.	Court House, La Crosse, Wis.	Oct. 11
Oct. 29.	Court House, Walker, Minn.	Oct. 4
Oct. 30.	School, Stockton, Cal.	Oct. 4
Nov. 1.	School, Rice Lake, Wis.	Oct. 11
Dec. 2.	Capitol work, St. Paul, Minn.	Aug. 16
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Dec. 15.	Htg. Capitol, Columbia, S. C.	Oct. 4
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11

MISCELLANEOUS.

Oct. 13.	Gar. Disposal, Newark, N. J.	Oct. 11
Oct. 15.	Hoisting engine, etc., Rahway, N. J.	Oct. 11
Oct. 16.	Evansville, Ind.	Oct. 11
Oct. 17.	New York, N. Y.	Oct. 11
Oct. 17.	Rem. of snow, New York, N. Y.	Oct. 11
Oct. 20.	Steel tower, Auburn, N. Y. Adv., Eng. Record, Oct. 11.	Oct. 11
Oct. 22.	Trap Rock, etc., Brooklyn, N. Y.	Oct. 11
Dec. 1.	Garb. disposal, Atlanta, Ga.	Oct. 4
——	Dredging, Babcock, Wis.	Oct. 4

THE ENGINEERING RECORD.

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The Compensation for Engineering Services.

Whenever all other subjects of engineering controversy, the proportions of concrete, the value of reheaters, and the like, are finally settled, there will remain for discussion the ancient topic anent the compensation for engineering services. It is ever-present and always pertinent—of interest to the chief as well as the rodman, and, of course, one which all engineers agree can only be settled properly by raising salaries and fees all around. The public, unfortunately, does not always think as it should, and some recent instances of its blindness to the money value of engineering are worth considering.

The first instance, strange to say, is from a Pennsylvania county where enough good engineering work has been done and paid for in the past to warrant some confidence in the existence of proper general knowledge on this important subject. Two bridges were needed, and the county commissioners were sufficiently intelligent to retain an eminent consulting specialist to make the necessary surveys and plans for them. No objection seems to have been raised to his work, but his bill of $1,907.20 for services rendered has apparently reduced the commission to nervous prostration. It is claimed by them in the local press that home talent would have done the work for $50 and that $150 for traveling expenses was the maximum additional charge that any one was warranted in making.

Of course $1,907.20 is somewhat larger than $50 plus $150, but it may not prove so much greater in the end. The Engineering Record formerly gave considerable space every month to obituary notices of county bridges of home design, but as these mortuary notes were not cheerful to anybody and seemed to have no particular influence in raising the standard of such work, their publication was stopped. The material for them is still received in a steady stream, however, and the reason for its ample amount is to be found in those $50 plans. A man who will design a $10,000 bridge for $50, and make the surveys, cannot furnish the practical experience and knowledge which will insure that the plans call for a structure strong enough for road rollers and electric cars as well as ordinary traffic, economical in material, and detailed so as to go through the shops and be erected at a minimum expense. Poor design may mean accidents, which are expensive, and high shop and erection charges, which sometimes run up in a surprising way when the home talent tries hard to be original in conception and bold in execution.

Another instance in consulting practice, but of an opposite nature, recently came up for discussion with The Engineering Record. One of the leading engineers in the country received a call from a stranger one Saturday evening, just after returning from a tiresome tour of inspection of work under his charge in a number of States. The stranger produced numerous blueprints and a voluminous report relating to an engineering project calling for an expenditure of three-quarters of a million. He proposed taking a half interest in the project and a leading Wall Street firm would take the other half if the engineer would report favorably on it. The answer was wanted at 2 o'clock the next day. Out of consideration for the financial house, the engineer gave up his needed rest, worked all through the night and the next morning, and then reported decisively against the undertaking. When he mentioned that his fee for thus saving the waste of $750,000 was the large sum of $100 The Engineering Record's feelings were not fit to express. That man ought to consider the famous advice of Rufus Choate to a young lawyer in a somewhat similar case: find out how much the client has been saved and then make the charge somewhat smaller.

The most interesting aspect of the subject has recently been brought up in a letter to the New York Rapid Transit Commission from Mr. William Barclay Parsons. It relates to the salaries of the principal assistant engineers and the assistant engineers of the highest grade. The younger men, who have opportunities for promotion and are without responsibility, are stated to be adequately paid, but the grades mentioned do not receive salaries equal to those of other city employes performing the same work and having far less responsibility. The four principal assistant engineers average $189 per month each and together have responsible charge of work amounting to $7,000,000. The twenty assistant engineers average $150 per month each, and are in responsible charge of work worth about $2,000,000. Mr. Parsons recommends strongly an increase in these salaries, and it is to be hoped the Commission will grant the request.

In making the recommendation, Mr. Parsons points out clearly the two conditions which govern the compensation of an engineer working on a salary; first, the responsibility put upon him, and, second, his opportunity for advancement. The work to be done fixes the salary, not the engineer's ability to do better work. The man who is merely a high-class skilled laborer in the field or drafting room should not expect the compensation of the man who has to be responsible for the work of others as well as himself. The American Society of Civil Engineers has very clearly indicated this in its requirements for admission to its two grades of active membership, which read as follows: "A member shall have been in the active practice of his profession for 10 years; he shall have had responsible charge of work for at least five years." "An associate member shall have been in the active practice of his profession for at least six years, and shall have had responsible charge of work as principal or assistant for at least one year." The second factor in fixing salaries is the opportunity for promotion offered in a position. So long as advancement is possible, the rate of compensation must necessarily be somewhat lower than that for similar work where there is no chance of promotion. That is a matter not always recognized, and it is surprising to notice the astonishment of some chief engineers whose good men leave them to accept the same or even lower salaries elsewhere. These chiefs forget that ambition is a great incentive to good work, and when ambition is killed it is possible to keep good men only by paying them well to give up their dreams of great things. Really good men live in the future while working in the present, and the failure to grasp this fact is one of the failings of the engineer as an employer. In fact, when all aspects of the matter of compensation are considered, it is probably safe to say that the older engineers are more responsible for the present low average rate than any other single influence.

The Proverbial Jersey Mosquito occupies an important position in the annual report of the Board of Health of Montclair, N. J. The following extract from this report may be of interest to householders: In the great majority of cases, houses breed their own mosquitoes, and the breeding places are usually pools, drains, empty tin cans, sagged gutters, and rain barrels on the premises. This is true because mosquitoes, with the exception of one variety, tend to abide near their breeding places.

The Water-Works Problem of New York is so serious that many citizens interested in public affairs are talking about the failure of the present administration to begin plans for the new-supply works which must inevitably be needed before they are completed. So much has been printed in The Engineering Record about the situation in New York that it is unnecessary to refer to it again, but some comment must certainly be made concerning a proposal by the City Comptroller that the Mayor should appoint a commission to consider means of increasing the supply. The proposal is to have the Water Commissioner act ex officio as chairman, Mr. John R. Freeman, M. Am. Soc. C. E., is to be a member, the Merchants' Association is to select another, and a third is to be chosen by those previously appointed. It is to be hoped nothing will come of this proposal for it is not well-considered. The work of Mr. Freeman and the engineers who conducted the investigation for the Merchants' Association a few years ago was so thorough that the design of a new system can be started as soon as the word is given by the Mayor, provided the law officers will first definitely decide whether it is safe to go to the Housatonic River basin for the supply. At present the situation is wholly a legal one. The Housatonic supply is the best, all things considered, but its availability is involved in complicated legal tangles; the second choice is the Hudson near Poughkeepsie, which will furnish water of good quality after filtration. Both projects have been so well studied that either can be developed in a year or so, provided one competent engineer is put in charge of the work. A commission will simply cause delay without any gain. The city now has a shrewd public-spirited Water Commissioner with good engineers to assist him in managing the existing works. The logical way to carry out the design of the new system, when the Mayor makes up his mind to begin the work, is for him to authorize the Commissioner to retain a consulting engineer for the purpose. Just what formalities must be adopted in executing this plan, it is safe to leave to Colonel Monroe, whose brief career as head of the New York water department indicates that he knows what to do and how to do it.

The Weston Aqueduct of the Metropolitan Water-Works, Boston.—I.

By Alfred D. Flinn, Engineer, Designing and Drafting Department.

In The Engineering Record for May 4, 1901, there was published a brief general description of the Weston Aqueduct, together with extracts from the specifications for earth embankments and tunnel work, and a few details were illustrated. This aqueduct has been designed for a capacity of 300,000,000 gallons per day and when completed will extend from the dam of the Sudbury Reservoir in Southborough to the bluff on the west bank of the Charles River, in Weston, at the westerly limit of the metropolitan water district, a distance of nearly 13½ miles. The construction of the aqueduct was begun in the spring of 1901 and substantially the whole work, excepting the superstructures of the controlling chambers, is now under contract. For the most important contract prices, the reader is referred to the contract news columns of The Engineering Record of September 7 and November 30, 1901, and March 15, May 10, June 21 and August 2, 1902.

The aqueduct comprises the head works at the Sudbury Dam, consisting of three lines of 60-inch cast-iron pipes, each about 480 feet long, with connecting chambers; 12,266 feet of masonry cut-and-cover construction and 5,879 feet in three concrete-lined tunnels, on a grade of 4 in 5,000; 130 feet of flat-arched, special steel and concrete construction under a railroad; 30,725 feet of masonry cut-and-cover construction and 5,686 feet in one concrete-lined tunnel, on a grade of 1 in 5,000; an open channel 1,366 feet long; an equalizing reservoir about 4,000 feet long; 5,125 feet of masonry cut-and-cover construction and 600 feet in one concrete-lined tunnel, on a level; and two inverted siphons of 90-inch riveted steel pipes, the first 3,603 feet long across the Sudbury River valley, and the second 1,123 feet long across Happy Hollow, two depressions which interrupt the grade of the 1:5,000 portion of the aqueduct. The masonry portions of the aqueduct, including the tunnels, have horse-shoe shaped cross-sections. Where the gradient is 4 in 5,000, the horizontal diameter is 10 feet and the vertical diameter 9 feet 3 inches; where the gradient is 1 in 5,000 and in the level portion, the horizontal diameter is 13 feet 2 inches and the vertical diameter 12 feet 2 inches.

For convenience during construction, the aqueduct was divided into fifteen sections and the reservoir into two. The department engineer's office was established at Saxonville, about the middle of the length of the line, and branch offices for the division engineers and the field parties located at other convenient places near the work. At the Saxonville office a complete cement-testing outfit was set up. Samples of cements are taken in small paper bags and brought to the office in baskets or boxes.

The contract for Section 1, the headworks, was awarded to T. H. Gill & Co., of Somerville, Mass., June 16; contracts for Sections 2, 3, 6 and 12, including tunnels Nos. 1, 2 and 3, were awarded, on May 9, 1901, to Shanahan, Casparis & Co., of Louisville, Ky., and Columbus, O.; Section 4 was let to P. McGovern, of Boston, and Section 5, including the crossing under the railroad, to Bruno, Salomone & Petitti, of East Boston, on May 6 and 8, 1901; Sections 7 and 9, the steel pipes, were let, on March 7, 1902, to Edward Kendall & Sons, of Cambridgeport, who sublet the earth and masonry work connected with the pipe lines to Winston & Co., of Clinton, Mass., with whom contracts for Sections 8, 10, 11 and 15, including tunnel No. 5, were made on August 28, 1901; Section 13, including tunnel No. 4, was let, May 8, 1901, to M. H. Keefe, of Yonkers, N. Y., but satisfactory progress not being made, the work was reorganized later and Mr. Keefe's interests assumed by the Columbus Construction Co.; and the contracts for Section 14, the open channel, and Sections 1 and 2 of the reservoir, were awarded to Nawn & Brock, of Boston, on November 26, 1901. Sections 2 to 4 inclusive are of the smaller cross-section. The work is now being actively prosecuted on all the sections and the contracts stipulate that all the work shall be completed before August 1, 1903. It is already necessary to be able to convey a larger supply of water into the metropolitan district.

The Weston Aqueduct has involved an unusual amount of interesting detail in its design, and descriptions of some of these details which may have value for the readers of The Engineering Record will be given in this article. The work will be in an interesting stage to visit at any time during this autumn and next summer.

The method of building foundation embankments for the aqueduct, where required by depressions in the ground, has proved very successful. It is substantially the same method as was employed in constructing the Wachusett Aqueduct and is fully described in a quotation from the specifications given in The Engineering Record of May 4, 1901. Embankments formed in this manner, even when the material was fine sand, have been found so solid that, after removing the few inches of surplus on top, which is unavoidably kept loose by the trampling of the horses' feet, a strong blow would not drive the point of a shovel more than an inch or two into the bank. No trouble whatever has been experienced from settlement of the masonry even on some high embankments. One of the illustrations shows the method of flooding the foundation embankments for the aqueduct, after they have been built. The careful selection of materials and thorough rolling in thin layers, however, are mainly depended upon for compacting the embankments, and the flooding is sometimes omitted.

Tunnels.—There are five tunnels, all of which are being driven from the portals only, without intermediate shafts. Tunnel No. 1, 704 feet long, is through very compact clay and gravel, known as hardpan, which will stand well without support for a short time after excavation. Two schemes for driving and lining the tunnel were proposed: first, to make the lining of three rings of brick on the sides and arch, the excavation being cut to just the right shape and size for the brickwork with a collar joint of mortar, and completed for a few feet at each shift, the masons to follow the excavators immediately; second, to drive the tunnel with three-stick timbering and lagging for the upper part, the sides being unsupported, making the hole somewhat larger than in the first scheme and afterwards placing a complete Portland cement concrete lining. In either scheme, the invert was to be of Portland cement concrete and placed last. The contractor's methods and organization have not been such as to make the first scheme successful and so a modification of the second is being employed.

Two of the remaining tunnels are of the smaller cross-section and all four were expected to be mainly through rock and to be lined completely with Portland cement concrete. The concrete arch will vary in theoretical thickness, in the tunnels of the smaller section, from 7 to 15 inches, and in the larger tunnels from 8 to 18 inches. The inner portions of the linings are to be of 1:2½:4½ concrete and the backing of 1:3:6, the concrete being filled against the sides of the rock excavation except that stone fragments will be allowed to some extent for filling large cavities over the arch.

Tunnel No. 4, however, developed unexpected conditions at its westerly portal. It had been anticipated, as the result of rod soundings, that this tunnel would be in solid rock, and so the portal cut was made and the tunnel excavation started where the depth over the arch was about 18 feet, although at this place the rock was only at the level of the springing-line and the upper part of the excavation was in stiff clay, the expectation being that the rock surface would soon rise, as the few soundings that had been made in this part of the line and other indications seemed to point to such a conclusion. Instead, however, the rock surface continued approximately level for a long way, and did not rise above the arch so as to bring the whole cross-section in rock until the tunnel had been driven about 915 feet. Timbering was used, of course, from the beginning, but in the expectation that the cut would soon be entirely in rock, much lighter sticks were put in than were adequate, a cap and two batter posts 8 inches square. These soon began to crush and sag, and so heavier pieces were used in the advance work, 10x10-inch and 10x12-inch hard pine caps and posts, with 3-inch lagging, and the earlier timbering was supplemented or replaced. Various methods of timbering and various sizes of timbers were used at different places in this part of the tunnel, according to the position of the rock and other conditions. Each frame of timbers is numbered and a record kept of it, levels being taken from time to time to detect settlement. Some of the caps have sunken as much as a foot, and some of the lighter ones first used have bent badly and a few have broken. About nine months were spent in excavating these first 915 feet. Once for a few feet along the tunnel, the rock dropped just below the elevation of the invert, and in two places for short distances it rose just above the crown of the arch. The rock is a seamy, broken granite, hard to work, and the clay is so hard as to require light blasting, but is so intersected with sand seams that it cannot be trusted to stand without substantial support. One sand pocket encountered in the side of the tunnel yielded water so freely and caused so much trouble that it took nearly a week to drive the bench 6 feet.

Through the clay and rock portion of the tunnel, the heading was usually kept about 40 feet in advance of the bench, but this distance varied from 20 to 120 feet. Two Ingersoll-Sergeant drills were used on the bench and one or two in the heading according to the position of the rock. The timber caps were set high enough to leave 6 inches to 1 foot clearance over an 18-inch arch.

At one time in the spring when the writer visited the west end of the tunnel, work was being carried on continuously by two 11-hour shifts of 22 men each. The average progress was about 30 feet per week, but some weeks the heading was driven over 40 feet. Since the section has been entirely in rock the average weekly progress has been about 36 feet and there have been no features of unusual interest connected with the excavation. At first materials were taken into and out of the tunnel by horses and mules drawing cars on 20-inch gauge tracks. A 3-foot gauge track was afterwards laid in the tunnel and on the dump. Mules are still used to haul the cars out to the point where the arch is being built, but an electric trolley motor moves the cars from this point on to the dump.

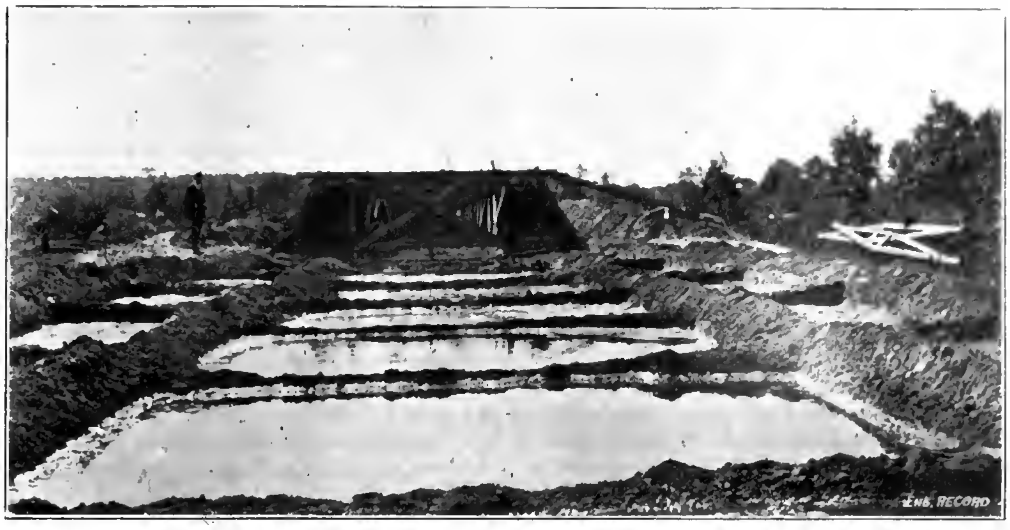
Compressed air is used for the drills and for the ejectors employed for draining the tunnel. The slope being toward the heading at this end pumping is necessary, and so sumps are dug and the water taken from them by the ejectors. A 10-inch galvanized ventilating pipe has been placed on one side of the tunnel about 6 or 7 feet above the invert. The tunnel is lighted by incandescent electric lamps. The power plant consists of two Ingersoll-Sergeant compressors of 657 cubic feet per minute capacity, two 60-horse-power and one 100-horse-power return tubular boilers, a 60-horse-power Westinghouse vertical engine and a 500-volt 70-kilowatt Thomson-Houston dynamo. The compressors are arranged to stop automatically whenever the pressure in the air mains reaches 100 pounds per square inch. The working steam pressure in the boilers is 100 pounds per square inch.

It was the original intention to have the placing of the concrete lining follow the excavating as soon as the tunnel should have been sufficiently well started to have the blasting at a safe distance, but the work was delayed. Finally, a beginning of the lining was made at the portal but the settling of the timbers and the nature of the materials so greatly increased the difficulties of this work that it was decided to uncover for about 75 feet farther and place the concrete in the open cut.

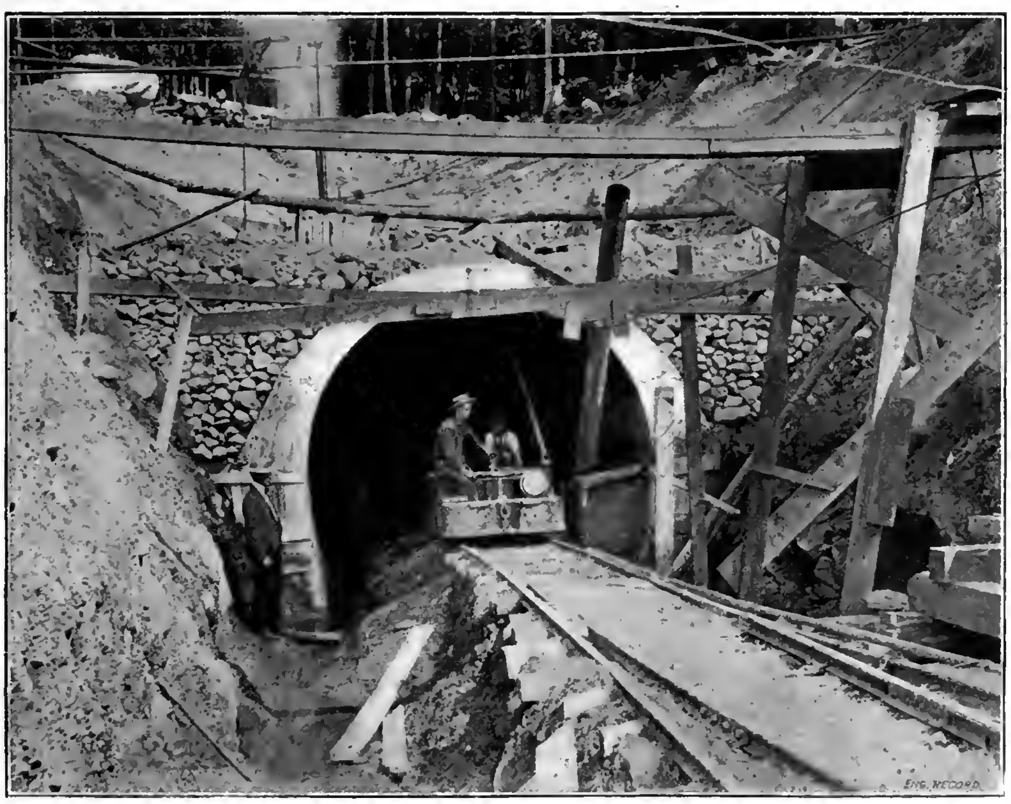
Stone bins, a stone crusher and concrete mixing boards have been set up near the portal. Selected stone from the excavation is dumped upon platforms near the crusher. The concrete is mixed outside the tunnel and brought in on the cars. For setting these forms for the lining, only the center line and the grade of the springing line of the finished arch are given. For the regular concrete tunnel lining, a traveler was used for a while, except in those places where the timbers had to be so placed as to prevent; but this was given up and various other means and methods have been employed from time to time. At two places where there was even more trouble than usual with the timbering, heavy brick lining was built for short distances.

The line and grade party consists of four men, who have also spent portions of their time on adjacent sections of the aqueduct. The conditions necessitated running the line, both over the hill and in the tunnel, on offsets. In the tunnel the line is marked mostly by horseshoe nails driven into the cross timbers, either caps or braces, as is most convenient in any case, but occasionally a chestnut hub is set well below grade in the bottom and covered with a stone. The nails have holes bored through their heads, through which a wire or string can be passed in order to suspend the plumb-bob. Stations are marked every hundred feet by white enameled tin labels about 4x6 inches in size, on which 3-inch black numbers are painted. These labels are prepared by the field party at odd times when in the office. They are tacked to the timbering about 7 feet above the bottom of the tunnel. The line is carried forward with a transit by reversing from a backsight. As thus projected with necessarily short sights, it has been checked by running in repeatedly from the base line outside with long sights, the first sight from the portal being 300 feet, the second 250 feet and the third 150 feet. The line was run twice and the instrument reversed six times at each instrument point. The target used is a piece of white celluloid upon which parallel black lines have been painted with the spaces increasing in width from the center of the target, similarly to the targets of some precise level rods. These targets were illuminated during use by the direct light of an acetylene bicycle lamp.

Tunnels Nos. 2, 3 and 5 have so far developed no unusual features. They are respectively 3,015 feet, 2,160 feet and 600 feet long. Tunnel No. 5 was completed late in the spring, having been driven entirely from the eastern portal.



Flooding Foundation Embankments for Aqueduct, for Final Settling, after Rolling in Thin Layers.

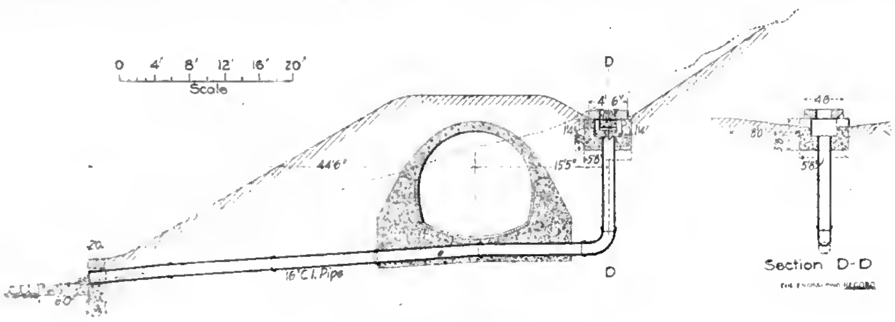


West Portal of Tunnel No. 4 Showing Cross-Section of Concrete Lining.

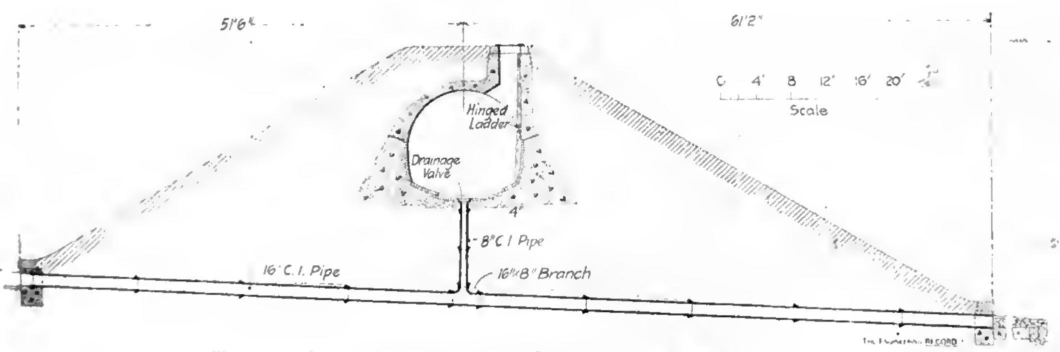
Culverts, Blow-offs and Manholes.—There are 39 culverts along the aqueduct, or somewhat more than an average of three per mile. Nine are siphon culverts, three are carried over the arch and twenty-seven are free draining beneath the aqueduct. Twelve are masonry and the others cast-iron pipes, the latter being used wherever a waterway less than two feet square was sufficient, or, in other cases, if more economical. Twelve inches was the minimum diameter used, with one or two unimportant exceptions. Pipe culverts have masonry head walls at inlet and outlet. Siphon culverts have masonry sand-catchers, or sumps, at their inlets, varying in area and depth according to the estimated needs of the situation, but always large enough for a man to clean them out with a shovel, the minimum size being 3x4 feet. Wherever the bottom of the sump would always be wet, it was made of 3-inch spruce planks; in other cases concrete was used for the bottoms as well as for the walls. Both inlet and outlet of each siphon culvert were provided with stop-plank grooves so that the culvert could be pumped out for cleaning and inspection.

In inconspicuous locations, the head walls of culverts were made either entirely of concrete or else with simply a granite coping stone; but wherever exposed to frequent view, as where near a highway, they were faced with a good quality of granite ashlar. Light dry rubble stone paving, averaging about 8 inches in thickness, was used at the inlets of most culverts to a moderate extent, while at the outlets, heavier paving laid on broken stone or coarse gravel, having frequently a total depth of 24 inches next to the head wall, was used to such an extent as to insure the impossibility of the end of the culvert being undermined by the water, the paving diminishing in thickness somewhat as the distance from the head wall increased. Masonry culverts were usually made wholly of Portland cement concrete, but in a few places where particularly exposed to freezing, the arches were made of brick. The arch, also, of one large culvert under a highway, where the earth cover was shallow and the loads would come upon it soon after construction, was built of brick. In two cases in which large brooks had to be taken under the aqueduct in siphon culverts, in order to avoid either a very wide flat arch or else an uncomfortable depth of digging in a wet place, twin passageways were constructed with a thin partition wall.

Pipe culverts were usually laid on a straight line from end to end, but wherever this was not feasible the change of direction was, with one or two exceptions, reduced to one vertical curve made by means of a standard special casting. In all cases the pipes were laid in trenches cut below the original surface of the earth. Where the aqueduct is in excavation this generally permitted the culvert to be placed very close to the bottom of the aqueduct and in many cases the pipe was partially or wholly included in the masonry of the aqueduct bottom. Where the aqueduct is on embankment the culvert is sometimes a considerable distance below the bottom of the aqueduct, and, if blow-offs occurred in such positions, the connection from the blow-off valve to the culvert was made with a vertical cast iron pipe composed of short lengths, with bell and spigot joints, arranged to allow for a slight settlement. In one place where the aqueduct is built partly in excavation and partly on embankment, along the side of a very steep hill, the inlet to a pipe culvert is a vertical pipe 13 feet high, the water dropping through this pipe to a nearly horizontal pipe passing beneath the aqueduct. Typical masonry culverts were illustrated in The Engineering Record for May 4, 1901; two of the accompanying drawings show the pipe culverts.



Special Pipe Culvert.



Typical Pipe Culvert, with Blow-off and Manhole.

At 13 free-draining culverts under the aqueduct, connecting with suitable water courses, blow-off valves were set in the bottom of the aqueduct to aid in draining out ground water during construction and removing dirty water during the periodic washings of the aqueduct after it shall have been put into service. In one part of the line where there was an unusually long distance between two culverts, a blow-off was provided although there was no water course into which it could discharge. Advantage was taken of a large gravel pit to turn the discharge into the permeable material, through which it could drain away, without detriment to anyone, reaching finally a lower and somewhat distant brook. Although several large brooks cross the line of the aqueduct, at only one or two of them will it be practicable to discharge such considerable quantities of water as would be of material assistance in emptying a portion of the aqueduct, and even then the water would have to be let out with great care in order not to flood or otherwise injure private property. These blow-off or drainage valves have a clear opening of 8 inches diameter, and consist of a pipe casting on the top of which is a bronze seat ring for the disk, which is raised about $2\frac{1}{2}$ inches, when the valve is opened, by a screw with a pilot point, operated by a wrench from above. Each valve is set in a small depression formed in the invert so that no part of the valve except the top of the screw projects above. At each blow-off is a manhole fitted with a hinged ladder, the lower part of which can be held in a horizontal position so as to serve as a platform from the end of which a man can reach the valve with a long wrench. The arrangement of manhole, valve and ladder is shown in one of the illustrations.

Where the first inverted siphon crosses the Sudbury River, however, it will be feasible to discharge large quantities of water, and so at this place two 16-inch blow-off pipes will be connected to the steel pipe now being laid and provision made for similar blow-offs from the other two pipes to be laid in the future. In the second, or Happy Hollow, siphon 10-inch blow-offs will be provided, but these will have to discharge through a pipe line 854 feet long and a ditch about 1,800 feet long, the water finally reaching the Sudbury River. The gradient of the lower portion of the aqueduct being so flat, the level of high water in the Weston Reservoir reaches nearly eight miles upstream from the channel chamber, or to a point 9,812 feet upstream from the Sudbury River siphon and just above the beginning of the 13-foot aqueduct at the railroad crossing. This condition of course complicates the problem of emptying the aqueduct.

The manholes mentioned above were placed not only at each blow-off, but also at such intermediate points as to make the distance between two manholes usually about a quarter of a mile. Each manhole has a granite coping and is provided with a steel cover locked down with one of the waterworks standard padlocks. The padlock is arranged to hang under the cover so as to be accessible to the man inside seeking to get out, but is fitted with a short chain so that it can be drawn up through a slot in the cover and unlocked from the outside. By this arrangement also the locks are less exposed. The ladder folds up out of the waterway when not in use. The lower, or hinged, part is provided with counterweights hung on "giant metal" chains, so as to move easily, and is so arranged that it can be reached and operated from either the inside or the outside.

At Station 17, on the 10-foot diameter aqueduct, and at Station 214, on the 13-foot 2-inch diameter aqueduct, are gauging manholes, to be covered with neat masonry superstructures and fitted with guide boards and other appliances for the convenient use of current meters, for making measurements of the flows in the aqueduct.

To aid in determining locations inside the aqueduct during inspection and cleaning, after the aqueduct is in service, white glazed tiles $2\frac{1}{4}$x4 inches and $\frac{1}{2}$ inch thick, with black figures and letters, are being placed in the side wall at the springing line, at every 100-foot station and wherever highways cross over or culverts are built under the aqueduct. Tiles of this description were set in the Wachusett Aqueduct and have been found satisfactory in four or five years of service.

(To be continued.)

A Four-Truss Double-Deck Railroad Bridge.—II.

The three western spans of bridge No. 1 of the Pittsburg, Fort Wayne & Chicago Railway across the Allegheny River between Pittsburg and Allegheny are duplicates, each 156 feet $\frac{1}{2}$ inch long from center to center of end pins. Each has four trusses and carries four tracks arranged the same as those of the 333-foot span which was described in The Engineering Record of October 11. The design of trusses, details of members and connections differ from those of the long span, but the floor system is the same and is continuous with that, and the specifications are the same. The loading assumed was the same except that the dead loads for the center and outside trusses were taken at 4,000 and 1,830 pounds per lineal foot respectively. The superstructure was made of open hearth steel, having a ductility so great that a punched hole $1\frac{1}{2}$ inches from the sheared edge of a plate could be drifted to a 50 per cent. greater diameter without cracking. Soft steel in the floor had an ultimate unit strength of 58,000 plus or minus 4,000 pounds. Medium steel for the rest of the superstructure had a unit strength of 66,000 plus or minus 4,000 pounds: rivet steel, 54,000 plus or minus 4,000 pounds. The minimum elastic limit was 55 per cent. of the ultimate strength. The percentage of elongation in 8 inches was required to be 1,500,000 ÷ ultimate strength. The percentage of reduction of area at the point of fracture was 2,800,000 ÷ ultimate strength. Full size test eyebars were required to break in the body; to stretch 12 per cent. in a gauged length of 10 feet; and to show a minimum ultimate strength of 62,000 pounds—9,000x(area ÷ perimeter).

All pins as well as eyebars and other forgings were annealed. Up to a diameter of 7 inches the pins were rolled and all pins were allowed 1/32-inch clearance and their holes were required to be bored within 1/32 inch of the required position. The end vertical connection flange angles for all stringers and floorbeams were fitted within 1/16 inch of exact position and then milled. All splice rivet holes in chord pieces were reamed while the pieces were bolted together in the shops in four or more sections.

The single intersection pin-connected Pratt trusses are 26 feet deep on centers and are divided into two end panels of varying lengths and five intermediate panels 22 feet $3\frac{1}{2}$ inches long. The two decks and the four trusses divide the cross section of the span into six panels, of which the upper right hand and the lower left hand ones are X-braced and the remaining ones are occupied by the tracks as in the long span, and are without transverse vertical bracing except what is afforded by the solid plate knee braces on the upper and lower sides of the ends of the upper deck floorbeams.

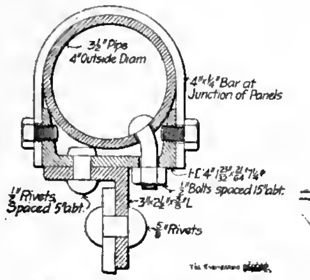
Owing to the arrangement of tracks and the clearance for trains the end elevation of the span necessarily corresponds almost precisely in general appearance with the cross section, and there are no portals or special end struts. The masonry coping is level in all cases and differences in size of expansion rockers and depth of shoes are made up by the use of grillages. In the center trusses the top chords and end posts are 40 inches wide and 26 inches deep, made with three webs throughout. The end posts have half-hole bearings on the chord pins and are locked to them with jaw plates on the outside webs. The hip joint is made on the pin center and is mitered with ½ inch clearance but all other top chord joints are made to butt and are covered, but not fully spliced, with riveted web and cover plates. In the end posts and in the other vertical posts the webs are connected at the foot and at the upper deck floorbeam by vertical transverse diaphragms. The end post has the inner flange, and the intermediate posts have both flanges, braced by intersecting lattice bars riveted together at points of contact. Horizontal connection plates are field-riveted to the feet of the intermediate posts to receive the bottom lateral diagonals.

The shoes are about 4½ feet high over all and have a 52x66-inch base plate and three webs, which give a combined length of 10 inches pin bearing. The main bearing plates have half holes, but the outside plates of the outside webs are only ½ inch thick and are extended to have full holes and lock the shoe to the similar full-hole jaw plates on the opposite sides of the corresponding webs of the end posts. The end floorbeams are riveted to the shoes through their end vertical web-stiffener angles and through the horizontal connection plates of the lower lateral diagonals which are field riveted to the bottom flanges of the floorbeams and base plates of the shoes. The expansion end shoes are seated on nests of segmental rollers with their end frames locked as described for the long span and the rollers are seated on a rack made of 13 1¼-inch thick transverse bars on a 52x1¼x78-inch base plate with a ⅛-inch sheet lead cushion between it and the cut stone pier coping.

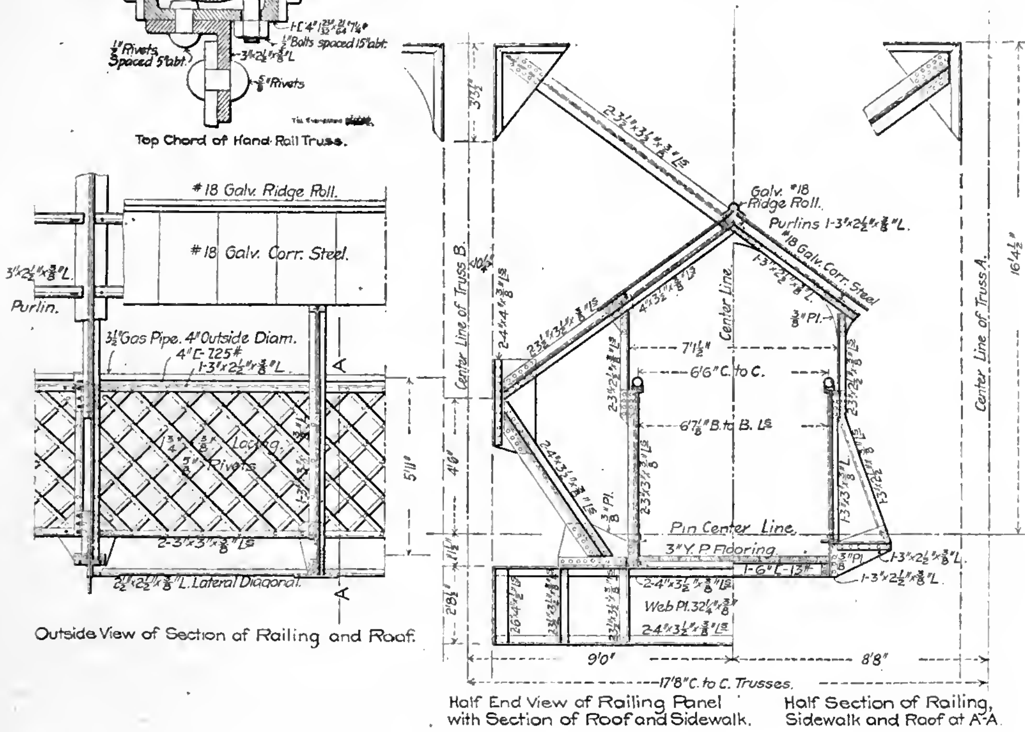
The top chord is made in three sections, the center one having a length of a little more than three panels to bring the splices beyond the pin reinforcement plates. The maximum cross section has one 40x7/16-inch cover plate, six 26x¾-inch webs, eight 6x4x¾-inch flange angles and two 5x¾-inch and one 9x¾-inch flange reinforcement plates. The hip pins are 9 inches, all the other top chord pins are 7½ inches and all the bottom chord pins are 8 inches in diameter.

The webs of the vertical posts are connected and stiffened at the floorbeam connections, by vertical diaphragms made with ⅝-inch plates and two pairs of 4x3½ and 5x3-inch angles at top and bottom respectively. The bottom diaphragm is only 33 inches long and receives the 38 field driven floorbeam connection rivets in four vertical rows. The top diaphragm is 9½ feet long and receives an equal number of floorbeam rivets and the rivets for the kneebrace brackets. All the intermediate vertical posts have two webs and four 4x4-inch angles, and have full pin holes at both ends. The main diagonals are 10-inch and the bottom chords are 8-inch eyebars, those in the end panels of the latter being stiffened by lattice bars on 3x2½-inch horizontal angles riveted to their inner faces. The trusses are cambered by making the top chord panel lengths ⅜ inch longer than the bottom chord panel lengths. The outside trusses correspond to the center ones, but are lighter and the maximum top chord section is one 32x⅝-inch cover plate, two 26x½-inch web plates, two 4x4x7/16-inch top flange and two 6x4x7/16-inch bottom flange angles and two 7x¾-inch bottom flange reinforcement flats.

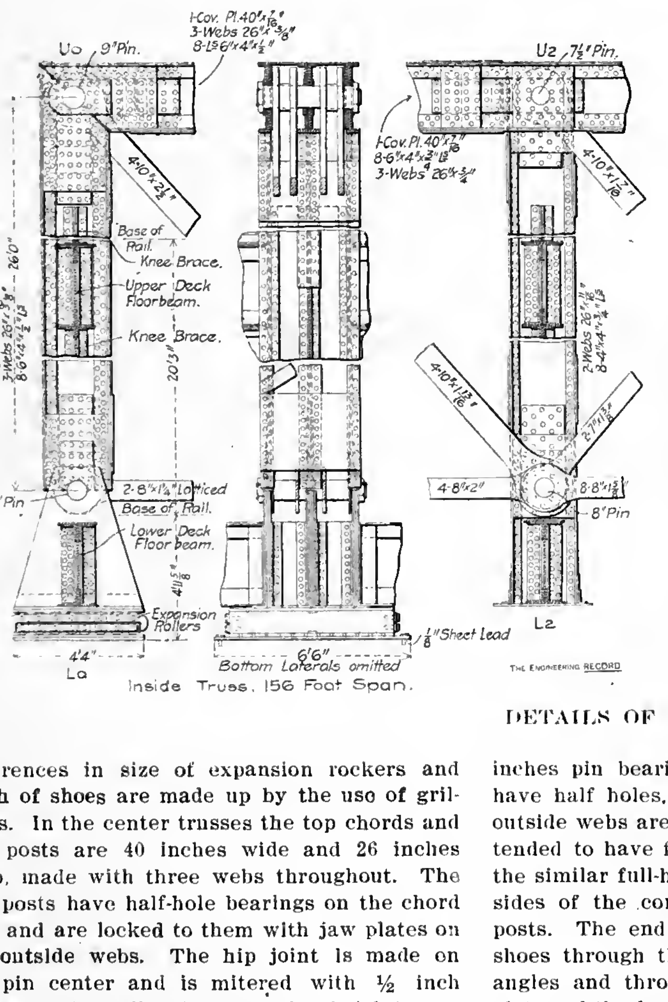
The top lateral diagonals are pairs of 3 and 4-inch flat bars with sleeve nut adjustments and eyebar heads which have 3-inch and 3½-inch vertical pins through connection plates riveted to the top flanges of the top chords and transverse lateral struts. The lower lateral diagonals are single 6x⅜-inch flat bars field-riveted to horizontal connection plates on the bottoms of the vertical posts and to the bottom flanges of the stringers at their intersections.



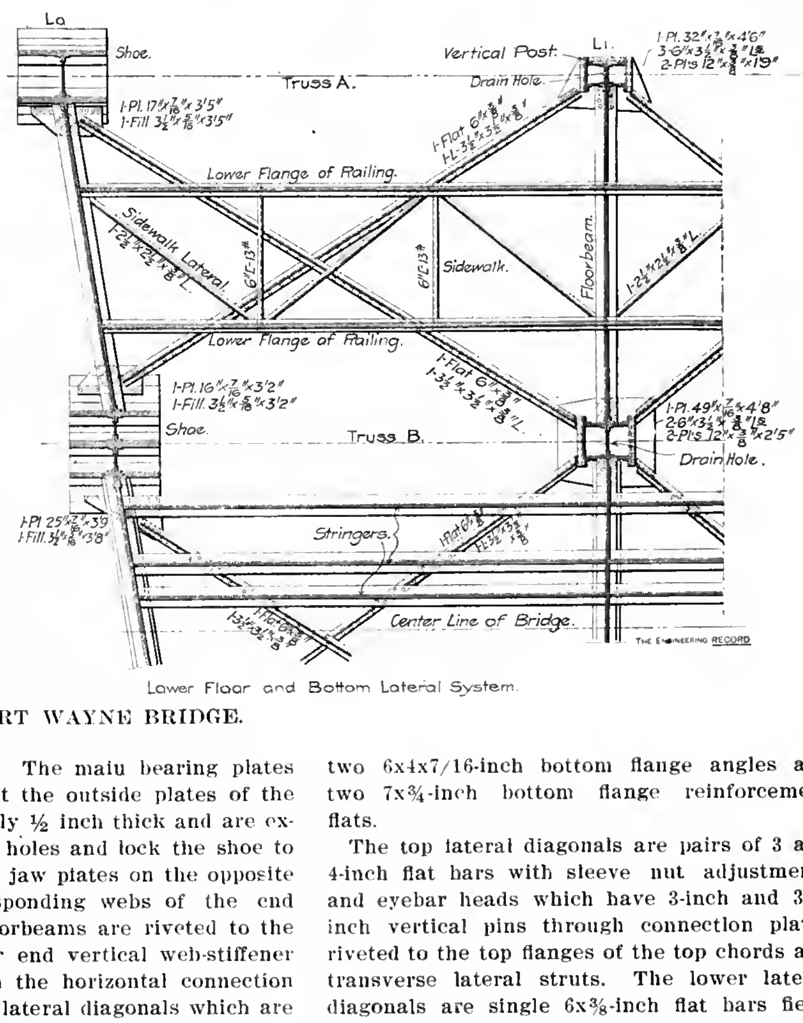
Top Chord of Hand-Rail Truss.



Foot Bridge and Shelter.



Inside Truss, 156 Foot Span.



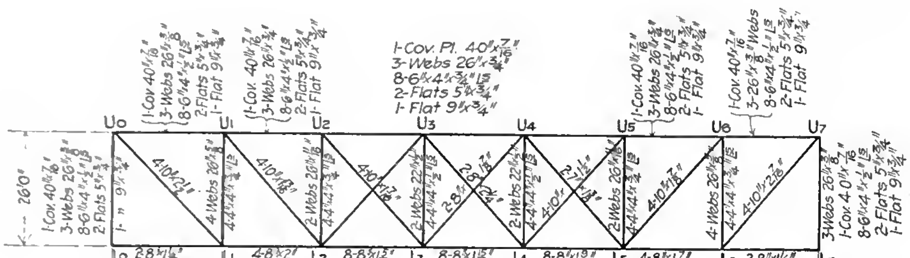
Lower Floor and Bottom Lateral System.

DETAILS OF FORT WAYNE BRIDGE.

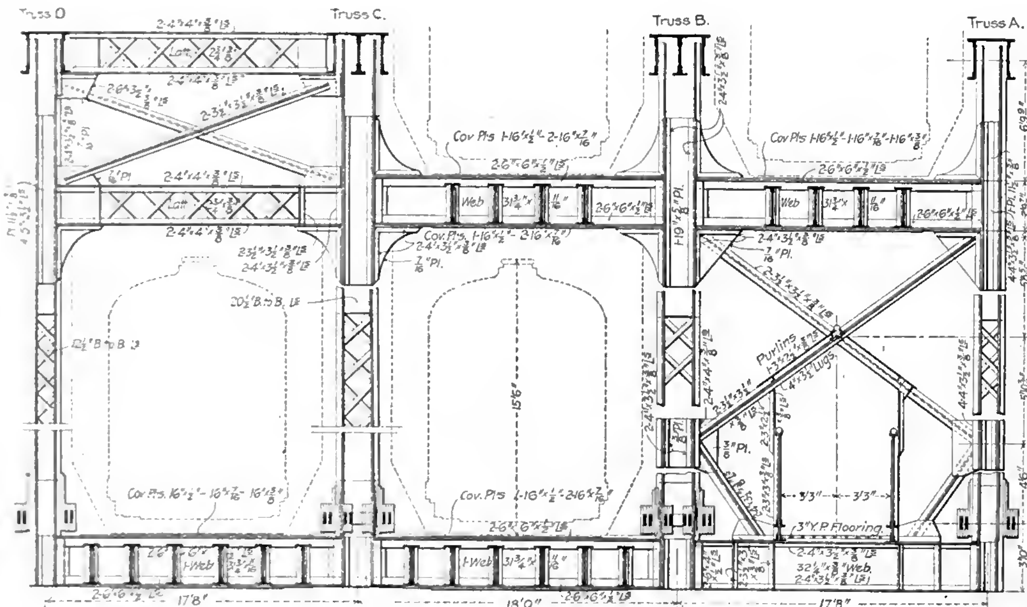
They are stiffened against flexure under their own weight by single 3½x3½x⅜-inch angles riveted to the upper side between stringers and at the ends, and they form three panels of X-bracing between every pair of floorbeams. At the ends of the span they are field riveted to horizontal connection plates shop-riveted to the base-plate of the shoe and field riveted to the floorbeam bottom flange.

As in the previously described 333-foot span of the same bridge the vertical transverse panels between trusses A and B, below the upper floorbeams and between trusses C and D above the upper floorbeams are occupied with sway brace diagonals. In both cases these are pairs of angles riveted together back to back to form Ts which have their wide flanges in the same plane and are riveted together at intersections. In both cases also they form simple X-braces, and above the upper deck their extremities extend to the ends of the transverse struts. Below the upper deck the bracing is modified by connecting the lower ends of the diagonals to the vertical posts at the tops of the kneebraces, about 6 feet above the top flanges of the floorbeams so as to raise the intersection of the diagonals and give clearance under their lower ends for a footwalk in the center of the panel. The footwalk is supplied with deep lattice-girder hand rails which carry its floor between panel points of the main truss, and it has a double pitched roof to protect it from drippings from the railroad track overhead. The top flange of the hand rail girder consists of a small channel, an angle and a 4-inch pipe fastened together as shown in the detail, the oval bottom heads of the bolts being inserted through slotted holes in the pipe and turned 90 degrees before their nuts were screwed up.

Each span weighs about 650 tons and was designed and constructed under direction of Mr. Thomas Rodd, chief engineer and Mr. J. C. Bland, engineer of bridges for the Pennsylvania Lines West of Pittsburg. The inspection was performed by the railroad company's force under Mr. C. P. Buchanan, inspector of bridges. It was built at the Keystone plant of the American Bridge Co., Mr. Richard Khuen, engineer. It was erected under direction of Mr. S. P. Mitchell, chief engineer, and Mr. H. A. Green, assistant engineer and superintendent of erection for the western district.



Material Sheet for Heavy Truss, 156 Foot Span.



Cross-Section at Center of 156 Foot Span.

The Water-Works of the Louisiana Purchase Exposition, designed by Mr. Richard H. Phillips, will have 15½ miles of cast-iron pipe 4 to 24 inches in diameter, 19¾ miles of ¾ to 6-inch wrought-iron pipe, 375 hydrants and 843 gate valves. The pipes will be run along the roofs of many of the buildings as well as underground. A novel feature will be the deck turret revolving standpipes in the buildings on platforms about 30 feet above the floor. When the ordinary fire streams are insufficient, these turrets will throw 3-inch streams under 150 pounds pressure, the direction being controlled by tiller wheels. Of course these powerful streams will wreck the exhibits they strike, but they will only be employed when the loss of a few exhibitors is needed to ensure the safety of many. Water will be drawn from an 8,000,000-gallon impounding reservoir by nine pumps, and there will be an emergency connection with the city mains.

Gravel Roads in Grand Rapids, Mich., according to City Engineer L. W. Anderson, are constructed so as to reduce the voids to a minimum, by using a mixture of fine gravel when necessary. The clay used in the body of the gravel has been reduced by this means to the smallest permissible amount. When giving the final rolling, an additional sprinkle of clay is added to prevent the gravel from raveling during the dry summer months.

The Use of Wood Pavements Under Heavy Traffic.

Abstract of a paper presented to the American Society of Municipal Improvements by F. A. Kummer.

Attention was drawn in the first part of the paper to a paving block exhibited in connection with it, which was removed from Tremont Street, Boston, after being in use nearly two years. It was taken from near the center of the street where the traffic is very heavy. The surface of this block was almost as hard as stone and the reduction in depth was very slight, being at the most not over ⅛ inch in two years. This reduction in depth was not due to wear, but to the compression of the upper fibers of the block under heavy travel, so that it is considered quite certain no corresponding reduction in depth will be apparent during succeeding years. Under the action of the traffic, the sand spread over the surface of this street was driven into the outer fibers of the wood, so that the whole wearing surface was compacted into a tough and absolutely impervious surface. The edges of the block have not rounded off any, due to the fact that the blocks are laid as close together as they can be driven, thereby leaving no point of attack, as is the case with granite or other block pavements laid with wide joints. When dry, wood pavements are not as slippery as, for instance, asphalt pavements, owing to the fact that the upper surface of the wood always retains a certain elasticity, which is not found with other forms of pavements. When the two pavements are covered with frost, sleet or slime, there is perhaps little to choose between them on the grounds of slipperiness on heavy grades, but for streets of this class a form of pavement has been developed which consists of a block laid with a grooved joint, which proves a perfect foothold for horses upon grades, and as so laid in the City of Boston, has been absolutely non-slippery.

In considering the general question of the paving of streets, several forms of pavement seem open to selection, namely, granite block, wood, asphalt, vitrified brick, asphalt block, bituminous macadam and ordinary macadam. Of these pavements, only the first three named have any place under very heavy traffic and it is questionable whether asphalt, unless laid with much greater care than is usually the case, should be included. For streets of the very heaviest travel, such travel even as is found on the streets in London, such as the Strand, Fleet Street and others too numerous to mention, wood is the most economical and satisfactory pavement that it is possible to lay. Experience has shown abroad that this is true, and streets such as those named have travel which is far heavier than is to be found upon any street in this country, although it is probable that on some of our streets the concentration of the loads is greater owing to the presence of street car tracks in the roadway. If we exclude asphalt as a suitable pavement for streets of this class, we have left only granite block and wood from which to choose.

Granted that it is possible to so prepare wood that it does not absorb moisture and is proof against decay, let us consider how such a block of wood can be destroyed by the action of traffic. If the practice were followed of laying the blocks with one-quarter or one-half inch joints, as is the case abroad, the exposed edges of the blocks would undoubtedly wear with more or less rapidity under the action of the shoes of horses. This wear is not as great in the case of wood as one might at first suppose, as has been demonstrated by the Boylston Street pavement in Boston, to which reference has already been made; but by laying the blocks on streets which are level or nearly level with no joints between them whatever; in other words, by driving them together so closely that their surface under travel presently becomes unified, presenting no joints or cracks, a smooth surface results which has no vulnerable point at which it can be attacked by the action of traffic. The calks of horses' shoes cannot chip off the surface of the pavement, as is the case with brick or even stone, nor can the fibers of the wood be ripped off because they are vertical, and resemble in this respect a bundle of fine wires set on end and tightly wedged together. We have found that the action of traffic on such a block is to drive the upper ends of the fibers down and compress them, so that the heavier the traffic, the more solid becomes the surface of the block, just as would result from the continual pounding with a hammer upon the end of a stick of timber. This felting action, as it perhaps might be termed, upon the fibers of the upper surface of the block, is assisted by the resinous material forced into the wood along with the creosote oil, for which reason we have never found a case of brooming in the upper surface of the block as is found with the timber as treated abroad, and especially when laid with an open joint. The whole theory of the vertical fibers in the block is that they should be tightly bound together so that each supports its neighbor, and for this reason the faces of the block should not be separated by a joint, if it can be avoided, as otherwise the blocks cannot mutually support each other. It is interesting to note that a recent copy of the "Sanitary Record" in London stated that the practice of laying wood blocks with a tight joint was rapidly coming into favor in London owing to the greater durability which it gave to the pavement. In the case of the grooved block used on Boylston Street, the groove between the blocks was one inch deep and the same results would have been secured had the groove been only one-half inch deep. This small groove would leave almost the entire two faces of the block bearing against each other and supporting each other solidly in the street.

Owing to the fact that the wood selected for treatment is all heart wood, there is very little difference, if any, in density in the individual block. What difference does exist is largely made up by the greater absorption of the preservative fluid by the more porous blocks and the corresponding less absorption by the denser blocks. This may seem a finely drawn theory, but yet the fact remains that over two years of heavy traffic on Tremont Street has failed to demonstrate the slightest irregularity in the wear of individual blocks. This is the only way in which such a pavement could wear out; that is, by wearing in spots which would result in holes in the pavement. So long as the wear is even over the entire surface of the pavement, its life is almost indefinite. It is interesting to note that the stretch of wood pavement laid in front of the Auditorium Hotel in Chicago, which is now in its fourth year, has shown exactly the same results as those recited above for Tremont Street.

In the foreign pavements far less care is taken in the selection of the wood and a large majority of the blocks laid have a considerable proportion of sap wood in them; this wood, being extremely porous and much softer than the harder blocks, does produce a certain irregularity of wear in the pavement. The four vital points of difference between the London pavements and those laid in Boston are: First, the far greater hardness of Georgia pine as compared with Swedish deal. Second, the treatment of the timber with 22 pounds of a mixture of creosote and resin as against 10 pounds of straight creosote oil generally used abroad. Third, the selection of all heart wood and the exclusion of all sap wood, a practice not followed abroad. Fourth, the laying of the blocks with a tight joint.

In these four respects we believe we have vastly improved upon the foreign practice, yet under a traffic of over 40,000 teams per day, the life of wood pavement on the Strand in London is given in official reports as seven years. Very few, if any, granite pavements would be in condition for travel at the end of that time under that traffic. It is therefore, first, the splendid showing of the pavements as laid abroad, and, second, the improvements made over the foreign practice, which causes us to say that properly constructed wood pavements have a longer serviceable life than granite.

An International Committee on Street Hygiene.

The International Congress for Hygiene and Demography, which convened in Paris in August, 1900, appointed an International Committee of Street Hygiene, composed of men prominently connected with municipal improvement on the continent of Europe, in England and America, Mr. Rudolph Hering, of New York, being the member from the United States. This committee met in September last and voted to prepare recommendations to be submitted to the next Congress of Hygiene and Demography, to be held in Brussels in 1903.

The purpose of the International Committee of Street Hygiene is to further that branch of sanitary science which deals particularly with the following subjects: Construction and maintenance of the surface of roads and streets; cleaning of streets, including removal of snow and collection, removal and disposal of sweepings; planting of trees and plants; public sanitary conveniences; storage, collection, removal and disposal of house refuse and refuse from mills, markets and slaughter houses. In general the committee recommends that public work of this character should be done by the public authorities under one administrative officer, who should be directly responsible to the authorities and who should be a trained engineer well acquainted with hygiene.

The cleaning of streets should be so conducted that neither the atmosphere nor persons nor objects will be polluted, and the raising of dust should be prevented by systematic watering. All public ways should be cleaned at least once a week and main thoroughfares two or three times a week or every day, the best time for the work being the night or early morning. Street sweepings should be removed immediately after their collection, without intermediate storage, in tight carts, which should be kept thoroughly clean. The use of street sweepings for filling lowlands, especially in the neighborhood of houses, should not be allowed if the sweepings contain much organic matter. All kinds of house refuse and refuse from markets and slaughter houses should be regarded as dangerous to health. Any handling of house refuse should be avoided, as far as possible, and the sorting of such refuse should be prohibited. In the houses the refuse should be put only into metal receptacles of convenient shape and size, which can be readily handled and thoroughly cleaned. Wherever possible, these receptacles should be collected or emptied every day, preferably during the night or the early morning hours before traffic in the streets commences. Destruction by fire is regarded as the most satisfactory method, and the tipping of such refuse into waste places, for filling, in the neighborhood of houses is so objectionable that it should always be prohibited. Dumping the refuse into a water-way, as is sometimes done, generally creates a nuisance.

The Mechanical Plant of the Prudential Buildings, Newark, N. J.

One of the most elaborate mechanical plants yet provided for meeting the requirements of the modern office building has been supplied for the group of four large office structures in Newark, N. J., belonging to the Prudential Insurance Company of America. The plant is a complete one in the variety and character of its equipment and possesses a number of features unusual in this class of work. It has been accorded valuable space in one of the buildings, and being readily accessible to visitors, not a little attention has been paid toward improving its general appearance.

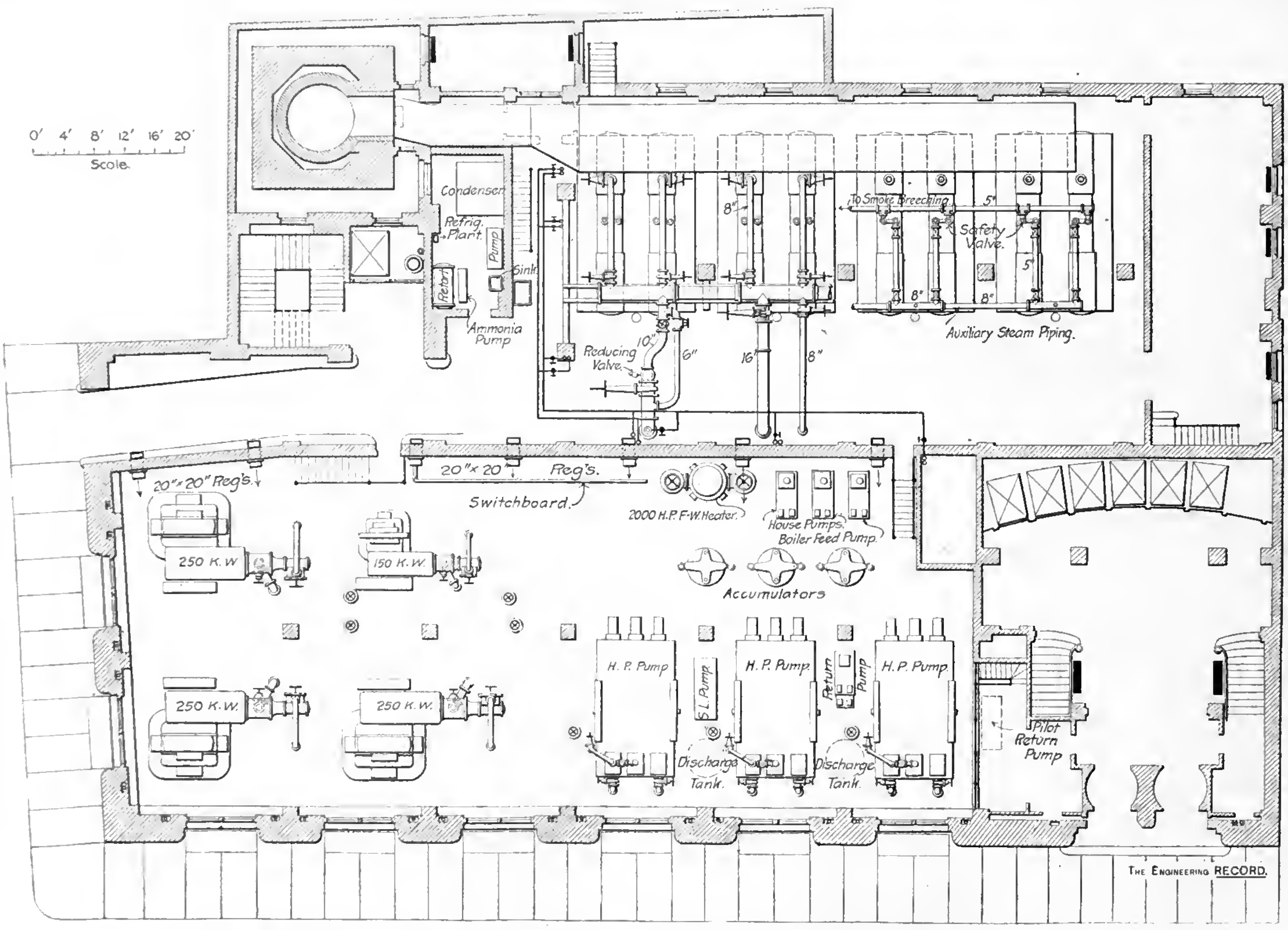
The four buildings are all twelve stories high and in the aggregate have approximately 13 acres of floor space. Three of the buildings and a large addition to an old building are new and in one of the new buildings, known as the North Building, is located the mechanical plant. The new plant supersedes that formerly serving the old building and is connected to all the buildings by means of tunnels under the separating streets. The chief requirements met by the new installation are lighting, heating, elevator service and a hot, cold and refrigerated water supply. Lighting is, as usual, by incandescent electric lamps, of which there are probably 15,000 all told, of 16 candle-power each on 110-volt circuits. Heating is largely by direct low-pressure steam radiation, supplied with exhaust steam ordinarily and with live steam when necessary. The elevators are all of the hydraulic type, supplied from the central plant with water at unusually high pressure. There are in all the buildings 27 passenger elevators and including book lifts and dumb waiters 36 hydraulic elevator units connected to this system. The water supply, that is, the plumbing service, is quite elaborate and has already been described in The Engineering Record of July 6, 1901.

The mechanical plant occupies all of the ground floor of the North Building except that required for the main entrance hall to the elevators and stairways for the office floors above. It consists of an engine room, which is in the building proper, and a boiler house, which is practically an addition on the rear side. The floor of the engine room is some distance below street level, and the room extends to the ground story ceiling. It is thus a lofty room and in addition has high windows on two street sides affording the public in the street a splendid view of all the machinery. To favor further the chance to make the plant an exhibition one, all piping, so far as possible, is carried in a cellar underneath the engine-room floor. The engine room is about 45x111 feet in plan and contains four electric generating sets, the pumping equipment and apparatus for the elevator installation, a number of other pumps, a feed-water heater and an elaborate switchboard facing the street windows. Vaults have been built under the sidewalks and this space has been largely utilized for a storage battery operated in connection with the electric plant. The engine room is served by two 8-ton hand-power traveling cranes of 22-feet span built by Reading Crane & Hoist Works.

The boiler plant, which is located in a room 45x79 feet in plan, is unique so far as being related to a power plant for an office building. It is provided with coal and ash handling machinery and a large overhead storage hopper or bin, allowing a gravity flow of coal to the firing space. Below the firing floor there is a cellar containing boiler-feed pumps, a number of tanks and the conveyors for hauling coal and ashes. In the boiler house, in addition, there is an elaborate ventilation plant and a refrigerating plant for furnishing iced water.

There are eight boilers in all, of 250 horsepower capacity, set in four batteries, with space for a fifth battery. They were built by The Babcock & Wilcox Company and are of wrought-steel construction of the following dimensions: Each boiler is 9 sections of tubes in width, each section having twelve 4-inch tubes 18 feet long. The steam drums are 42 inches in diameter and 23 feet 4 inches long, made of ½-inch plate. Each boiler has 2,217 square feet of heating surface and 39.1 square feet of grate surface, a ratio of 56.7 to 1. The boiler plant is served by a masonry double-shell chimney, rising clear of the building as an octagonal shaft of Indiana limestone, surmounted by a heavy carved stone capital. This structure, which was described in detail in The Engineering Record of December 14, 1901, has a total height of 230 feet 9 inches, but its top is conveyor, the former delivering coal received at the street to the latter and the bucket conveyor carrying the coal overhead to the bin, this conveyor, as is frequently done, being used also to carry the ashes, dumping them into an ash bin from which they are loaded from a spout into ash carts, as desired. Coal, as delivered through a coal hole in the sidewalk, falls into a weighing hopper. This is emptied upon the belt conveyor which travels in the cellar of the building to the nearest corner of the boiler house cellar. The belt, which was furnished by the Webster Manufacturing Company, is 16 inches wide and is driven by a 2-foot pulley from a 7½ horse-power C & C electric motor. At 70 revolutions per minute the belt speed would thus be 440 feet per minute. The belt is enclosed its entire length by a box of No. 10 sheet metal to prevent the dust flying all about, and at its discharging end, after it dumps through a chute upon the bucket conveyor, it is located a chute through which the ashes are dumped from the conveyor to an ash hopper. Ash carts are backed in a driveway underneath this and there filled. The movable dump carriage can be controlled by chains from the boiler-room floor. The coal bin is of the V-shaped class and its sides, which are of brick arches sprung between longitudinal I beams, are pitched about 23 degrees. Its total capacity is about 750 tons. In this connection mention should be made of the fact that the boiler room below the bin is ventilated, as indicated in the cross-section drawing herewith, the air at the inner wall of the boiler house having to pass through louver openings in a monitor built against the adjoining building wall.

There are two steam headers, each supplied by independent connections from each of the boilers. One, 20 inches in diameter, collects the steam for the electric generating units and the other, 8 inches in diameter, receives steam



THE MECHANICAL PLANT FOR THE PRUDENTIAL BUILDINGS, NEWARK, N. J.
George B. Post, Architect.

210 feet above the level of the grates; it has a constant inside diameter of 9 feet.

The smoke breeching connecting boilers and stack is of No. 8 black iron, suspended across the rear of the boilers and of the same cross-section throughout, changing in shape at the stack to enter the necessarily narrow and long inlet to that point. This cross-sectional area is about 25 per cent. greater than the full area of the chimney. The aggregate area of the individual smoke passages from the boilers to the breeching is practically that of the main breeching. For non-conducting covering magnesia blocks 1½ inches thick fastened to wire mesh placed to enclose 2 inches of air space were used, with ½ inch of magnesia plaster and ½ inch of hard finish plaster painted two coats of waterproof paint on top of the blocks.

The coal and ash handling machinery comprises a belt conveyor and a chain and bucket cleaned by means of a wire brush rotated against it. The dust liable to cling to it is in that way not allowed to accumulate and cause trouble. The conveyor hauls the coal upward at an angle of about 5½ degrees with the horizontal.

The bucket conveyor is of the McCaslin type and travels in the usual way, along the cellar floor underneath the ash hoppers below each boiler ashpit, then up one end of the building, then across overhead the length of the coal bin and down at the other end of the building. It runs through a monitor to the roof above the bin, which thus affords sufficient light to inspect readily the distribution of coal throughout the hopper, and at one end of the monitor is located the drive, which requires a 10-horse-power electric motor. The usual tripping or dump carriage is provided, and at the opposite end of the monitor from the driving motor is for the various pumps, this header being provided in the boiler by a cross-connection with the larger header and joined in the cellar under the engine room with a main from the larger header, so that the pumps of the elevator installation can obtain steam from either source. The steam piping in the boiler room is shown in the accompanying drawings. An 8-inch pipe feeds the 20-inch header from each boiler, with a valve both at the steam drum and at the header. From the header are taken a 16-inch main for the electric generating sets, a 10-inch connection for supplying the heating system through pressure reducing valves, when live steam is necessary, and an 8-inch pipe joining main header with the auxiliary or pump system of steam mains. For the auxiliary header, the safety-valve outlet from each boiler is fitted with a Y fitting, and to one branch of this is attached the safety valve and to the other a 5-

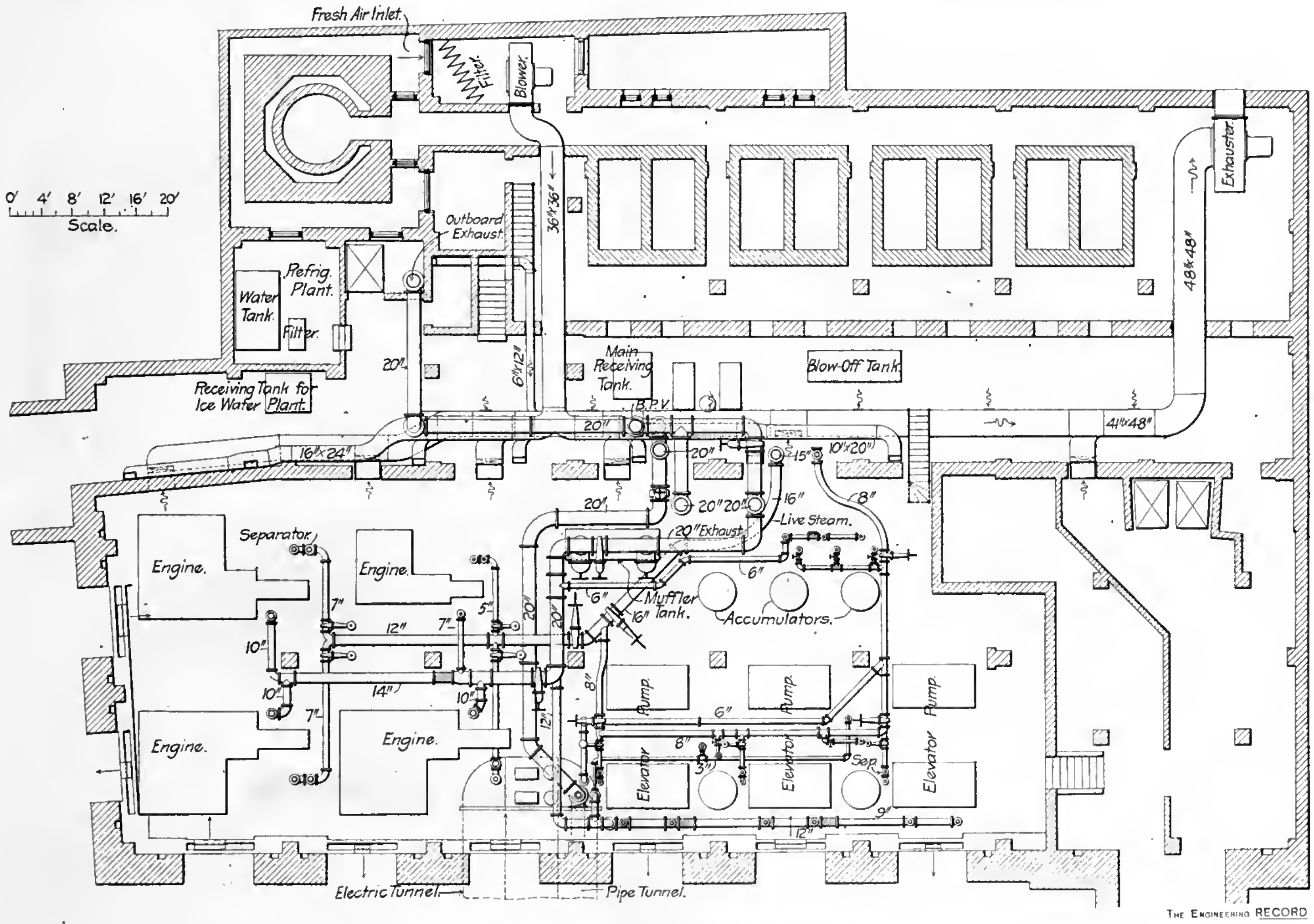
inch connection to the auxiliary header, two valves also fitted in the auxiliary header feeders. The safety-valves all have exhaust or discharge pipes for the blow-off steam and these all connect into a discharge main which is carried into the smoke breeching close to the stack.

The working pressure is 150 pounds per square inch and the steam piping was tested to stand 250 pounds hydrostatic pressure. The pipe bends from boilers to headers, the high-pressure mains from the headers and the branch pipes to the engines and pumps are all of wrought iron, with valves and fittings designed according to the Walworth Manufacturing Company standard for 250 pounds pressure. The flanges have a plain face with a raised surface for gaskets and are spot faced for bolts. For high-pressure pipes 6 inches in diameter and larger, the Van Stone joint is used, as it is also for low-pressure work 7 inches and over. For the elbows below the floor. The 16-inch outside diameter pipe in the boiler room is dropped from the main header to the cellar, as shown, and subdivides into a 15-inch outside-diameter main for the electric generating units and into an 8-inch pipe which is connected into the 8-inch pipe carried from the auxiliary header into the cellar. At this cross connection are tapped the steam supply pipes to the elevator pumps. The steam connections to all the engines and the main elevator pumps are provided with De Rycke steam separators in the cellar and in addition to the throttle valve have bevel-geared valves near the supply mains in the cellar operated from floor stands in the engine room. The sizes of the pipes would indicate, in the case of the boiler supplies, at the normal rating of the boilers, a velocity of steam flow of 1,100 feet per minute and in the case of the engines at rated load and fair steam consumption about 1,600 feet per minute.

pressure and consequently smaller pipes to the different buildings are possible. With this high pressure, instead of the pressure tank usual with lower pressure systems, accumulators are used. These weighed tanks rise through cellar into the engine room. For the satisfactory operation of the valves to the elevator cylinders, a low-pressure hydraulic system has been installed, for which purposes the pilot return pumps have been provided maintaining a pressure of 80 pounds.

Between the three accumulators and the partition wall are three 10x6x10-inch Laidlaw-Dunn-Gordon duplex pumps, two for house and fire service and the third, with outside packed plunger, for boiler feeding. A Berryman steam-tube feed-water heater, containing 1,660 lineal feet of 2-inch seamless-drawn brass tubing, is also located in the engine room. It is 58 inches in diameter and has a height of 17 feet.

The exhaust steam from the engines is collected into an 18-inch main and that from the elevator pumps into a 12-inch main, and the two unite into a 20-inch main, as shown in the plan of the cellar below the engine room. To provide for expansion in these lines Wainwright expansion joints are employed. The exhaust first passes through a tank 12 feet long and 4 feet in diameter, which is a Utility combined grease extractor and muffler tank. It is constructed of a ⅜-inch steel shell and ½-inch heads and is provided with a by-pass for the steam, if it is desired to cut it out temporarily. The exhaust main next reaches the connection to the feed-water heater, about which it has a by-pass in the cellar. From this point the steam may pass into the heating system for the buildings or into the atmosphere, the latter pipe fitted with the usual back-pressure valve. Here, as shown, is the auxiliary live-steam supply to the heating system; this is a 20-inch pipe dropping from the boiler room, starting as a 10-inch



CELLAR PLAN OF THE PLANT, SHOWING STEAM PIPING AND VENTILATION.

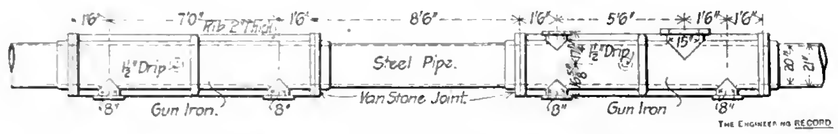
other high-pressure pipes extra heavy screwed joints are used, with the pipe flush with the flange after the latter was faced off in a lathe. The gaskets are of corrugated copper. The steam headers are made up of cast gun-iron headers, with which the connections to and from the headers are made, and of steel pipes with the Van Stone joint, the gun-iron headers being opposite each pair of boilers and the steel pipes connecting the gun-iron parts. The gun-iron headers are built with heavy ribs, of iron of 30,000 pounds tensile strength and with flanges drilled for the Walworth 250-pound standard. The steam headers are supported from heavy brackets, the 20-inch header on roller chairs to allow for expansion.

The machinery in the engine room is, in general, supplied by wrought-iron bends rising through the floor and turning downward to the steam cylinders, all of sufficient length to eliminate flanged joints between throttle and

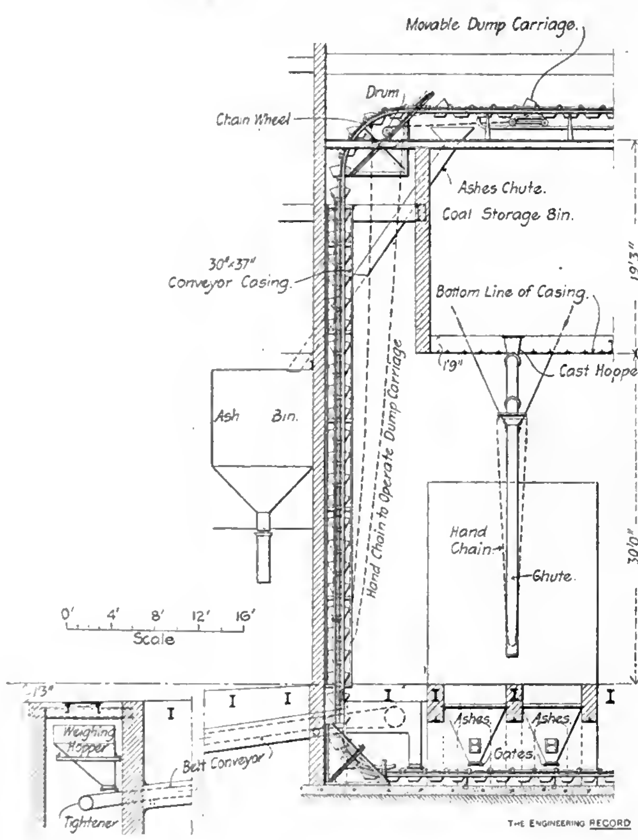
The electric generating units are located at one end of the engine room and consist of Ball & Wood non-condensing tandem-compound engines direct connected to Bullock 125-volt direct-current dynamos. Three of the units are of 250 kilowatts capacity each, and the engines are 17 and 30x18 inches in cylinder dimensions; the fourth is of 150 kilowatts capacity with a 12 and 22x16-inch engine.

The elevator equipment includes three compound three-cylinder Laidlaw-Dunn-Gordon pumps, the three cylinders located side by side and driving three water plungers, a safe-lifting pump and two pilot return pumps. The large pumps have one 17-inch steam cylinder and two 19-inch steam cylinders, 5-inch water plungers and a 24-inch common stroke. For regular service a pressure of 750 to 800 pounds is maintained by the pumps, with perhaps an average of 720 pounds at the elevators so that the volume of water necessary is less than with a lower pipe from the main steam header and fitted with two Kieley reducing valves arranged in series to reduce from 150 to 80 pounds and from 80 to 0 pound. The heating main continues 20 inches in diameter through the cellar to the tunnel to the West Building, supplying on the way a 10-inch main for the North Building and the North West Building.

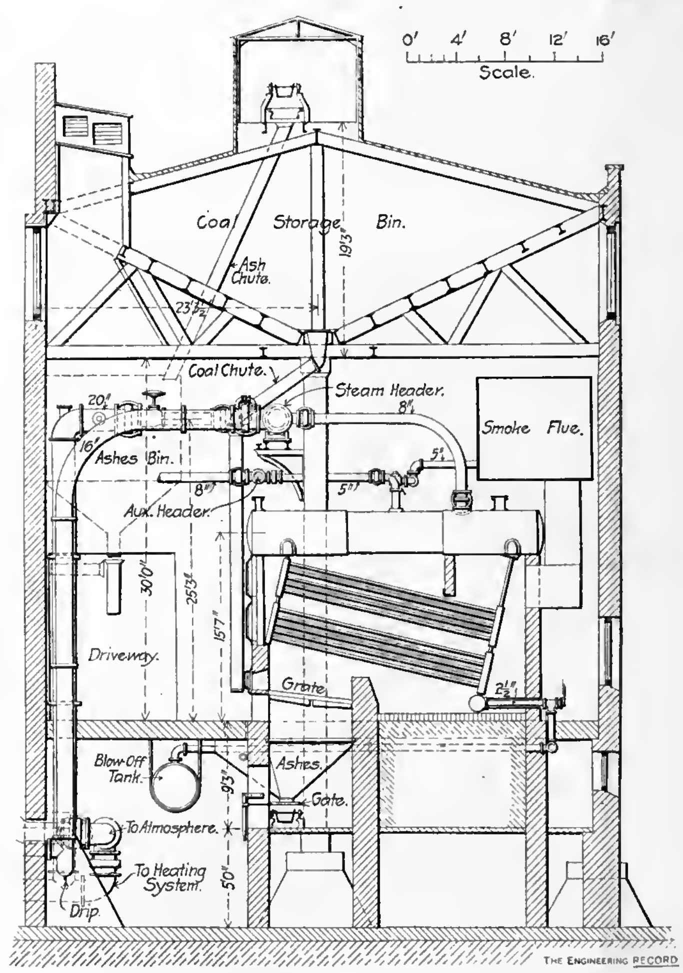
A section of the tunnel connecting the North and West Buildings is given in the accompanying drawings. It is built in duplicate, there being two tunnels parallel with each other, about 6 or 7 feet apart, the two tunnels united at each end, and one given up to the steam and other piping, as indicated, and the other to electric cables and wires. The construction is fully shown. The tunnels are 75 feet long and their floors are about 21 feet below street level. The steam pipes are supported, as shown, on wrought-iron pipe standards adjustable as regards height; besides the heating main there is a high-pressure main and the corresponding exhaust main. The heating main is graded slightly in the direction of steam flow and at convenient points suitable drain connections are provided. To receive the drip water, from piping in cellar and tunnel, 18-inch tanks 5 feet long are located at the power-plant end of the tunnel, one to collect high-pressure drips, another, the low-pressure drips, and the third the drips of the plumbing system. Each tank is served by a 4½x2¾x4-inch duplex steam pump under the control of a pump governor, one delivering the high-pressure drips to the main receiving tank, while the low-pressure drips, containing grease laden water from the exhaust main, is discharged into the blow-off tank. The heating return main, not shown in the cross-section drawing of the tunnel, is 4 inches in diameter and passes through the cellar of the plant to the main receiving tank, which is located against the boiler-room cellar wall.



THE CONSTRUCTION OF THE STEAM HEADER.



COAL AND ASH HANDLING.



CROSS-SECTION OF THE BOILER HOUSE.

All the condensation from the heating systems of the buildings is returned to the main receiving tank, which is 5x6x6 feet in size, this water being supplemented as may be necessary by water from the receiving tank of the refrigerating plant. This tank is of the same size as the main receiving tank and takes the overflow of the condenser of the refrigerating apparatus. Near the main tank are two boiler feed pumps of the same size and type as the boiler feed pump in the engine room, the latter pump being a reserve which is connected for house or fire service as well. The pumps discharge through a feed-water filter and the feed-water heater in turn before delivering to the boilers. The filter is a Ward combination zinc box and filter composed of 10 cast-iron 18-inch cylinders 7 feet high.

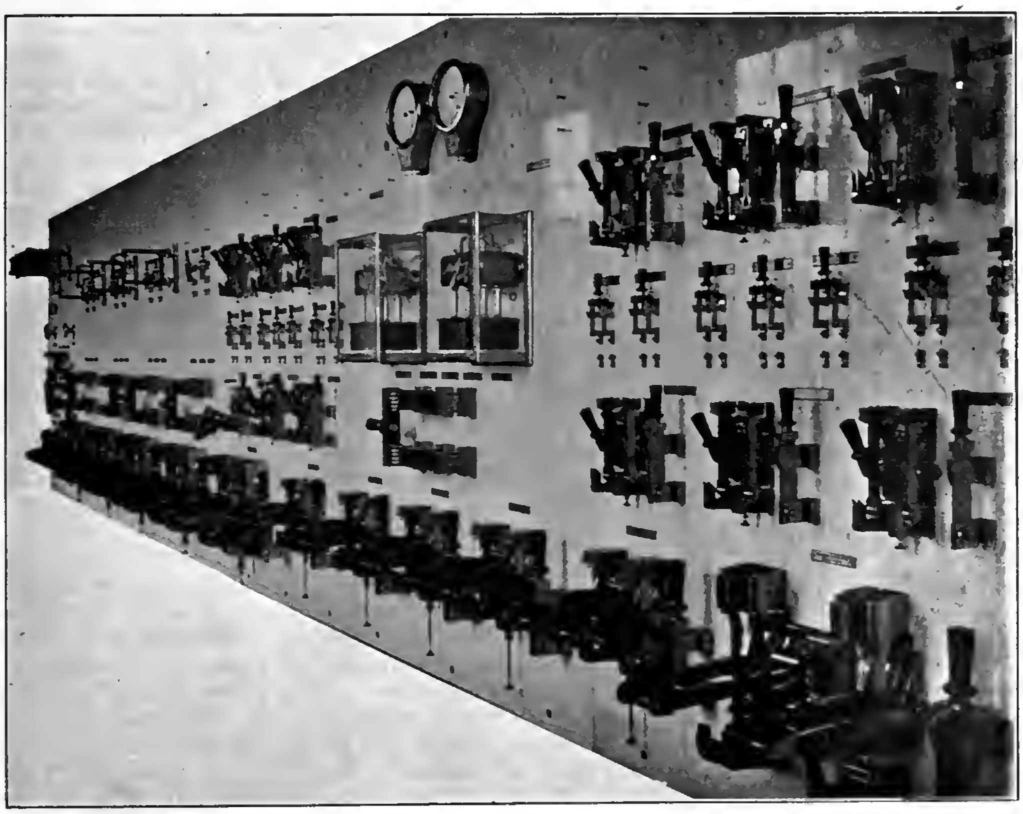
The feed piping is of brass, 4 inches in diameter, and the main extends under the boiler floor with 1½-inch brass connections rising through the floor to the boilers. Each riser has a 1½-inch inlet for an injector connection, a Nathan injector being supplied to each boiler. Valves, fittings, flanges, etc., of the feed piping are of cast bronze. The blow-off tank located, as shown, is 4 feet in diameter and 12 feet long, constructed of ⅝-inch steel with 7/16-inch heads. The contents of the tank have to be cooled before discharge into the sewer, and such fresh water as may be required for the plant is passed as usual through a submerged coil within the tank. There are ten of these, of 2-inch seamless brass, with their ends connected to two cast bronze headers with 5-inch water connections. There are all told about 230 lineal feet in the brass coils.

For ventilation the plant is unusually well equipped, having both a plenum and an exhaust fan. The air supply is not heated at all, as, of course, the circulation of air is intended largely to maintain as low a temperature as possible, particularly in the pipe cellar. The fresh air is blown into the engine room and exhausted from the cellar, the air to the cellar, however, coming partly from the engine room through manholes in the floor, but chiefly from out of doors. The plenum fan is located at a rear corner of the boiler-house cellar and draws through a cheese-cloth screen consisting of 15 leaves, each 6½ feet high and 2 feet wide, giving a total dust filtering area of 195 square feet. The fan is placed immediately within the filter and is of the single inlet type with a 72-inch centrifugal blast wheel in a full housing. It is of the B. F. Sturtevant manufacture and is direct-connected to a 15-horse-power **C & C** electric motor arranged to run at 200 to 300 revolutions per minute. Assuming that it delivers 25,000 cubic feet of air, the velocity through the filter will be about 2 feet per second. As shown in the cellar plan, the air is discharged through a duct 3 feet square, which delivers to seven vertical flues running to openings in the engine room, these 12 feet above the floor. The velocities of air on the assumed fan capacity figure 2,750 feet per minute in the ducts and 2,550 feet in the flues. The registers in the engine room, which are twice the area of the flues, are provided with copper swivel discharge outlets, directing the air downward, horizontally or upward, as desired.

The exhaust of the air is accomplished in an interesting manner. Vertical flues are built in the outside walls of the building receiving outside air a short distance above street level and discharging it, some flues into the pipe cellar, others into the vault. The air is drawn through the cellar to vent openings in the inside wall of the cellar, where it is exhausted through a duct and discharged through a vertical shaft into the atmosphere by means of the exhaust fan. This is a Sturtevant centrifugal fan, of 7-foot wheel, direct connected to a 20-horse-power motor. When running between 170 and 240 revolutions per minute, it is depended on to exhaust 60 to 80 per cent. more air than blown in by the plenum fan, so that there may always be an inflow through all sorts of openings into both the engine room and the cellar. It should be stated that the vault, which contains the storage battery, has a separate exhaust to the atmosphere, lead lined to resist the action of the acid fumes from the storage battery. The fresh-air supply ducts are covered with 1-inch magnesia blocks wrapped in canvas.

Returning to the engine room, and the electric equipment, the switchboard consists of nine panels of marble, 7½ feet high, 36 feet in total length. Eight of the panels are devoted to the instruments controlling the electrical output, while the ninth contains instruments pertaining to the steam plant, eight steam gauges corresponding to the eight boilers, a low-pressure steam gauge, a vacuum gauge and a recording steam gauge. Of the electric panels of the board, the first has the instruments for the storage battery control, the next four correspond to the four electric generating sets and the remaining three are given up to the various feeders. The board stands 5 feet from the wall.

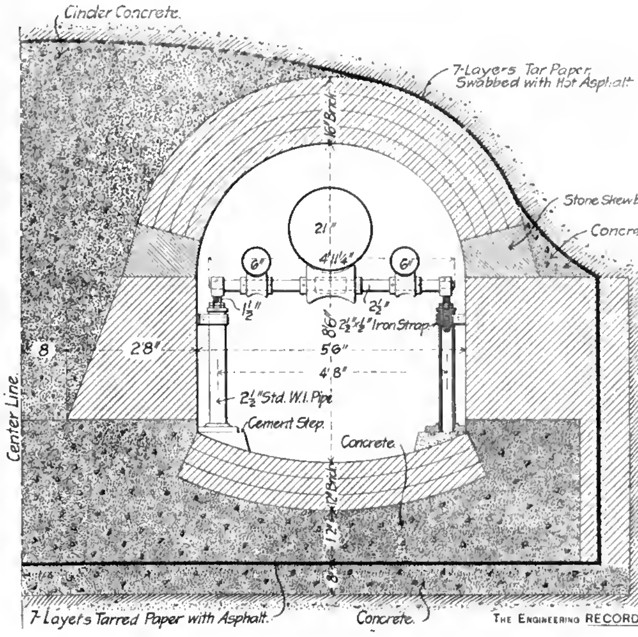
The storage battery is located in the vault under the sidewalk and is used for nights or at times when but few lamps are required. It is of 800 ampere-hours capacity and includes 15 end-cells with a motor-driven end-cell switch which can be controlled from the switchboard. A Crocker-Wheeler motor-driven generator, in the engine room, is used as a booster in charging. For the control of the battery, the usual instruments are provided, including a two-pole double-throw switch for charging in the one case and discharging in the other and a similar switch for connecting the battery on either the light or power busses. Circuit breakers are provided and an automatic overload switch, together with a wattmeter, a voltmeter and an ammeter, the latter two mounted on brackets.



Switchboard before Indicating Instruments were in Place.

An elaborate electric bell installation is installed, supplied from small motor-generators for lowering the voltage.

Each of the generator panels has a two-pole double throw main switch, so that its dynamo can be placed on either the light or the power busses, and has a circuit breaker, separate equalizer switch and an ammeter. Three volt meters on the four panels, connected up from multiple-point switches are supplied. Across the tops of the three feeder panels are two recording voltmeters and six ammeters, one ammeter each for the North Building, the North West Building, the West Building, the Main Building, the Main Building Addition and one unassigned or blank. The amount of current supplied to each building is thus separately indicated. Each of the feeders has a circuit breaker, these arranged along the bottom of the board, except that for the North Building, that in which the switchboard is located, in which case the various smaller circuits are arranged on the switchboard with individual circuit breakers instead of one main one. The North West Building houses an elaborate printing establishment which the company has furnished to do all its printing, and in this case, a power feeder is provided separate from the light, with circuit breakers in each case. Below the recording voltmeters, which are on the center of the three feeder panels, are two large wattmeters, one for recording the total energy supplied through the light busses and the other for all the energy supplied for power. The accompanying photograph shows the switchboard before the indicating instruments were in place.



Cross-Section of Main Pipe Tunnel.

The architect for the buildings is Mr. George B. Post, of New York, and all engineering work in connection with them was done under the supervision of Mr. Amory Coffin, his engineer. The power and heating piping and the ventilating apparatus was installed by Messrs. Baker, Smith & Company, of New York, and the electric work, for which Messrs. Pattison Brothers were retained as consulting engineers, was done by Messrs. Hatzel & Buehler, of New York. The switchboard was constructed by the General Incandescent Arc Light Company. The elevators were installed by the Otis Elevator Company, for which Messrs. W. T. Hiscox & Company, of New York, were sub-contractors. The coal and ash handling apparatus was designed by Mr. T. Amory Coffin, of New York. Mr. Tysilio Thomas is superintendent of the building and Mr. J. P. Russell, operating engineer.

The New Power House of the Twin City Rapid Transit Company of Minneapolis will be a 255x154-foot building 87 feet high, with two 16-foot Custodis stacks 235 feet high. There will be twenty-four 550-horse-power Babcock & Wilcox boilers equipped with Jones underfeed stokers and Mead coal and ash conveyors. Five 5,000-horse-power Allis vertical cross-compound engines direct-connected to 3,500-kilowatt General Electric generators will be installed to furnish current at 13,200 volts. Blake vertical marine condensers, Dean feed pumps and Stilwell-Bierce & Smith-Vaile heaters will be used.

Proposals for Building Jetties and dredging channels at Galveston, Tex., are invited by the U. S. Engineer Office, as advertised in The Engineering Record. The total estimated cost of the work is about $2,000,000. The approximate quantities for the jetties are 172,000 tons large stone blocks for covering riprap, 31,500 tons large riprap, 38,000 tons small riprap, and 80,000 linear feet of logs in cribs and spurs. The channels will require the dredging of about 12,850,000 cubic yards of material, as estimated by the engineers. Inquiries for specifications and further information should be addressed to C. S. Riche, Captain of Engineers, at Galveston.

Report of the Chairman of the Committee on Sewerage and Sanitation.

Presented to the American Society of Municipal Improvements by Prof. A. Prescott Folwell.

Municipal Sanitation.—The present chairman of this Committee, in looking over the "Proceedings" of the Society, was impressed by the fact that while many papers have been presented in the past nine years on sewerage, relatively little attention has been paid to sanitation; to be definite 21 papers have been devoted to sewerage and but 5 to any other subject which might be classified under sanitation, aside from those upon water-supply, garbage and refuse disposal, and parks, which subjects are covered by other Committees. The papers presented by the Committee this year include none on any branch of sanitation other than sewerage, and it therefore seems proper that it should make some report upon the many neglected but important subjects included under this general title. And it seems to the writer that the greatest service which he can render within the limits of a brief report is to call attention to the importance in municipal improvement of certan sanitary problems other than those included under the heads of sewerage, water supply, garbage disposal and parks.

It is one of the advantages of this Society that its members occupy various legislative and executive positions, and consequently each subject is, or is supposed to be, discussed from all, or many, points of view. A very large percentage of the papers, however, are presented by civil engineers, and this must result, it seems to me, in the loss of the benefit due to diverse view-points, and this especially to the engineers themselves. It seems probable that the reason the neglected branches of sanitation to which I wish to call attention are neglected is that they require but slight services from the engineer. This predominance of engineers among the list of authors of papers is not, I feel sure, because they have more of interest to present to the Society, nor because they are a leisure class, and I have prepared this paper in hope that it may suggest to some of the non-engineering members that they can give the Society instructive information on these subjects. I speak from a selfish point of view, hoping as a result of these remarks to ultimately receive much more information than I give. I propose therefore to name some of the directions in which sanitation can effect municipal improvement, and discuss each in the most general way only.

A list of such would include the collection of vital statistics; abatement and prevention of nuisances, including smoke, noise, odors, hideous and light obstructing street signs and buildings; the providing of public fountains, baths, latrines and convenience stations; food inspection; prevention and treatment of communicable diseases; hospitals; abattoirs; the disposal of the dead; as well as the drainage of wet lands, extermination of mosquitoes; consideration of effects of trenching and other earth excavation on the health of a community. Sanitation forms but a small part of the benefit afforded by many of these; but all of them, with many not mentioned, work in part to the sanitary betterment of cities.

Vital Statistics.—The collection of vital statistics is given more attention in Europe than in America, but our cities are moving rapidly into line. A brief consideration will show how important such statistics are. All practical or applied sciences are based upon the results of observations, and these sciences can not be more accurate than the data upon which they are based. Moreover, a general law dealing with complex natural phenomena can ordinarily be learned approximately only, and the more the number and the greater the range of such phenomena which are compared for this purpose the greater the probability of accuracy in the statement of the law. Our efforts to improve the sanitary conditions of the cities must be guided by our understanding of the laws of health and of life as affected by external conditions, and our success can not be expected to be greater than the accuracy of such understanding. This understanding of the law, in other words our knowledge of sanitary science, is derived wholly from observation, and its application along any line will generally be successful in proportion to the number, range and accuracy of observations made along the same line; not directly proportional to the number it is true, but proportional to some root of the number. As an illustration: it has been claimed that wood-block pavements are unhealthful, because of their supposed tendency to absorb water; but sufficient data relative to the health conditions of various communities which are and which are not provided with wood-block pavements and have otherwise similar conditions affecting their health, have not been collected, and this question can not be satisfactorily settled. Again, data recently collected seem to demonstrate that malaria can be prevented by suppressing breeding places for mosquitoes, and a way seems to be opened to prevent the spread of this disease.

Most of our large cities require every physician, midwife, undertaker, and clergyman to make returns to some public officer of all births, deaths, and marriages at which they have served; and also that physicians report immediately all cases of communicable diseases. In many cases fear of isolation or of quarantine prevents the reports of sickness. (Rochester reports for 1901 31 deaths from typhoid and only 102 cases or a fatality of 30 per cent., while the average for the past five years is 25 per cent. The average percentage of deaths from typhoid in other cities seldom exceeds 12 per cent., and the general average is 10 per cent. Rochester physicians therefore seem to be peculiarly unskilful in treating this disease, or delinquent in reporting cases). Now it is the sanitarian's part to prevent rather than cure diseases; consequently the record of cases of sickness are more important to him than those of deaths, but are often incomplete for contagious diseases and altogether lacking for all others. Would it not furnish very important data to the sanitarian if every case of sickness were reported to him? A copy of the city map constructed for each disease, in which each case was indicated by a dot, would undoubtedly be of great assistance in detecting local causes.

Much as the present system at the best lacks of satisfying the sanitarian, it is still of great value to him, and it is to be hoped that cities which are not now requiring and publishing the returns of vital statistics will be brought to see the advisability of doing so, and that the scope of the records be enlarged along the lines indicated. The necessity for this is illustrated by the statement in the Report of the Wisconsin State Board of Health for 1900 "that practically our vital statistics, so far as they are made to the different registers of deeds of the different counties, are absolutely useless"; also in Massachusetts, which is distinguished for its advanced standing in sanitary matters, 1 town of more than 5,000 population, 14 of between 1,000 and 5,000, and 66 of less than 1,000 population failed to report any vital statistics in 1900.

Abatement and Prevention of Nuisances.—City life is an artificial life, and natural processes can not be relied upon in urban surroundings to maintain unassisted sanitary conditions, it being more difficult there for nature to restore a disturbed equilibrium. Moreover, the denser the population the more intense becomes the mutual reactions of human deeds and misdeeds. It is, therefore, necessary for the citizens, individually and through their government, not only to assist nature to restore a normal condition of elements—air, water and earth—but to prevent the pollution of these which cause unsanitary conditions; and also to protect each citizen from the effects of the creation by his neighbor of such conditions. Most of these conditions are included under the general head of nuisances; although many of the nuisances so classified by law are offensive to the senses rather than dangerous to health, and so are outside the scope of this report. Unsanitary conditions are created by the smoke nuisance, by the odors from some chimneys, by exposed excrement, by flooded urban land, by anything which totally excludes direct sunlight from a dwelling, and by nerve-racking noises. Cities should encourage each other to suppress these nuisances by reporting successful methods and by rivaling each other in faithfulness in applying them. The smoke-nuisance seems to be especially troublesome; while the public needs awakening to the importance of sunlight as a health-preserver, and of the effect of jarring noises in producing nervous disorders and through the nerves aggravating many others.

The extreme eastern cities have been practically free from any smoke problem until within the last few months, but the scarcity of hard coal has led to the use of soft wherever possible, with the resulting dense smoke, and it is possible that some difficulty may be experienced in compelling urban coal consumers to return to anthracite when it becomes available; so that the nuisance may become more widespread than ever before, and methods of combatting it of more general interest. The more common method first tried by most cities is that of placing an ordinance upon the books—and it has been proven as commonly inefficient. Probably the greatest success has attended moral suasion combined with eternal vigilance, moderation, and common sense. To apply these some practical method must be known which can be urged as an alternative to the objectionable methods complained against. It will not be enough to say, "you must not make so much smoke," but an answer must be ready for the retort, "are we then to shut down the factory?" The argument frequently advanced that the escape of carbon in black smoke causes a financial loss which it will pay to prevent can not be proved, it is thought, since such matter amounts to but a small percentage of the coal consumed (15 pounds of soot per ton of coal in the blackest smoke, or about 0.7 per cent.), and its value is not often equal to the cost of smoke consumers. It does not necessarily follow, however, that methods cannot be adopted by large plants which, while greatly decreasing the amount of smoke, will cause an economy of maintenance. The more complete burning of gases, and the more uniform and higher heat resulting from continuous stoking by mechanical stokers and from better oxidation by mechanical draught, larger grates, and other similar devices, are well worth while from the owner's view point. In this as in other reforms the public must be educated to expect better results, and then the owners must be made to feel the popular displeasure by detecting and publishing the names of offenders. This method, rather than spasmodic prosecution, has proved most successful. And the public sentiment must not be taken for granted; where, as was the case in at least one city, a pride is taken in the smoky atmosphere as indicating manufacturing activity and prosperity, anti-smoke legislation can have no effect.

One of the evils of a smoky atmosphere is the excluding of sunlight. Another cause of darkness, dampness and dirt is the height of modern buildings. In hundreds of buildings in many of our large cities are office rooms, sales rooms, sleeping rooms, which have never received one ray of direct sunlight. Darkness, dampness and dirt are the ideal conditions for the preservation and dissemination of many if not all species of disease germs. Sunshine is the most effective universal germicide known. Not only germ diseases, but afflictions of the eyes and nerves with probably many others, can be traced to such conditions as their cause. The rule which has been adopted in London, is that no building shall be so high as to rise above a line drawn at an angle of 45 degrees with the horizontal from the base of any building opposite either its front or rear; and I believe that the violation of this rule must in the near future cause weak eyes, pale cheeks, consumption and generally lowered vitality in large numbers of the clerks and business men of our largest cities.

Food Inspection.—Another class of preventative action is that of food inspection. Many cities and most states have on their books laws against food adulteration, the enforcement of which is in the hands of special agents. Few of the adulterations used are injurious to anything but the pocketbooks of healthy adults; but infants and invalids may receive great harm from so-called embalming or preservative substances. In the neighborhood of my own home the state inspector has found half of the milk dealers selling milk adulterated with formalin, borax and similar preservatives. Diluted milk may also be injurious, to infants especially, by depriving them of the full amount of nourishment required. Food inspectors are employed by all of the cities having more than 250,000 population, by all but 5 of the 23 having between 100,000 and 250,000 population; by 29 of the 40 having between 50,000 and 100,000 population; and by 36 of the 57 having between 30,000 and 50,000 population. There seems to be no relation between the numbers of inspectors employed and the population; Rochester employs twice as many as Newark, for instance, although having but two-thirds of the population; and New Orleans has three times as many as Philadelphia, whose population is more than four times as great.

The prevention of the spread of communicable diseases is in the power, and is consequently the duty of the city. Aside from the protection of the milk and water supply, this is best effected by quarantining and by isolation hospitals; by the use of disinfecting apparatus; and by compelling a proper care and disposal of the bodies.

Disposal of the Dead.—The disposal of the dead, by cremation or by burial, and the location of burial grounds are important subjects. The burial of New York's dead requires annually about 50 acres, or a square mile every 12 years. In view of this the question of cremation may well be considered by large cities where the cemeteries must ordinarily be situated several miles from the centers of population. There are certainly arguments in favor of substituting the crematory for the "potters field." There were 26 crematories in operation in the United States in 1901 and the number is slowly increasing; 13,281 bodies were cremated in this country in the last quarter of the nineteenth century. Even now, however, not more than one-fifth of one per cent. of the dead are cremated in the United States. Data concerning the cost of cremating and of burying the pauper dead in large cities would be of interest. Assuming the necessity of the cemetery, its location as affecting sanitary conditions and its treatment as a breathing spot or a place for a quiet outing are worthy of more consideration than is generally given them.

Abattoirs and Markets.—The providing of public abattoirs and markets and the proper regulation of them will go far towards insuring the people against decayed or stale vegetables and meat, "bob" veal, and other unhealthful kinds and conditions of food. More than 100 cities of the United States own their markets, and more than 50 of these have a population of less than 50,000; the South showing more in proportion to the total number of cities than any other part of the country. While the smaller cities may not be able to afford the public buildings, neither can they afford to do without careful and frequent inspection of all private slaughter houses and markets. A health officer, generally under the direction of the local board of health, is in most cases the agent for such inspection.

Public Fountains, Baths and Convenience Stations.—Public fountains and drinking places, the latter especially, are now considered a necessity in all large cities, and many small ones find them worth while. The cooling effect of a fountain in a small city park located in a congested district may mean increased health and even life to many a child and invalid, and render existence more tolerable to many a healthy adult; while the restful effect of splashing water is particularly soothing to nerves wearied of a city's jarring noises. In cities and towns of all sizes drinking fountains for horses, cattle and dogs are even more necessary than for men. Information concerning the amount of water required to maintain these and possible methods of preventing waste; the best locations for them and the number required; the supplying of both ordinary and iced water to human beings, and the automatic cleaning of the cups used; these and other points will reward investigation.

Public baths are of late becoming a more common municipal institution. To mention a few examples only, Boston, Mass.; Yonkers, Fonda, and New York, in New York; Newark, N. J.; Pittsburg, Pa., Chicago, Ill., and San Francisco, Cal., have public baths. In Boston's public schools baths are provided and are compulsory where the necessity for them is evident. In 1900 36 cities of the United States had either all the year or summer public baths. In these 36 cities are included all three of those having more than 1,000,000 population; 2 of the 3 cities having between 500,000 and 1,000,000; 3 cities having between 250,000 and 500,000 population, or $33^1/_3$ per cent.; 6 cities having between 30,000 and 50,000, or 10½ per cent.; 6 having between 10,000 and 30,000, or 2 per cent.; and 5 places having less than 10,000 and more than 3,000, or 0.5 per cent. In New York State, by an act of 1895, all cities of 50,000 inhabitants or over must provide public baths.

In Buffalo, Rochester, and Philadelphia—probably in other cities also—are public wash-houses for the convenience of the poor whose contracted living quarters do not admit of washing in their so-called homes. Both of these institutions encourage and assist in cultivating that personal cleanliness which must go hand in hand with perfect municipal cleanliness. A collection of information concerning the location, structural and mechanical details and administration and popularity of these would be helpful to many cities which are contemplating the introduction or extension of these efficient aids to sanitation.

In our larger cities latrines or convenience stations are a necessity which is but poorly met. Most large parks contain such stations; but in the business districts where thousands congregate daily the saloon or hotel for men and the larger dry-goods stores for women are looked to to furnish as a convenience (which the sensitive person feels should be paid for by a perhaps unwished for beer, cigar or ribbon) what the city should provide for all as their right. European cities are far ahead of us in this respect, although we would not be satisfied with the regard paid by them to more or less conventional modesty. New York has made a beginning of supplying such stations underground in the business district. The home water closet in the cellar, basement, or under the back stairs has been pretty well abolished; and while an underground municipal closet is better than none, it would seem that the same arguments which were advanced against the private dark-closet would hold against the public one.

Drainage.—There are two classes of wet lands often found in and near cities, and these should be drained—natural swamps, and lands flooded by street grading which are too low for a natural surface outlet. The latter are objectionable because making the ground in their vicinity moist for a large part of the time and thus causing damp cellars and unhealthful ground air; because they are used as convenient points for drowning cats and dogs and for the secret and convenient disposal of garbage and other refuse; and because they form breeding places for mosquitoes, which are both unpleasant and, it is believed, dangerous as carriers of malaria. Natural swamps are objectionable for the latter reason, as well as because they might if drained be utilized to some profit.

Earth Excavations.—The danger of sickness resulting from trenching or other excavation in the north is not so great as in the south; and yet epidemics of what is generally called malaria have undoubtedly accompanied many cases of wholesale excavation for sewerage or water works systems even at this latitude; while in the south yellow and other fevers are thought to result from excavations in hot weather. That such results can be avoided was apparently demonstrated in Havana, during the United States occupancy, when a large percentage of the streets was dug up for sewers and pavements during all seasons, while the sickness in the city meantime was but a small fraction of that which had always existed previously; the treatment of all fresh earth with chlorine obtained by the Woolf process being credited with the innocuousness of the excavations. Data going to prove or disprove the popular impression that excavations cause sickness, or to demonstrate under what conditions of temperature, soil or air this is true, would be of value.

Oiling Roads has been investigated by City Engineer E. W. Chase, of Colorado Springs, who reported that the best work he saw was in Chino, Cal., where the methods explained in The Engineering Record of March 30, 1901, are followed. He says that the people along the roads which have been oiled were opposed to the work, but after the oil was applied they discovered that it was not so bad as had been reported; and along roads and streets where the oil has been properly applied, or applied with an indifferent degree of propriety, the people are more than satisfied. Teamsters are especially enthused over the oil paved road, as it does away with the dust and mud. The road is somewhat heavier than when paved with other material, but is lighter than the natural soil or even the graveled road. The color of the road is a dark brown, pleasant to the eye, and quite in contrast to the glare of our own streets. For a short time after the road has been prepared with oil, there is quite a heavy odor, but Mr. Chase did not find it more unpleasant than that of an asphalt-paved street.

The Scope and Purpose of the Irrigation Investigations of the Office of Experiment Stations.

By Elwood Mead, Irrigation Expert in Charge. From the Report of the Office of Experiment Stations.

With relation to rainfall the territory of the United States is divided into three parts—the humid, the subhumid, and the arid. In the humid region the rainfall is ordinarily abundant, but there are occasional seasons when it is insufficient for the raising of crops, and in most seasons there are times when crops are checked in their growth by periods of drought lasting from a few days to a few weeks. The subhumid region includes the territory where dry periods in summer are the rule. The injury to crops in subhumid regions is due to two causes—insufficient moisture and great irregularity in its distribution. The arid region includes the areas where cultivated crops can not be grown by the aid of rainfall alone.

Geographically, these regions are arranged from east to west, although no exact line can be drawn separating them. The humid region, as generally described, includes all of the United States westward to a line which would cross Nebraska and Kansas about half way between their eastern and western borders. The subhumid region lies between the humid and arid regions, extending from the Gulf of Mexico to Canada and including irregular areas in the different Pacific coast States; while the arid region includes all the territory lying west of the eastern subhumid belt with a considerable exception along the Pacific coast, and with smaller local areas in each of the arid States.

Irrigation is employed as an aid to agriculture in all of these regions. It is a necessity in the arid region, of great value in the subhumid district, and is proving highly profitable in the growing of certain crops in the humid region. There are also large areas in the recently acquired insular possessions of the United States where irrigation is required, and where the value of the products permits of a large outlay to provide for its use. The work of the irrigation investigation of the Office of Experiment Stations covers therefore the whole of the United States.

Investigations in the Arid Region.—The greater part of the irrigation work of this Office has been carried on in the region where farming is impossible without the artificial application of water to crops. This includes all of the Territories of Arizona and New Mexico, the States of Colorado, Utah, Nevada, Montana, and Wyoming, and large parts of California, Oregon, Washington, Idaho, North Dakota, South Dakota, Nebraska, Kansas, and Texas. The greater attention paid to the problems of this section of the country is justified by the fact that here irrigation is a necessity rather than a valuable adjunct to agriculture. It measures agricultural settlement and very largely controls the development of other industries, because both the cost and comfort of living are very largely determined by the production of a home food supply. In the regions farther east, the adoption of irrigation is determined by whether or not it will improve conditions already favorable, but in the arid region it is the choice between civilization and desert condition.

The work in this region has followed two general lines—agricultural and engineering, legal and social. Of these, the legal and social problems present the greatest difficulties and stand most in need of an early solution. The success of irrigated agriculture in this region requires first of all the creation of institutions which shall offer a just and adequate foundation for future development. Such a foundation requires that the users' rights to streams must be clearly defined in order that those who now use streams and those who expect to use them may understand how much of the water supply is appropriated and how much remains open to appropriation. The litigation and controversy which now menace communities and which are a constant source of anxiety and loss to irrigators should be brought to an end. In order to effect these desirable reforms, a knowledge of certain essential facts is required. Among these are the quantity of water required to grow crops, the losses from seepage and evaporation in distribution, the character of the control over streams already vested, and the kind of administrative measures needed to insure effective division of streams among the multitude of users who depend thereon. Specific information along these lines is indispensable to wise and effective action in the future either by the Government or by individuals. It is the information which should have been gathered at the very outset of this development, but the long delay in its collection renders it all the more urgent that it be carried on now to an early and effective completion.

The work along agricultural and engineering lines has been largely carried out in cooperation with the agricultural experiment stations of the different States, and with the State engineers in States having such officials. By undertaking systematic work on some of the general problems of irrigation, this Office has been able to supplement and extend the work of the experiment stations, and at the same time has aided them to take hold of other studies, such as problems relating to the economical use of water on different crops. It makes possible the bringing together of observations from the whole country. It promotes uniformity of methods in these investigations and thus gives to the results a wider value than is possible with each station working independently and alone. It brings together the experience of the whole irrigated West for the use of each locality, and shows the farmers of one section where their practices can be improved by adopting those of other and oftentimes far distant sections.

Agricultural and Engineering Problems.—The studies of the practical questions involved in diverting water from streams, transporting it through canals and ditches, distributing it over the land, and determining the requirements of different crops have been carried on in all of the arid and semiarid States with one exception. In general, the results of this work show that the losses in distribution are much greater than has usually been supposed, and that the quantity of water required, where these losses are included, is somewhat greater than has been estimated by many writers on the subject or stipulated in many water-right contracts. The stations for the measurement of the duty of water are scattered over nearly one-third of the United States. The averages of the different measurements for the past two years show a surprisingly close agreement when this wide range of conditions is considered, as appears from the following summary:

	Feet.
The average depth of water applied to crops in 1899 was	4.35
The average depth of water applied to crops in 1900 was	4.13

One of the results of this work has been to show the importance of keeping canals in good condition, and to emphasize the benefits resulting from diminishing as far as possible the losses by percolation. Measurements show that the loss from seepage and evaporation in ditches and canals varies from 15 to 70 per cent. of all the water taken in at their heads, and that by far the greater part of this loss is due to seepage. Formerly many believed that most of the loss was due to evaporation, and was therefore beyond the power of man to remedy. Now that it has been demonstrated that the water disappears through the sides and bottoms of ditches and canals, steps can be taken to improve these channels and the loss stopped to a great extent. Improvements of this character will increase the area which can be irrigated, and save much land for productive agriculture which would otherwise become swamps and marshes.

The difference between the high and low duties obtained under practically the same conditions shows that where water can be had in abundance the natural tendency is to use too much, resulting in a reduction in the yield of crops, a temporary injury to the land, and a limitation of the area which can be irrigated with the available water supply.

In many localities a lavish use of water has converted areas once arid into alkali marshes, of which the only product is cat-tail flags, and made drainage necessary at a cost fully as great as was required to provide the water supply in the first instance. The need of this drainage might have been avoided in many cases had canals been constructed with more care and the evil results of overirrigation appreciated at the outset.

The soils of the arid region are rich in mineral ingredients. This is due in part to their origin and in part to the scanty rainfall, which has not been sufficient to wash out the soluble elements, as has been the case in humid regions. Because of this there are large areas which are highly charged with alkali. The tendency of irrigation is to leach these salts out of the higher grounds and concentrate them in the lower lands. Evaporation tends to bring them to the surface, where they accumulate in such quantities as to kill vegetation. The remedy is to be found in drainage, and this investigation has been called upon to assist in solving the larger engineering and legal problems connected with the formation of drainage plans. As some of these districts embrace in the aggregate many thousands of acres, in which not only the alkali but the water plane has risen until it has reached the surface, it is necessary that the plans should be comprehensive, and must include provision for removing the surplus water as well as the salts which are to pass with it. Drainage studies must include the causes of their being flooded and a determination of the source and volume of the water to be removed. Drainage and irrigation are a part of one whole, and their investigation should be carried on together. The office is now engaged in this work in Colorado and California.

The publication and circulation of the facts being gathered regarding the injuries resulting from excessive losses in distribution or wasteful use will go far to prevent a recurrence of such injuries in other localities where irrigation is yet in its infancy. Another result will be the reclamation of more land than would otherwise be possible.

Instruments for Measuring Water.—In carrying on the measurements of water it was found that the instruments used were in many cases not suited to the work required of them, and were so expensive as to limit their use generally to Government and State work. With the progress of the work of the investigation there has been a growing demand for instruments which will do accurate work and at the same time be within the reach of canal companies and individual irrigators. The instruments most used are the current meter and the register for keeping a continuous record of depth of water at any point. Efforts have been made to cheapen these instruments and at the same time increase their efficiency. Little has been accomplished with the current meter, but the water register has been so simplified as to reduce its cost by more than half without any sacrifice in accuracy.

Legal and Social Problems.—The measurements made to determine the quantities of water used and the losses from canals has another object besides the improvement of agricultural practices. It is a principle of irrigation law, in theory at least, that rights to water are based on beneficial use; that is, a person or company can maintain a right to only so much water as he or it can put to a beneficial use in irrigation. It is of first importance, therefore, to know how much water is needed to grow crops on a given area, in order that courts and boards of control may intelligently determine the amount of rights to water, and officers charged with this duty be able to prevent wasteful use by those who have early rights or a desire to monopolize the supply. Because of the lack of this information, rights to water have too often been established without any regard to the volume of the stream, the capacity of canals, or the needs of the land to be irrigated. The attempt to utilize such excess rights can lead to nothing else than continued litigation and trouble. The facts gathered in these investigations are already being eagerly sought as a guide in the establishment of water titles, and they are certain to prove one of the most effective agencies in preventing erroneous or excess decrees in the future.

A knowledge of the extent of the losses from canals is also necessary to the proper distribution of the supply. Appropriations usually contemplate the measurement of the volume allowed at the head of the canal, hence the amount granted should be great enough to meet all the necessities of crops and also to allow for losses in transit. If this estimated loss is too large the volume taken in at the head gate will be greater than the needs of the land irrigated, but if too small irrigators will suffer. Excessive allowance for these losses puts a premium on poor construction, hence data is needed to show what are reasonable losses and to prevent anything above this. Where losses can be stopped appropriations should be cut down in order to compel ditch owners to make them economical water carriers. Losses which can not be stopped should be provided for.

Along with the observations and experiments in the use of water has gone a study of the laws and customs which control its distribution. This study reveals the fact that the development of irrigation law has not kept pace with irrigation engineering or agricultural practices. As the need and value of water has increased, engineers and farmers have found ways to conserve the supply and economize in its use. But it is too often the case that this increase in value has only added to the uncertainty as to titles, since it presents greater inducements or temptations to those holding inferior rights to try to secure a larger share of the supply. The absence of tribunals for the final establishment of water titles, and the lack of public control over the division of streams, puts upon the holders of the older and better rights the burden of protecting their interests either by force or in the courts. The greatest need of irrigation is legislation which will end this uncertainty and controversy, but from the nature of things such legislation is hard to secure. Conservative legislative bodies are slow to act, and they often have not the information on which to base intelligent action, even if they have the desire to do all that should be done. The conflicting views of appropriators of water make it impossible to enact any effective law which will not be strongly opposed, or which will not work hardship to some individual. The work of this Office is limited to collecting and publishing information, with discussions by experts whose broad views enable them to better interpret the facts than is possible where details and local interests obscure the general policies which should prevail.

Studies of irrigation laws and customs have been made in connection with the measurements of water in all the arid States and Territories. Comprehensive studies of irrigation laws and customs have been made in California and Utah. A report dealing with the agricultural situation in California has just been published. This study was undertaken in response to a petition from the citizens of that State in the hope that a clear statement of existing conditions would help toward the enactment of a comprehensive code of irrigation laws.

A similar study has been made in Utah, and the reports of the different observers are about ready for publication. These reports will show that titles to water in that State are far from being stable or secure, and that there is urgent need of a cheaper and simpler method by which they can be permanently settled.

The conditions found in California and Utah are not peculiar to those States. They are common to nearly all the arid States. Their betterment is the first step in the successful or the complete use of Western water supplies. As has been said, the work of this Office can not extend to the enactment of laws. It must stop with showing existing conditions and pointing out remedies for the evils found. With this end in view the laws of not only our own States, but of Canada, Australia, Europe and Egypt, are being studied in order that the best lessons from the experience of all the world may be within the reach of those who must enact the laws which will protect and encourage investment in irrigation enterprises.

Not less important than the system of irrigation laws is the character of the organizations which control the water supply under these laws. Irrigation is essentially a cooperative industry. In its beginning small ditches were sometimes constructed by individual farmers, but opportunities for such construction are practically all utilized. The large canal covering the lands of many farmers is in most remaining cases the only possible one; hence the existence of the industry calls for organization and cooperation, and in most cases not only cooperation of farmers but of capitalists as well. The problem to be solved here is how to secure returns upon the capital invested and at the same time keep the land and water within the reach of the poor man, the only man who is seeking for a new home. This problem has not been solved in this country. It is one which must be solved before irrigation can go much further.

Under the laws of many States water rights are granted to the canal companies. In those States the rights of the farmers depend on the form of the organization of these companies rather than on the laws. The reports of this Office show that the peace and prosperity of many communities, as well as the economy with which water is used, depend almost wholly on the rights of the individuals under the companies. This study of organization and its effect on development is being carried on wherever the measurements of water have been made.

In this connection it seems proper to reiterate the views expressed in a former report on the subject of water rights. The first step in future development should be to reach an enlightened agreement regarding the true character of these rights. The idea of private ownership in water apart from land can not prevail without creating institutions essentially feudal in character. To give to companies or individuals the control of streams, and make the farmers who use those streams dependent for their rights on the conditions which these companies impose in private contracts, is to make the water company the practical owner of the land it serves and the irrigator and farmer a tenant. A proposition which would contemplate turning over all the land of the West to private monopolies and making those who have homes upon it dependent upon these monopolies would not command popular support, but the idea of private ownership in water, amounting to a virtual monopoly of this vital element, has been permitted to grow up in some sections of the West. To a certain extent it has obtained recognition in legislation and protection in judicial decrees and decisions. Such a doctrine meets with no favor in other irrigated lands, and should in this country give place to the more just conception that rights to water should be restricted to the right of use, and that ownership should not be vested in either companies or individuals, but in the land itself. When this principle is adopted the control of water is divided like the control of land among a multitude of proprietors; water monopoly is impossible, and no other abuse or injustice is encouraged. Years of experience in other lands and the limited experience of this country have abundantly proven that peaceful and orderly development can not be realized except as water and land are united in one ownership, and canals treated as public or semipublic utilities rather than as a means of fastening a vicious monopoly upon communities.

Irrigation in the Subhumid Portions of the United States.—The subhumid portions of the United States possess certain advantages in the employment of irrigation which must in time greatly extend its application in this section of the country. There is a greater rainfall and a more humid atmosphere than in the arid region, so that a given water supply and a canal of given dimensions will irrigate more acres than in the region wholly arid. Much of the subhumid district east of the Rocky Mountains is remarkably well suited to the distribution of water in irrigation. The slope of the country away from the mountains is about what is needed for the construction of canals and the distribution of water over the ground. The practical obstacles to be encountered, either of an engineering or agricultural character, are less, as a rule, than in either the arid or humid sections, and the cost of supplying water is proportionately reduced. Important studies have been made during the past year in this region by Prof. O. V. P. Stout, of the Agricultural Experiment Station of the University of Nebraska, acting under the direction of this Office. This station is in a section where lands have been cultivated for many years, and where agriculture is a demonstrated success without the aid of irrigation. The question to be settled is whether the use of water on general farm crops will give sufficiently increased yields to repay with a profit the cost of providing the water supply and distributing it over the land. Results thus far secured show that it will. The maximum yield of corn in this locality without irrigation is about 40 bushels per acre, while the lands irrigated during the past year yielded from 40 to 60 bushels per acre, with a maximum yield in rare instances of 90 bushels per acre. Two adjacent fields, one irrigated and one depending on rainfall alone, yielded 66 bushels and 20 bushels per acre, respectively.

The methods of diverting and applying water were those of the ordinary irrigator; the soil and climate were typical of the territory which extends westward from the Missouri River for

250 miles, and the results can fairly be taken as representing what may be expected in seasons of scanty rainfall throughout the greater part of the subhumid district.

Irrigation in the Humid Portions of the United States.—The experience thus far gained makes it certain that irrigation is destined to be an important means of improving the already prosperous conditions of agriculture in humid and subhumid portions of the United States. The possibilities along this line have not yet been fully established, but the lessons thus far learned seem to be that it has a wide field of usefulness wherever intensive agriculture is practiced or where insurance from drought is important. The irrigation investigations of this Office now include a study of the problems of irrigation in this region—in Wisconsin and Missouri, to determine what can be done in the States of the Middle West; in New Jersey, to ascertain its field of usefulness in the North Atlantic States; in the Carolinas and Georgia, to determine its possibilities in the South Atlantic region; and in Louisiana and Texas, in connection with the increasing use of irrigation in the production of rice.

During the past season studies of the benefits of irrigation in Wisconsin have been carried on under the immediate direction of Prof. F. H. King, of the College of Agriculture of the University of Wisconsin, at the station farm at Madison and at Stevens Point. In both cases the water supply had to be provided by pumping, and records have been kept to show the amount of water used, the time of its application, the cost of pumping, and the increase in yield of the various crops to which it was applied. Owing to the exceptional drought which prevailed, the results were highly favorable to irrigation. If the results of one season's trial would justify drawing definite conclusions, it would be that irrigation in Wisconsin is a marked success; but that is not the case, and it is the intention to continue these studies for a number of years, the work being broadened so as to include all the crops which promise beneficial results.

A cooperative investigation in irrigation is also being carried on between the Missouri Experiment Station and this Office at Columbia, Mo., under the direction of Prof. H. J. Waters. Apples, strawberries, and nursery stock were the crops receiving the most attention, arrangements for the water supply not having been completed in time to prepare for its application to other staple farm crops. Careful records were kept of the quantity of water used, the cost of furnishing it, and the time of its application. The report of Professor Waters states that "the season was very disastrous to strawberry plants, many of the old plants dying, and practically no runners being formed under ordinary treatment. The irrigated plants developed strong crowns, and undoubtedly stored an abundant supply of food for next year's crop. The strawberry nurseryman, the man whose business it is to supply plants for the commercial strawberry grower, will find in irrigation absolute protection against failure." It will require next year's record of the yield to determine the full measure of the benefits of this year's irrigation. Referring to the result of this year's watering of nursery stock, Professor Waters believes that nurserymen will find irrigation exceedingly profitable, that it will result in securing larger growth in young trees, trees with better formed heads, and possibly a saving of one year in the time when nursery stock can be placed on the market. He also believes that the protection of bearing trees from injury by drought is a matter of very great importance, because this injury often extends beyond the season when the scarcity of water begins.

In the North Atlantic States the large area devoted to market gardens makes security against drought a matter of much importance. Throughout this region the average rainfall provides sufficient moisture if properly distributed, but short droughts just at the time when the crops are maturing frequently cause heavy losses. In many years no such droughts occur, but they come often enough to make the growing of vegetables and small fruits uncertain. The problem to be solved is whether the saving of an occasional crop and the increased yield of many crops will repay with a profit the cost of providing a water supply. The study of these questions is being carried on by this Office in connection with the agricultural experiment station in New Jersey, Prof. E. B. Voorhees, director of this station, being in charge. His experiments, so far reported, have been limited to small fruits. They show that, in case of almost all varieties, the increase in the product of the irrigated tracts over the unirrigated ones was considerably more than enough to pay in a single season the entire cost of providing the water supply as well as the expense of applying it.

In addition to making experiments with small fruits, Professor Voorhees collected data from private parties in regard to the irrigation of various kinds of garden truck. In most cases the results were equal to those obtained in the experiments made under his personal direction, paying the entire cost of installing the pumping plants, with a profit, in a single season.

An analysis of the rainfall records at Philadelphia, covering a period of seventy years, shows that in considerably more than half the years there was a lack of rainfall in some one month of the growing season to seriously affect the yield of small fruits and garden vegetables, which constitute so large a part of the products of the Eastern farms. Taking Philadelphia records as typical of the eastern United States, and the results so far obtained in New Jersey as a basis for deduction, it will be seen that an irrigation plant would be a profitable investment for most of the farmers living where our large cities provide a ready market for small fruits and vegetables.

It is not likely that the water-right problems which are so large a factor in Western development will prove of equal importance in the East, owing to the larger flow of streams and the fact that the areas to be irrigated will always be restricted, but in many localities there are already indications that important legal problems will have to be solved before irrigation can safely assume the importance which its value will naturally give it. The work of this investigation along the legal and social lines can well be extended to this section. The experience of the West will in time come to be of value in solving the water problems of the East.

Among the important work which needs to be done in the East along agricultural and engineering lines is a study of the cost of installing and operating pumping plants for small areas. Something has already been done along this line and arrangements are being made to continue this more effectively in the future.

During the past season the problems of rice irrigation have received much attention from this Office. The investigations inaugurated have been principally along agricultural and engineering lines. In the Carolinas it has included a study of the methods of storing water to provide a supplemental water supply; the methods of diverting and distributing it over the fields and the problems connected with the regulation of tidal rivers so as to determine what may be done, either by the Government or by the concerted action of private individuals; and the construction and maintenance of levees for the protection of fields against floods or injury from breaks above or below.

Rice growing in the Carolinas and Georgia is not as important an industry as it was fifty years ago. In part, this decline is due to the cost of labor. The rice fields are located along the low alluvial bottom lands where the greater part of work must be done by hand. This leaves only a small margin of profit at present prices, and the danger of this being occasionally lost through breaks in levees or river floods has tended to retard a revival of what was once an important and valuable industry.

There seem to be two or three questions which this investigation can properly deal with. One is to what extent State or Government aid is required to assist in the regulation of streams, and to study the topography and watersheds of streams to ascertain what measures may be taken to furnish a supplemental water supply through storage.

The growing of rice on the uplands in Louisiana and Texas presents an entirely different condition of affairs. Here the industry has been from the first unusually successful, and it has increased until it has assumed a national importance, promising to make the United States an exporter instead of an importer of this staple product.

Aside from the agricultural questions peculiar to rice farming, the irrigation of these uplands presents new problems in canal construction and the lifting of water. In the arid region streams as a rule have a heavy fall, and it is therefore easy to get water onto the lands to be irrigated by gravity. In the rice districts the water supply is below the lands to be served, in streams which have hardly enough fall to produce a perceptible current, and the water must therefore be raised by pumps. Even with this expense, rice growing has proven remarkably profitable. The rice lands, which were formerly worth from $1 to $3 per acre, and used only for grazing, now sell for from $30 to $50 per acre, and yield an annual return equal to the value of the land. About 250,000 acres of these lands have already been devoted to rice culture, and much more is capable of the same use.

Along a few of the streams used more land has already been devoted to rice than the streams can properly water, and the question of protecting the early users against the demands of those coming later is pressing for settlement. Louisiana has no laws or customs affording this protection. The publications of this Office place at the command of the canal owners and lawmakers of that State the results of the experience of other States and countries, and will afford them the means of enacting a just and intelligent law governing water rights whenever such action becomes necessary.

A report will soon be published showing the methods used in irrigating rice and discussing the problems which have arisen in the rice districts. This investigation should be continued by the experts employed by this Office, whose familiarity with conditions elsewhere makes them especially fitted for the solution of the problems arising in this new field.

Irrigation in the Insular Possessions of the United States.—During the past summer officials of the Hawaiian Islands requested this Office to make such investigation of the irrigation problems of these islands as would furnish the facts needed in framing an effective code of irrigation laws. The need of such legislation is becoming urgent. Large investments in irrigation works to supply water for the growing of cane have made the subject of water ownership and control one of the most important internal questions of these islands. Proposals have been made by private parties to purchase from the government all of the water rights attached to public lands. Wise action on such proposals will be promoted by a thorough investigation of agricultural conditions and the prospective needs of irrigators. An agent is now engaged in collecting facts as to the use of water on these islands.

Large areas in Porto Rico to be productive require irrigation. Legislation will therefore be needed for the establishment of water titles and to protect the holders of these titles in times of scarcity. It is now admitted everywhere that if water laws and land laws had been framed and administered together in the settlement of the arid West many of the complications which now exist could have been averted. The opportunity is now open for inaugurating a comprehensive code of laws in Porto Rico which shall control development from the outset, and it is believed that an investigation to determine the facts on which such laws should be based should be inaugurated at once.

Interurban Road Improvements.

Extracts from a report to the American Society of Municipal Improvements, by Nelson P. Lewis, Chairman Committee on Street Paving.

Whenever suburban districts are added to our cities, there is immediately presented the problem not only of maintaining such improved streets or roads as the new territory may possess, but the extension of those improvements on a scale suitable to the needs and requirements of the community. The urban resident, too, is not content to be limited to the paved streets of his own town and to flounder in a sea of mud or be covered with dust whenever he attempts to leave them. He wants good roads leading out into the country on all sides, while those who supply his table with garden produce must have good roads on which to transport it. The prosperity of a city and the comfort of each citizen can be truly said to depend upon the character of the highways leading out of the city as well as upon that of the street upon which he lives or those which he traverses in his daily duties.

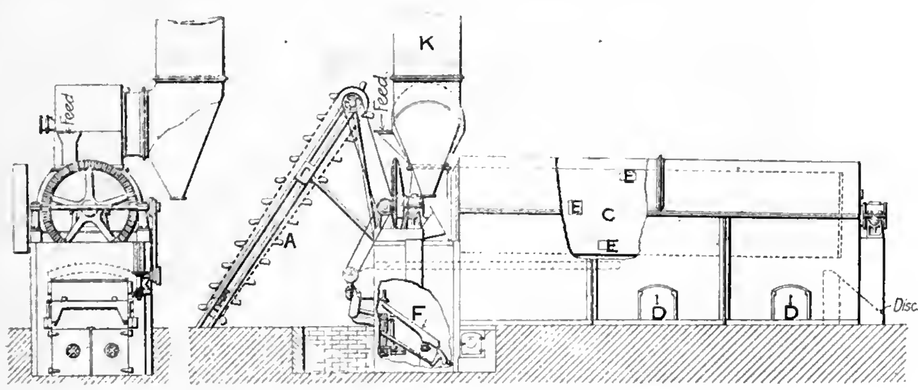
It is time, therefore, that the subject of roads, as distinguished from city streets, should receive the consideration which its growing importance merits. The building of a system of roads to connect different cities and towns, if left to the initiative of the towns themselves, would be almost impossible of consummation. The State alone is capable of planning and executing such an improvement. It is advisedly called "an improvement" for it should be complete in itself and result in unifying the Commonwealth as nothing else could do. The first State to take up this question on an extensive scale was New Jersey, which has now a splendid system of highways connecting nearly every city and village within its borders. Massachusetts has for some years been creating an excellent system of modern roads and in a manner characteristic of the old Bay State, her Highway Commissioners are doing their work with exceptional thoroughness, giving much attention to details of grade, alignment, drainage and the general appearance of the roadside. During the last few years New York has devoted much attention to the subject of roads and many miles of fine highway have been built and are under construction.

It will be seen that the propaganda which may fairly be said to have been started by the bicyclists a few years ago has been steadily gaining ground. The automobile is now an important ally of the good roads advocate, and the sane driver of the horseless vehicle who has some regard for the rights and safety of his fellows can add a great impetus to the movement, though at least one instance has come to the notice of your Committee where a proposition to bond a town for the purpose of building several modern highways was defeated by popular vote solely as a result of accidents caused by the outrageous disregard of the safety of the general public shown by the drivers of high speed automobiles. These high speed cranks are the worst enemy of the good roads cause.

But the building and maintenance of macadam roads is not only of interest to the small city and the good roads enthusiast. Many of our larger cities have miles of their streets so improved and they are, as a rule, grossly neglected, while such repairs as are made, are carried out in an unintelligent and extravagant manner. According to the bulletin issued by the United States Department of Labor in September, 1899, giving statistics of cities, 140 cities containing over 30,000 inhabitants have over 82,000,000 square yards of macadam, which is equivalent to more than 4,650 miles of roadway 30 feet in width. The proper building and intelligent care of such roads, therefore, cannot be a matter of indifference to our larger cities, but it is one of the most vital importance.

A Self-Contained Dryer.

The self-contained dryer shown in the accompanying illustration has been designed without any very heavy parts in order that it can be dismantled and moved to a new site without difficulty. It is enclosed in a steel casing, lined with firebrick on the sides, and the cover has a fire-proofing protection. The illustration shows the dryer fitted with the makers' type of mechanical stoker, but the furnace can be arranged with grates for burning any kind of fuel.



The Cummer Self-Contained Dryer.

The material to be dried is lifted by the elevator A into the feed hopper, discharging into the drying cylinder C, which is driven by the large pulley and gearing shown in the end elevation of the apparatus. The shaft of this pulley carries a cone pulley which drives the belt operating the stoker. The heated air from the furnace is drawn into the cylinder through the square openings E, and after passing over the material to be dried is forced up the stack K by a fan in the horizontal flue at its base. The holes E are protected by hoods which prevent the material from dropping out while permitting the free entrance of air. There are registers, D, in the sides of the casing, which are used for regulating the temperature of the air before it is admitted to the cylinder.

The dryer is made in several sizes by the E. D. Cummer & Sons Co., Cleveland, for use with coal, stone, marl, clay, slag, ores, concentrates and other materials.

Trade Publications.

The Massachusetts Fan Co., Waltham, Mass., has issued a special catalogue, No. 50, devoted to the Davidson propeller fan and its adaptation to heating, ventilation, drying and kindred uses. The fan is designed particularly for the movement of large quantities of air at comparatively low pressures and is constructed to operate at high speed, if necessary, being proportioned to withstand a rim speed of 10,000 feet per minute. The Company has also brought out two bulletins. No. 67 describes the Stirling disk fan and the Simplex ventilator fan, the former provided with 12 blades which overlap one another to prevent back lash and to effect a large air delivery against pressure. No. 68 illustrates the details of direct-connected motor-driven Davidson propeller fans.

"A Crocker-Wheeler Trolley Trip" is the title of an attractive booklet printed for distribution by the Crocker-Wheeler Co., Ampere, N. J. It describes a trip over the Flint Division of the Detroit United Railway from Detroit through the towns of Royal Oak, Rochester, Romeo, Oxford and Flint. At Rochester is the power house, which is equipped with Crocker-Wheeler electrical machinery.

The Chicago Pneumatic Tool Co., Fisher Building, Chicago, has issued a catalogue of air compressors which it builds in sizes ranging from a capacity of 95 cubic feet of free air per minute to 2,052 cubic feet and of the single, duplex and compound types. The book describes in considerable detail, by the aid of excellent halftone cuts, the various parts of the machines and gives some valuable information on the uses of compressed air and the effect of compounding, cooling, intercooling, aftercooling and reheating. A number of useful tables are also included.

The Fort Wayne Electric Works, Fort Wayne, Ind., has now ready for distribution three bulletins, an instruction book for the proper installation of Wood ammeters and voltmeters and a flyer devoted to the Wood Type A oil transformers. Bulletin No. 1028 describes in detail the Wood enclosed direct-current arc lamps for operation two in series on 200 to 250-volt circuits and five in series on 500 to 575-volt circuits and Bulletin No. 1029, enclosed direct-current arc lamps for 110-volt circuits. Bulletin No. 1034 covers standard small motor panels in sizes from 1/4 to 30 horse-power for 115, 230 and 500-volt circuits. These boards are equipped with automatic overload and underload release. Type A transformers, described in the flyer, have capacities of 0.6 to 50 kilowatts and primary voltages of 1,000 or 2,000 volts with secondary voltages of 50 or 100 and 100 or 200 volts.

A 77-page catalogue on "Electric Locomotives for Surface Haulage" has been published by the Baldwin Locomotive Works, Philadelphia, and the Westinghouse Electric & Manufacturing Co., Pittsburg. The standard types and classes are enumerated, and a general description of their construction, both the mechanical and electrical features, is given, together with tables of weights and characteristics of each class. Some 22 full-page reproductions from photographs serve to show their varied and widespread adaptation.

The Aceterator is an acetylene gas generator, adapted for out-door subsurface installation. It was developed to provide a generator that could be placed entirely outside the building and has allowed for the use of a large gas holder. A booklet describing it and the method of supplying illumination to a house may be obtained from Ralph B. Carter, sales agent, 26 Cortlandt St., New York.

The H. W. Johns-Manville Co., 100 William St., New York, has prepared for general distribution a booklet, Catalogue V, on Vulcabeston packing, which is composed of asbestos combined with vulcanizable gums to render the packing tough, pliable and yielding. It is furnished in sheets and rolls, in the form of a flexible rope for piston rod packing and for rope rings and gaskets, in moulded form for gaskets for pressure of 200 to 250 pounds, and in the form of convex and concave packing rings. A detailed price list is included for each case.

The Buffalo Forge Co., Buffalo, N. Y., has issued a 52-page catalogue which will prove of particular value to those engaged in the choice of equipment for industrial works. It is devoted to the Buffalo down-draft stationary and heating forges, containing illustrated descriptions of the various classes of this apparatus, together with data concerning blowers and exhausters for use with them.

The Sunlight Lava Mfg. Co., Chattanooga, Tenn., has issued a catalogue of acetylene gas burners. These are made of a solid piece of talc, designed to consume ¼ to 1 foot of gas per hour, except some small ones for bicycles, lanterns, etc.

To all lovers of the æsthetic in municipal betterment, the 1902 Year Book of the Municipal Art Society of New York will be found very interesting. The society has a number of committees on different work and all seem to have been quite aggressive and fairly successful. The lines followed have included signs and street fixtures, private advertising signs, parks, thoroughfares, and flowers, vines and area planting.

A good presentation of the subject of the purification of water for boilers has been prepared by D. W. & R. P. Patterson, Harrison Building, Philadelphia, including not a little of the chemistry involved. The work has been produced to show the advantages of the Bachman system of water purification, which they control, and describes in some detail the apparatus required for plants of less than 500-horse-power capacity and for those of 500 to 3,000 horse-power.

A new design of friction water-wheel governor, made to transmit, if necessary, 5,000 foot-pounds per second to the turbine gate, has been built by the Woodward Governor Co., Rockford, Ill. A feature of the governor, which is known as Size B, Compensating Type, Horizontal Model, is a device to provide that the gate is moved to that point which will give the correct speed after the momentum of the machinery has been overcome. The governor is described in a circular issued by the company.

Personal and Obituary Notes.

Mr. Herbert Conant has been appointed town engineer of Attleboro, Mass.

Mr. John B. Heim has been re-elected superintendent of the Madison, Wis., water-works.

Mr. Walter Brown has been elected county surveyor of Franklin county, Columbus, O., succeeding Mr. Henry Mætzel.

Mr. E. T. Perkins, of the U. S. Geological Survey, has charge of an engineering corps for irrigation study along the Colorado River from Needles to Yuma.

Mr. C. S. Brice, who several months ago succeeded Mr. J. J. Patterson as division engineer of the Montana Central Railway at Great Falls, Mont., has resigned.

Mr. Alten S. Miller, consulting engineer of the Consolidated Gas Co., of New York, has been appointed general manager of the Consolidated Gas Company of Baltimore.

Mr. J. K. Wilkes, formerly in charge of sewer construction in New Rochelle, N. Y., has been appointed chief engineer of sewers of that city, succeeding Mr. L. E. Van Etten, resigned.

Mr. James W. Johnson, for nearly 14 years city engineer of Riverside, Cal., has tendered his resignation in order to devote his time to other work which will take him out of that city.

Messrs. Elliott & Eaton have opened offices in the Keystone Building, Pittsburg, to practice general engineering, including the construction of coke plants, electric and steam railroads, foundations, buildings and bridges.

The Buffalo Chapter of the American Institute of Architects has elected the following officers: President, E. B. Green; first vice-president, H. O. Holland; second vice-president, R. A. Wallace; secretary, F. A. Whelan; treasurer, M. G. Beierl.

Mr. Emmett A. Gould, for thirteen years superintendent of the Eastern Division of the Wabash Railroad at Peru, Ind., has resigned that position to succeed Mr. Daniel Hardy as general superintendent of the Missouri Pacific Railway at St. Louis.

Mr. W. S. Henning, who has been resident engineer for the Houston & Texas Central Railroad for a number of years, has resigned to accept a similar position with the Southern Pacific Company and Mr. Hans Helland has been appointed as his successor, with headquarters at Ennis, Tex.

Mr. Thomas Appleton, M. Am. Soc. C. E., has been transferred from the construction department of the U. S. Life Saving Service to the office of the Supervising Architect of the Treasury Department and has been detailed to superintend the construction of the new post office at Creston, Ia.

Messrs. Norman B. Livermore & Co., who organized recently at 320 Sansome Street, San Francisco, to conduct a general engineering business, have been appointed Pacific Coast agents for the Wm. B. Scaife & Sons Co., of Pittsburg, for the sale of the water softening and purifying systems of that company.

Clarence E. Pullen, at one time surveyor general of New Mexico, died October 8 at Bangor, Me., aged 52 years. He was graduated from the Massachusetts Institute of Technology, began engineering in construction work on the Bangor & Aroostook Railroad and was afterwards connected with the Atchison, Topeka & Santa Fe Railway.

The New Jersey Chapter of the American Institute of Architects has elected the following officers: President, Herman Kreitler, of Newark; first vice-president, F. W. Wentworth, of Paterson; second vice-president, Robert C. Dixon, Jr., of Union Hill; secretary, Hugh Roberts, of Jersey City; treasurer, Thomas Cressey, of Newark.

Mr. Richard W. Sherman, M. Am. Soc. C. E., has received the Democratic nomination for the office of state engineer and surveyor of New York State. From 1866 to 1873 he was engaged in railroad engineering work, and since that time has largely devoted his time to municipal work, chiefly to the construction of water-works. In 1886 and 1887 he was engineer of Oneida county and only recently was mayor of Utica.

Mr. J. C. Irwin has resigned as engineer of signals of the New York Central & Hudson River Railroad, to enter the operating department. Mr. Peter G. TenEyck has been appointed his successor, and Mr. John Roberts succeeds Mr. TenEyck as supervisor of signals of the Middle Division. Mr. Thomas A. Lang has been appointed engineer of construction in the Pennsylvania Division, with headquarters at Mahaffey, Pa.

Capt. Eugene W. Van C. Lucas, Corps of Engineers, U. S. A., has been ordered to Memphis to relieve Captain E. E. Winslow, Corps of Engineers, of the duties in connection with the First and Second Districts of the Mississippi River improvements, and Capt. Winslow is to assume the duties performed by Capt. Lucas, with headquarters at Wilmington, N. C. Lieut. Lytle Brown, Corps of Engineers, has been assigned duty at the West Point Military Academy.

A New Meter Ordinance has recently been adopted in Madison, Wis., for the purpose of making landlords responsible for the water supplied to tenants. It reads as follows: "Water rents, when first collected for new buildings, or when water is first put in old buildings, shall be charged and collected as follows: The rent for the first semi-annual period, or for the part thereof remaining until the next first day of January or July proportionately, at the schedule rate and thereafter according to the quantity used, as shown by the meter. If at the end of said first semi-annual period the meter shows less water used than the amount paid would entitle the consumer to at regular meter rates, then the consumer shall receive credit for the difference on his next six months' water rent. In cases of change of tenants, where water rent is delinquent when a tenant moves out of a building, the water rent, so delinquent, shall be charged and collected from the owner of the premises and it shall be the duty of the superintendent to immediately notify such owner of such delinquency, and to shut the water off from the premises, and the water shall not be again turned on for such premises until the water rent, with penalty, is paid to the city treasurer."

Oiled Shell Roads have recently been constructed in Galveston, Tex., by methods which City Engineer C. G. Wells outlines substantially as follows: The subgrade of sand is first soaked with water and compacted by ramming. It is then covered to a depth of 9 inches, and rising about 2 inches above the finished surface grade, with a mixture of 80 per cent. rotten shells, 8 per cent. terra-cotta clay and 12 per cent. water. This is dredged from reefs in the Bay. It is allowed to stand until the surface is nearly dry, which usually occurs in about two days, and is then worked to grade with a 6-ton roller. Finally it is thoroughly sprinkled with crude oil, and a month later is again oiled. Oil costs 60 cents per barrel, and its total cost on the road is 0.56 cent per square yard, including labor. The amount of the other items of the roadwork is 31.5 cents per square yard. About 18,000 square yards of street have been surfaced in this manner, and after two months' service under heavy teams there has been no appreciable wear. If they hold up for a year, it is proposed to surface all unpaved streets in this way.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvii, xviii and xxvii.

WATER.

Portland, Me.—The City Water Co. of Chillicothe, Portland, has been incorporated to build and operate water works. Capital, $175,000. Pres., E. Caswell; Treas., C. D. Booth, both of Portland, Me.

Bridgeport, Conn.—The Bd. of Aldermen has passed a resolution providing for the employment of a hydraulic engineer to investigate and report upon what plan should be adopted to improve the city water.

Portsmouth, N. H.—Water bonds to the amount of $50,000 were sold recently.

New Britain, Conn.—Chmn. Hall, of the Water Bd., is reported to have stated that plans for the new retaining reservoir in Wolcott call for a capacity of 140,000,000 gals, the cost to be $75,000. It has been decided not to begin construction until the spring.

Worcester, Mass.—The City Council has passed an order for a new dam at Leicester; estimated cost, $120,000.

Westminster, Md.—The Common Council has passed an ordinance accepting the proposition of the Citizens' Co. to furnish water for city purposes for $800 per year, and directing that a contract in accordance therewith be made.

Troy, N. Y.—Bids will be received Oct. 24 (readvertised) by the Bd. of Contract & Supply for erecting a gatehouse, with fixtures and appurtenances, and laying approximately 120 ft. of 20-in. cast iron pipe. John Phelan, Comr. of Pub. Wks.

Baltimore, Md.—The $1,000,000 water loan ordinance has been passed by both the First and Second Branches of the Council.

Lonaconing, Md.—A. M. Evans, Secy., writes that the Lonaconing Water Co. is about to construct a dam (contract not let) at a cost of $7,000.

Quogue, L. I., N. Y.—It is proposed to construct water works at a cost of $76,000, to supply this town, West Hampton Beach and East Quogue.

Canajoharie, N. Y.—It is understood that the Canajoharie Water Supply Co. has offered to sell its system, recently completed, to the village for $135,000.

Altoona, Pa.—Ordinances have been passed providing for water mains in several streets.

Salem, Va.—J. H. Palmer, Secy. Water Com., writes that said Com. has been appointed to ascertain the cost of sinking an artesian well to secure a better water supply. W. B. Dillard, Chmn. of Com.

Charleston, S. C.—Bids will be received Oct. 22 by the American Pipe Mfg. Co., Philadelphia, Pa., for erecting a pumping station. Plans may be obtained from Wm. C. Miller, 35 Broad St., Charleston.

Atlanta, Ga.—See "Sewerage and Sewage Disposal."

Summerville, Ga.—The coming Legislature will be petitioned by this village for authority to issue $25,000 bonds for the improvement of the water works and sewerage system.

Griffin, Ga.—Nesbit Wingfield, City Engr. of Augusta, is said to be making an investigation of the public needs of this city with special reference to the water works.

Tampa, Fla.—The Tampa Water Works Co. is said to be considering plans, prepared by Miller & Kennard, for the new water works plant which said company proposes to build. A pump of 4,000,000 gals. capacity per day will be installed.

Kewanee, Ill.—City Engr. J. E. Kemp writes that on Oct. 7 John M. Healy, Opera House Blk., Chicago, received the contract for furnishing pipe, etc., as follows: 8,500 ft. of 6-in. main in place, 92 cts. per ft.; 200 ft. 4-in. main in place, 73 cts. per ft.; 16 fire hydrants in place $26.50; five 6-in. valves and boxes in place, $17.

Montevideo, Minn.—E. A. Aspnes, Supt. Water Wks., writes that proposed new water works will cost about $15,000.

Columbus, O.—Bids are wanted Oct. 23 for furnishing the Water Works Dept. with 15 tons of pig lead. C. M. Addison, Clk. Bd. of Pub. Works.

Bloomington, Ill.—City Clk. C. C. Hassler writes that it is proposed to improve the water works, but no definite plans have as yet been made.

Marinette, Wis.—A correspondent writes that the American Water Works & Guarantee Co., of Pittsburg, Pa., contemplates lowering the 18-in. intake pipe across Menominee River at this point 5 ft.

Ruthton, Minn.—Bids will be received Nov. 3 by the Village Council for $3,000 water works bonds. Frank L. Nash, Village Recorder.

Shinnston, W. Va.—The Town Council is reported to be considering the question of constructing water works at a cost of about $12,000.

Lanesboro, Minn.—Bids will be received Nov. 3 by the Village Council for $6,000 water works and electric light improvement bonds. O. N. Viste, Village Clk.

Truman, Minn.—Bids will be received Oct. 28 by O. N. Steenstrup, Village Recorder, for constructing water works from plans of M. B. Haynes, of Mankato.

Westbrook, Minn.—Bids will be received by John E. Villa, Village Recorder, for constructing water works. M. B. Haynes, Engr., Mankato.

Kiester, Minn.—Bids will be received Oct. 30 by C. W. Tuebner, Village Recorder, for a cypress tank of 30,000 gals. capacity, and a 50-ft. steel tower to support the same.

Vinton, La.—The Hurd-Ford Inv. Co. writes that the Sabine Canal Co. contemplates the extension of its irrigation plant at a probable cost of $150,000.

Bessemer, Ala.—City Engr. Wm. J. Parkes writes the Council has ordered him to prepare plans and estimates for a complete system of municipal water works; water to be obtained from springs 3 miles distant; capacity of proposed works, 3,000,000 gals. per day. It is expected to be ready to begin construction by Jan. 1, 1903. Bonds to the amount of $200,000 have been authorized for this purpose.

St. Louis, Mo.—Engr. in Charge Ben. C. Adkins writes that an ordinance now pending provides for an appropriation of $15,000 for meters and $100,000 for sprinkling plugs.

San Saba, Tex.—A charter has been granted to the San Saba Valley Irrigation Co., with a capital of $360,000, to irrigate and place under cultivation a tract of several thousand acres in the valley of the San Saba River. Incorporators: John Kelly and John R. Cunningham, of San Saba County; Stephen D. Emmon, of Chicago, Ill., and others. Principal office, San Saba.

De Queen, Ark.—The City Council is stated to have passed an ordinance providing for the construction of water works.

Sherman, Tex.—This city has sold $45,000 water and sewer improvement bonds.

Sebree, Ky.—Press reports state that a water works system is to be built.

Guthrie, Okla. Ter.—A territorial charter has been granted to the Otter Creek Irrigstion Co. with the principal place of business at Mountain Park and with $1,000,000 capital.

Seattle, Wash.—H. A. Johnson, Town Clk. of West Seattle, has applied to this city for the extension of the Cedar River water supply to that town.

Fulton, S. D.—The question of issuing bonds for water works is under consideration.

Richfield, Utah.—This city has voted $14,000 bonds for a system of water works.

Caldwell, Idaho.—It is reported that bids will be received Oct. 26, at the office of the Pioneer Irrigation Dist., Caldwell, for completing the Phyllis Canal, requiring the removal of 187,500 cu. yds. of material, and for the completion of the Straborn Canal, requiring the removal of 66,400 cu. yds. of material. R. H. Davis, Secy.

Roswell, N. M.—The citizens of this place are considering the question of installing a system of water works.

Redlands, Cal.—City Clk. L. W. Clark writes that the question of municipal ownership of the water works is under consideration.

Sterling, Colo.—Town Clk. C. L. Goodwin writes that at a special election held Oct. 11 it was voted to construct water works at a cost not to exceed $63,000.

Renton, Wash.—The citizens are stated to have voted on Oct. 7 in favor of constructing water works.

Redlands, Cal.—The Oakglen Domestic Water Co. has been incorporated; principal place of business, Redlands; capital, $10,000. Directors: Isaac Ford and C. H. Sargent, of Redlands, and W. C. Lukens, of Oakglen.

La Junta, Col.—Bids will be received Nov. 1 by M. F. Miller, Secy. Bd. Dir. of the Otero Irrigation Dist., for $300,000 irrigation bonds.

Colorado City, Col.—This city is said to be planning to build a municipal water works.

Cando, N. D.—Local press reports state that this city has decided to install water works and sewerage systems.

SEWERAGE AND SEWAGE DISPOSAL.

Westfield, Mass.—Bids are wanted Nov. 5 for building Section 2 of the system of storm water sewers, as advertised in The Engineering Record.

Lenox, Mass.—At the town meeting Oct. 13 it is stated that $20,000 was appropriated for new sewers.

Brackenridge, Pa.—Bids will be received by T. A. Gallagher, Boro. Clk., until Oct. 20, for the construction of a two-ring brick sewer on certain streets; in all 3,488 ft. 4 ft. by 5 ft. sewer, with 6 manholes and 2 catch basins. Estimated cost, $20,000. E. E. Maurhoff, of Tarentum, Pa., is City Engr.

West Hoboken, N. J.—Town Surveyor Sebastian Maulbeck writes that plans have been completed for the proposed relief sewers.

Lower Merion, Pa.—The Lower Merion Township Comrs. have decided to borrow $250,000 for the construction of the sewer system.

Philadelphia, Pa.—The proposed construction, at the city's expense, of a new main sewer in Market St., under the ordinance recently introduced in Select Council, will save the Philadelphia Rapid Transit Co. the cost of that improvement, which has been roughly estimated at $175,000.

Bayonne, N. J.—Bids will be received Oct. 21 by the City Council for constructing sewers in three streets. W. C. Hamilton, City Clk.

Batavia, N. Y.—The Sewer Comrs. have presented to the Bd. of Aldermen their report, placing the estimated maximum cost of portion of sewer system proposed to be constructed at $375,000. Minimum cost, $300,000.

Etna, Pa.—Bids are wanted Oct. 24 for constructing a sewer on Vilsack St. and a portion of Wilson St. Geo. H. Jacob, Boro. Clk.

East Washington, Pa.—Bids will be received Oct. 21 by the Burgess and Council for $20,000 sewer bonds, also $30,000 paving bonds. Norman E. Clark, Secy.

Baltimore, Md.—City Engr. Fendall, in his estimated expenses for 1903, has incorporated an item of $94,500 for the construction of Sumwalt run sewer.

Saratoga Springs, N. Y.—The Bd. of Trus. has granted the application of the Sewer, Water & Street Comn. for an issue of $40,000 bonds, the proceeds to be used in the construction of a sewage disposal plant.

Roselle Park, N. J.—Bids will be received Nov. 8 by the Mayor and Council of Boro. of Roselle for constructing a sewerage system. A. M. Woodruff, Boro. Clk.

Perkasie, Pa.—An ordinance is before the Council granting to W. H. Davis and Harry T. Shelly, of Quakertown, and Grier Scheetz, of Perkasie, the right to construct and maintain a complete system of sewers in the Boro.

Bridgeport, Pa.—Plans and estimates are reported to have been prepared for a system of sewerage.

Easton, Pa.—Mayor Lehr in a recent message to the Councils, advocates the issue of $300,000 bonds to pay for needed improvements, such as additional sewers, street improvements, etc.

Pittsburg, Pa.—The Finance Com. favorably reported an ordinance providing for the construction of sewers in numerous streets.

Perth Amboy, N. J.—The Bd. of Aldermen is stated to have awarded a $55,000 sewer contract to Martin Hanson and Carl C. Christensen; there will be 1,200 ft. of 2x3-ft. brick sewer, 3,710 ft. 7-ft. and 1,350 ft. of ditch emptying into Staten Island Sound.

Atlanta, Ga.—The Council has adopted a resolution appropriating $500 for the purpose of paying an expert to confer with the City Engr. with a view to arranging plans for an improved sewer system. The Council has approved the proposition to issue $400,000 bonds for the extension of the sewer system, and a like amount for the improvement of the water works.

Summerville, Ga.—See "Water."

Norfolk, Va.—Guild & Co., of Chattanooga, have received the contract for establishing a sewerage system in Berkley for $23,000.

Cape Charles, Va.—The City Council has voted to employ an engineer to begin work on a sewerage system for this place.

Rock Island, Ill.—City Clk. H. C. Schaffer writes that it is proposed to construct new sewers in the southwestern part of the city, City Engr. W. Treichler's report to be ready in a few weeks.

Columbus, O.—Bids are wanted Oct. 30 for constructing sanitary sewers, as advertised in The Engineering Record.

Bids are wanted Oct. 23 for the construction of an 18-in. and 15-in. pipe sewer in Miller Ave.; bids are also wanted on the same date for the construction of a main trunk sewer in numerous streets, varying in size from 36 in. to 8 in. in diameter. C. M. Addison, Clk. of the Bd. of Pub. Wks.

Julian Griggs, Ch. Engr. Dept. of Public Improv., writes that a large amount of sewer construction is soon to be undertaken in this city, for which bonds have been authorized to the amount of $255,000. The largest diameter is 10.5 ft., and trenching machines will be required. As soon as these sewers are under way it is expected that an expenditure of $150,000 additional will be authorized for storm water relief sewers. The completion of the main trunk sanitary sewer will also probably be followed by the construction of about 10 miles of sanitary laterals.

Ottumwa, Ia.—Bids are wanted Oct. 20 for the construction of a portion of South Ottumwa trunk sewer. T. F. Keefe, Chmn. Street Com.

Glenville, O.—Local press reports state that the Council has awarded sewer contracts as follows: To the W. J. Townsend Co., Doan St., between Garfield and Massie, for $43,533; also Doan St., between Massie and the s. village limits, for $25,092; to Wm. Lehsm & Sons, Doan St., St. Clair to Garfield, for $22,005.

Troy, O.—John P. Force, of Columbus, is stated to have been engaged to prepare plans and make surveys for the proposed sewerage system.

Niles, O.—It is stated that bids will be received Oct. 29 by the Sewer Comrs. for constructing sewers, catch basins, etc., in Park Ave. and 2 other streets. W. Y. Sayers, Clk.

Youngstown, O.—It is stated that bids are wanted Oct. 25 for constructing sewers in Inglis St. and Himrod Ave. C. E. Cross, Clk.

Cincinnati, O.—Bids are wanted Oct. 27 for constructing sewers in portions of Central Ave. Robert Allison, Pres. Bd. of Pub. Service.

Lake Charles, La.—This city has employed John W. Maxcy, of Houston, Tex., to prepare plans, specifications and estimates for sewerage, sewage disposal and pavements, estimated to cost $250,000.

Bessemer, Ala.—City Engr. Wm. J. Parks writes that the Council has ordered additional storm sewers, ranging in size from 18 in. to 42 in., to be built in the 2d Ave. Dist., at an estimated cost of $7,500. This work will be let about Nov. 4.

Topeka, Kan.—A petition is being circulated for the creation of a sewer district to include Dennis & Martin's addition, Orchard Place and Walnut Grove. Estimated cost of building sewers, $50,000 to $100,000.

Vermilion, S. D.—City Auditor C. I. Vaughn writes that the contract for constructing sewers in Dist. No. 1 (bids opened Oct. 6) has been awarded to Eric Nylen, of Vermilion, as follows: Pipe sewers, per lin. ft., 12 in., 89 cts.; 18 in., $1.24, and 8 in., 70 cts.; manholes, $55 each; catch basins, $47 each; trench to average 9 ft. in depth.

Lincoln, Neb.—This city will build about $6,000 worth of lateral sanitary sewers, all work to be done by day labor under the supervision of City Engr. Geo. L. Campen.

Tacoma, Wash.—City Engr. Taylor is reported to have about completed surveys for the proposed Edison trunk sewer. The sewer is designed to furnish sanitary drainage for the 6th addition, South Side addition, and the entire Edison Dist.

Revillo, S. D.—It is stated that bids are wanted Oct. 23 for constructing 12-in. sewers. John Elstad, Town Clk.

Loveland, Colo.—The Bd. of Town Trus. has established Sewer Dist. No. 1, extending the entire length of the town.

Cheyenne, Wyo.—The contract for constructing Warren Ave. sewer extension is reported to have been awarded to Frank S. Joslin, of Cheyenne, for $7,827.

Columbus, Neb.—Bids will be received Oct. 28 by G. W. Phillips, Co. Clk., for deepening and widening the Carrig & Jewell drainage ditch in Lost Creek and Shell Creek Township; approximate number of cu. yds. of earth to be removed, 31,000.

BRIDGES.

Bridgeport, Conn.—Local press reports state that the question of constructing a new bridge over Ash Creek, connecting Bridgeport and Fairfield, is under consideration. Probable cost, $25,000.

Reading, Pa.—The Berks Court has approved the building of 8 county bridges to cost $20,000.

Raymertown, N. Y.—According to plans and estimates prepared by Prof. Leslie Allen, of Albany, the cost of a bridge across the proposed Tomhannock reservoir, would be $65,000.

Connersville, Pa.—G. L. Potter, Gen. Mgr. of the B. & O. R. R., Baltimore, Md., is said to have approved plans for a bridge at their yards at Connersville.

Nutley, N. J.—The Nutley Bridge Com., of the Bd. of Freeholders, John F. Clark, Chmn., will erect a stone arch bridge over Third River at Franklin Ave.

Washington, D. C.—See "Miscellaneous."

Cumberland, Md.—The City Council has passed an order requesting the Baltimore & Ohio R. R. to place an overhead bridge across the tracks at Baltimore St.

Scranton, Pa.—Provision is made in the bond issue now pending in the Common Council for the erection of a steel bridge across Lackawanna River at a cost of about $29,000. The bridge is to be located either at Race St. or Sanderson Ave.

Neshanic, N. J.—The Somerset County Bd. of Freeholders, Somerville, has decided to rebuild the West bridge, near Neshanic; a low truss iron structure has been decided upon. Thos. E. Gibson, Chmn. of Com.

Port Perry, Pa.—Ch. Engr. W. H. Brown, of the Pennsylvania R. R., has awarded the contract to the Pittsburgh Construction Co. for the erection of a steel double-track railroad bridge, about 1,000 ft. long, main span 407 ft. long, over Monongahela River, at Port Perry. The bridge is to be completed within 8 months, and will cost approximately $550,000 in addition to the masonry.

Sanatoga, Pa.—It is stated that a bridge to cost about $30,000 will be constructed over the Schuylkill, at Sanatoga, Montgomery Co., to be paid for by Chester and Montgomery Counties. (Norristown, C. H.)

Spray, N. C.—The Rockingham Co. Comrs. are stated to have decided to appropriate $3,000 toward constructing a bridge over Smith River at Spray. (Wentworth, C. H.)

Huntington, Ind.—The County Council has made appropriations for the following county bridges: $14,000 for bridge over Salamoni River at Warren; $9,000 for bridge over Wabash River, south of Huntington, and $6,000 for a bridge over Wabash River north of Andrews.

St. Paul, Minn.—The Bd. of Aldermen has passed a resolution directing the City Engr. to prepare plans for the construction of the east end of the 3d St. bridge over the railway yards. Appropriation, $65,000.

Minneapolis, Minn.—The Council Railroad Committee has ordered the Northern Pacific R. R. Co. to build a bridge over its tracks on Harvard St. and one over the street at Como Ave., where the Como-Interurban tracks cross the railroad.

Indianapolis, Ind.—Local press reports state that the Virginia Ave. viaduct will be repaired by the Indianapolis Union Ry. Co., as soon as the approval of Pres. J. McCrea, whose headquarters are in Pittsburg, can be secured.

Bids are wanted Nov. 6 for the construction of a bridge over Little White Lick Creek, on road running north from Bridgeport. John McGregor, Comr. of Marion Co.

Akron, O.—The Northern Ohio Traction Co. has awarded the contract for constructing a $60,000 bridge across Cuyahoga River to the King Bridge Co., of Cleveland. Paul & Henry, of Barberton, O., will do the stone work and grading. E. D. Eckroad, Engr. in charge.

Winnebago, Minn.—The County Bd., Blue Earth City, is stated to have decided to erect a bridge across Blue River, south of Winnebago.

Streator, Ill.—Petitions are being circulated asking that the City Council take steps toward the construction of a bridge at the foot of Main St., across Vermilion River.

Vincennes, Ind.—Edw. C. Faith is said to have prepared plans for a bridge, consisting of three spans of 140 ft. each, piers of stone and concrete, to cross White River.

Chicago, Ill.—Local press reports state that the bridge over the river at Archer Ave. and 31st St. is to be replaced by a steel structure of the bascule type, to cost $200,000.

Traverse City, Mich.—A press report states that Blomshield & McCloy are preparing plans for a combination concrete and steel bridge for Traverse City. The structure will be 100 ft. long and 66 ft. wide, and will carry double railway tracks. The bridge will have 16,000 pounds per lin. ft. capacity.

Hamilton, O.—The Miami & Erie Canal Transportation Co. and the Cincinnati, Hamilton & Dayton Traction Co. (C. G. Waldo, Mgr., Cincinnati) are reported to have decided to erect a bridge over the canal at Dayton St.

Utica, Mo.—Ernest Allen, Fred. Sherman and others are said to be interested in the construction of an iron bridge over Grand River, north of the town. Cost about $4,000.

Arkadelphia, Ark.—The Clark County levying court has voted in favor of building a steel bridge across Ouachita River, between Arkadelphia and Daleville.

Topeka, Kan.—Bids are wanted by the Comrs. of Shawnee Co., S. H. Haynes, Chmn., until Nov. 10, for the erection of a 60-ft. low truss steel bridge, tubular piers, with 32-ft. approach, to cross Missouri Creek, in Dover Township. John M. Wright, Co. Clk.

Memphis, Tenn.—The proposed stone and iron overhead bridge to cross the tracks at Dunlap St., will, it is estimated, cost $10,000; the railroad companies interested will probably pay seven-eighths of said cost.

De Queen, Ark.—The Sevier Co. Comrs. at Lockesburg, are stated to have decided to appropriate $5,000 for a bridge over Rolling Fork River, west of De Queen.

Ellendale, N. Dak.—Co. Aud. H. J. Oberman writes that the contract for constructing a 250-ft. steel bridge across James River, has been awarded to Wm. S. Hewett & Co., of Minneapolis, Minn., for $7,896.

San Jose, Cal.—Co. Surveyor J. G. McMillan has been ordered to prepare plans and specifications for bridges over Llagass Creek, on San Martin Ave., Rucker Ave. and Llagass Ave., Road Dist. No. 1.

Spokane, Wash.—A joint bridge is to be built over Hangman Creek by the city and the county. Total cost, $36,000; the county has agreed to appropriate $14,000.

Tiburon, Cal.—Citizens of this place have petitioned the Co. Bd. of Supervisors, San Rafael, to appropriate $5,000 toward the construction of a bridge to span the channel of the lagoon at Tiburon. Total estimated cost, $8,000.

Lexington, Neb.—Co. Clk. J. T. Costin writes that $12,000 bonds were voted Sept. 25 for the construction of a bridge across Platte River.

Tempe, Ariz.—The Maricopa County Bd., Phoenix, Ariz., is said to be considering the construction of a bridge over the river at Tempe.

Chippewa, Ont.—Bids are wanted by Norval B. Hagar, Allenburg, Ont., Chmn. of Road & Bridge Com. of Welland County, until Oct. 21, for supplying material and building abutments, center piers and guards, and superstructure for a steel swing bridge across Welland River at Montrose, 4 miles from Chippewa; length over all, about 190 ft.; length of swing, 110 ft.; fixed span, 80 ft., with clear roadway of 16 ft.; concrete piers and abutments. Geo. Ross, of Welland, Ont., Engr.

Hilo, Hawaii.—Bids are wanted Oct. 31 for furnishing and erecting 2 steel bridges, one over Walakea River, 100 ft. span, pin centers, and one over Wailuku River, 170 ft. span, pin centers, both bridges to have 20-ft. roadway and 2 4-ft. sidewalks. Jas. H. Boyd, Supt. of Pub. Wks.

PAVING AND ROADMAKING.

Fall River, Mass.—Both branches of the City Council have voted to authorize an additional highway loan of $40,000.

Boston, Mass.—Bids will be received Oct. 22 by James Donovan, Supt. of Streets, for constructing portions of Bennington St., in East Boston. A check of $5,000 is required with bids.

Springfield, Mass.—The City Council has passed the order providing for the extension of Court Sq. to the river.

Washington, Pa.—J. M. McAdam writes that 168 separate bids were received Oct. 6 for 38,712 cu. yds. of grading and 116,946 sq. yds. of paving, with brick and hill-side block; R. T. Hallam & Sons, of Washington, Pa., received the contract for paving 28 of the streets; Park Paving Co., Philadelphia, received 10 streets, and Wm. Pickett & Co., of Washington, received 2 streets. Bids of successful bidders averaged about $1.28 per yd., with a range from $1.23 to $1.30 for limestone bed. Grading was let at 28 cts. to 32 cts. per yd.

Allentown, Pa.—Bids will be received Oct. 21 by the Mayor, Fred. E. Lewis, for paving portions of 2 streets with Trinidad Pitch Lake, Bermudez Lake or Alcatraz sheet asphalt.

Buffalo, N. Y.—Bids will be received Oct. 25 by Wm. H. Daniels, Co. Treas., for $70,000 Erie Co. good roads bonds.

Syracuse, N. Y.—The Syracuse Improvement Co. is stated to have received the contract for paving with standard brick in Butternut St. from North Salina St. to the city line, for $61,591.

West Hoboken, N. J.—Sebastian Maulbeck, Town Surveyor, writes that 5,700 sq. yds. of bituminous macadam waterproof pavement is to be laid.

Washington, D. C.—See "Miscellaneous."

Brooklyn, N. Y.—Bids are wanted Oct. 23 for repairing and repaving with asphalt on old asphalt foundation the walks in Prospect and Ft. Greene Parks. Wm. R. Willcox, Comr. of Parks.

Bids will be received Oct. 29 by J. Edw. Swanstrom, Boro. Pres., for improving numerous streets; the work includes 70,880 sq. ft. cement sidewalk, 10,370 sq. yds. asphalt pavement, 9,960 sq. yds. macadam pavement, and 5,900 sq. yds. granite pavement.

Trenton, N. J.—Bids are wanted Oct. 21 for repaving S. Broad St. with sheet asphaltum over Belgian block. C. Edw. Murray, City Clk.

New Brighton, S. I.—Bids will be received Oct. 24 by Geo. Cromwell, Boro. Pres., for repaving with asphalt block on concrete foundation, portions of Broadway. Engineer's estimate, 2,800 sq. yds. asphalt block pavement; 470 cu. yds. concrete, including mortar bed, and 1,700 lin. ft. new curbstone furnished and set on concrete foundation.

Buffalo, N. Y.—The contract for paving with brick on Sobieski St. has been recommended for award to Wm. H. Kinch for $5,913.

Washington, D. C.—The Commissioners have been requested by the East End Suburban Citizens' Assoc. to include in their estimates to Congress an item of $25,000 to continue the improvement of Bladensburg Rd., $5,000 for the repair of that road and $200 for resurfacing Park St.

Baltimore, Md.—The Municipal Bd. of Estimates has received a proposition from the U. S. Wood Preserving Co., offering to pave North Ave. with wooden blocks, for $470,000, the estimate being as follows: 139,814 sq. yds. to be paved, $433,423; new curbing, $17,040; old curbing reset, $1,125; old headers, $1,125; new cobble, $494; old cobble, $895; grading, $11,031.

Auburn, N. Y.—City Engr. Ackerman estimates the cost of proposed paving as follows: 12,707 yds. of sheet asphalt paving at $1.97 per sq. yd.; cost to city, $23,600; the Auburn City Ry. Co.'s share would be $1,432; total cost of brick pavement between railway tracks, $2,158.

New York, N. Y.—Bids are wanted Oct. 22 for the following work in the Boro. of Bronx: Paving with granite block in several streets, about 79,255 sq. yds.; asphalt paving in several streets, about 21,735 sq. yds., and asphalt block paving in several streets, about 24,200 sq. yds.; also grading, setting curbstone, etc., in E. 181st St., work to include 18,250 cu. yds. of rock excavation, 36,050 sq. ft. of new flagging, etc. Louis F. Haffen, Pres., Boro of Bronx.

Newark, N. J.—The Essex Co. Freeholders are about to begin the construction of a public speedway, to be 1 mile long and 150 ft. wide, on the outskirts of Newark; cost not to exceed $50,000, including the purchase price of the right of way.

Canandaigua, N. Y.—The Ontario County Bd. of Superv. has voted to improve 30 miles of highways in accordance with State regulations; cost, $259,000, the State paying half.

New York, N. Y.—The following bids were opened Oct. 14 by J. A. Cantor, Pres. Manhattan Boro., for repaving with asphalt and granite on present pavement and concrete foundation Park Ave. from 111th St. to 133d St.: A, Century Constr. Co.; B, Barber Asph. Pavg. Co.; C, Asphalt Constr. Co.; D, Sicilian Asphalt Pavg. Co.:

Bidders.	Asphalt, 61,200 sq. yds.	Granite blk., 2,400 sq. yds.	Old stone relaid, 61,500 sq. yds.	Concrete, 400 cu. yds.	New curb, 7,600 ft.	Old curb, 1,900 ft.	Manhole covers, 73.
A	$1.23	$3.25	$.26	$5.00	$.82	$.35	$20
B	1.01	2.38	.29½	4.95	.80	.37	20
C	1.00	2.47	.20	4.50	.75	.32	6
D	1.03	2.50	.20	4.50	.70	.30	17

St. Augustine, Fla.—The Council is said to be taking steps towards paving several streets with vitrified brick.

Portsmouth, Va.—Bids are wanted Dec. 22 for paving certain streets with asphalt, brick and macadam, as advertised in The Engineering Record.

Kent, O.—It is stated that bids are wanted Oct. 27 for paving, curbing and laying drain pipes on portions of Water St. L. E. Chapin, Consulting Engr.

Laporte, Ind.—It is stated that bids are wanted Oct. 27 for completing the Michigan, Coolspring and Springfield township system of macadam roads. John R. Weaver, Chmn. Bd. Comrs.

Cincinnati, O.—Bids are wanted Nov. 12 for paving and macadamizing portions of 2 streets. Bids are also wanted Oct. 29 for paving with brick portions of Schiller St. Robert Allison, Pres. Bd. of Pub. Service.

Lafayette, Ind.—City Engr. G. H. Stevenson writes that the contract for constructing sidewalks (bids opened Oct. 13) has been awarded to Edw. L. Sheehan, of Lafayette, at 11 cts. per sq. ft.; total, $5,390; also the contract for brick crosswalks at $1 per sq. yd.; total, $493; extra excavation and gravel foundation at 3 cts. per sq. ft.

Milwaukee, Wis.—The contract to curb and macadamize National Ave. has been awarded to Wm. Gutknecht for $7,904.

Fond du Lac, Wis.—Local press reports state that about 20,000 yds. of pavement is to be laid next spring and summer; brick or asphalt will be used. L. A. Bishop, City Engr.

Decatur, Ind.—The contract for paving 4th St. with brick on a concrete base has been awarded to Calvin Miller for $19,868.

Fairbank, Ia.—The Council has ordered 12th St. and 2d Ave. paved with asphalt.

Grand Haven, Mich.—A special election will be held Oct. 24 to vote on the question of issuing $42,000 bonds, of which $35,000 will be used for street improvements.

Cedar Rapids, Ia.—A resolution before the Council provides for the paving of S. 9th St. with 2 course brick.

Cincinnati, O.—The Bd. of Pub. Service has approved plans for the improvement of Calhoun St. From Vine to Jefferson granite will be laid, and from Jefferson to West Clifton Ave. there will be new asphalt. The cost is estimated at $36,743.

Bloomington, Ill.—City Engr. Elmer Folsom writes that asphalt pavement is to be laid on Fell Ave. and on E. Grove St.; also ½ mile of brick pavement on Grove St. will be resurfaced with asphalt.

Columbus, O.—Bids are wanted Oct. 23 for stone block, asphalt brick or block pavement on Maple and 4th Sts. and Reinhard Ave.; bids are also wanted until the same date for furnishing and delivering 450,000 paving bricks, delivery to commence in October, 1902. C. M. Addison, Clk. Bd. of Pub. Wks.

Dayton, O.—Bids are wanted Oct. 21 for paving with cement the sidewalks of numerous streets. J. E. Gimperling, Pres. Bd. of City Affairs.

Elkhart, Ind.—Bids are wanted Oct. 29 for constructing cement sidewalks on certain streets. Emil V. Anderson, City Clk.

Lake Charles, La.—See "Sewerage and Sewage Disposal."

Cameron, Mo.—City Clk. John A. Clark writes that it is proposed to pave 3d St. from Walnut to Cherry, but it is possible that litigation will delay matters until next spring.

Oklahoma City, Okla. Ter.—Press reports state that it is proposed to lay 2 additional miles of asphalt pavement.

Guthrie, Okla. Ter.—The City Council has under consideration the question of paving the business streets of the city.

Jefferson Barracks, Mo.—The Deputy Q. M. Gen., U. S. A., writes that the contract for constructing granitoid walks (bids opened Oct. 6) has been awarded to John Dougherty, Jr., 8108 Vulcan St., St. Louis, for $6,799. Bids received at the same time for constructing roads were rejected, and new bids will be opened Oct. 20.

Louisville, Ky.—Local press reports state that the Bd. of Pub. Wks. has asked for bids for vitrified brick paving in 15 squares of city streets.

New Orleans, La.—Councilman Dickson has asked the Council to make an appropriation of $5,000 in the reserve fund of 1903, to be applied to the building and equipment of an asphalt plant, to be placed in charge of the Dept. of Pub. Wks.

Omaha, Neb.—Wm. Coburn, Secy. Bd. of Pub. Wks., writes that contracts for improving a portion of 21st St. (bids opened Oct. 10) have been awarded as follows, subject to selection of material by property owners or by Mayor and City Council: Barber Asphalt Paving Co., Omaha, sheet asphaltum, class B, 5 years' guarantee, $1.99 per sq. yd.; Chas. E. Fanning, Omaha, vitrified paving blocks, class A, 5 years' guarantee, $1.97 per sq. yd., 10c. extra for cement grouting; John Grant, Omaha, artificial stone, combined curb and gutter, 65c. per lin. ft.; C. D. Woodworth, Omaha, artificial stone, combined curb and gutter, 75c. per lin. ft.; Colorado sandstone curbing, 77c. per lin. ft.; Bedford sandstone curbing, 67c. per lin. ft.

Lincoln, Neb.—City Engr. Geo. L. Campen writes that the only bid received Oct. 6 for paving with vitrified brick on 2-in. sand and old concrete base, in several streets, was from R. S. Young Building & Supply Co., Lincoln, at $1.14 per sq. yd.

Seattle, Wash.—The contract for concrete walks in Cedar and other streets has been let to the Sparger Concrete Co. at $1.27 per yd. Total, $28,137.

POWER PLANTS, GAS AND ELECTRICITY.

***Ellsworth, Me.*—The Union River Light, Gas & Power Co.**, of Ellsworth, has been incorporated with a capital of $1,000,000 to develop the water powers on Union River and its tributaries. A. W. Jackson, N. Y. City, N. Y., and I. H. Halman, Boston, Mass., are the incorporators.

***Dover, N. H.*—Contractors have submitted estimates** for the power house to be built at Dover for the Gas & Electric Co. Allen D. Richmond, Supt. Estimated cost, $18,000.

***Manchester, Mass.*—Raymond C. Allen**, Chmn. Investigation Com., writes the town has voted unfavorably upon the proposition to construct a municipal electric light plant.

Waterville, N. Y.—M. W. Terry, Supt. of the Waterville Electric Light & Power Co., writes that said Co. has awarded the contract for a steam heating plant to the American District Steam Co., of Lockport, N. Y., for $5,000.

***Brooklyn, N. Y.*—Bids are wanted** Oct. 23 for furnishing materials and labor necessary to complete the central power plant for the Brooklyn Institute of Arts & Sciences. Wm. R. Willcox, Comr. of Parks.

Bids are wanted Oct. 24 for installing electric light wiring, fixtures and electric bell systems in schools 139 and 141, Boro. of Brooklyn. C. B. J. Snyder, Supt. of School Bldgs., New York City.

***Canandaigua, N. Y.*—The Ontario Light & Traction Co.** is stated to have secured the contract for lighting the village at $65 per light per year.

***Plymouth, Pa.*—It is reported** that charters have been granted light companies in Dorranceton, Luzerne, Courtdale, Kingston Township, Plymouth Township and Kingston. The companies are all controlled by the West Light Co., of Plymouth, of which Ambrose West, of Plymouth, is the head. The intention of the companies is to furnish these towns with street and commercial light.

***Wilmington, Del.*—The Merchants' Electric Co.**, of Wilmington, is reported incorporated to generate and store electric current for light, heat and power. Capital, $150,000.

***Conway, Pa.*—A press report** states that plans have been approved by the Pennsylvania Co. for an electric lighting plant at Conway, Pa., on the Fort Wayne. The building and equipment will cost about $50,000. Thos. Rodd, Ch. Engr., Pittsburg.

Washington, D. C.—Ernest T. Hooley, London, Eng.; I. F. McLaughlin, Toronto, Ont.; Russell Thayer, of Philadelphia, Pa., and others, are interested in the Potomac River Power Co., which proposes to develop the power of Potomac Falls, near Washington, at an estimated cost of $5,000,000.

***Blue Ridge, Ga.*—J. H. Carter**, Pres. of the Blue Ridge Electric Light & Power Co., writes that it is proposed to expend $6,000 to $10,000.

***Forsyth, Ga.*—The City Council** is stated to have passed an ordinance providing for the purchase of a 120 kw. dynamo and a 186 H. P. engine for the electric light plant.

Richmond, Va.—The Electrical Construction Co. of Va. will petition the City Council for permission to erect poles and string wires for power, etc. A. Pizzini, Jr., Mgr.

Kershaw, S. C.—H. Gould, Engr., writes that the Kershaw Oil Mill has awarded to the General Electric Co., Atlanta, Ga., the contract for constructing an electric light system, for about $4,000.

***Adrian, Mich.*—G. C. Blanker**, of Columbus, O., is stated to have petitioned the Council for a franchise for heating the city from a central plant, in conjunction with a lighting plant.

The Council is reported to be considering the establishment of a municipal electric light plant.

***Kokomo, Ind.*—The Indianapolis Northern Traction Co.** is stated to have petitioned the Council for a franchise for an electric lighting and heating plant in Kokomo.

Dayton, O.—The Co. Comrs. are stated to have granted the Dayton Electric Light Co. the right to erect poles along the Lebanon Pike and on the Wade Rd. Its intention is to furnish light to the residents of Oakwood.

Ferndale, Minn.—Consulting Engr. C. Claussen, of St. Paul, writes that the following bids were opened Sept. 25 for the construction of an electric light plant: *a*, with building repairs; *b*, without building repairs: T. G. Robertson, St. Paul, *a*, $7,424; Crowley Electric Co., Duluth, *a*, $7,186 (awarded); W. L. Gray & Co., Minneapolis, *b*, $7,316; Fairbanks, Morse & Co., St. Paul, *b*, $6,740.

Sparta, Tenn.—C. P. Hutchison writes that the Sparta Electric Light & Power Co., in which he is interested, is now receiving bids for constructing an electric light and power plant to cost $4,000. Water power will be used.

***Council Grove, Kan.*—The Council Grove Electric Light & Power Co.**, of Council Grove, has been incorporated with a capital of $10,000. The company will purchase the old plant which has been operated by the city and purchase such new machinery as is required. Incorporators: Jesse Shaw, Topeka; John H. Packer, Perry, and others.

***Springfield, Mo.*—The citizens** are stated to have voted to grant Mr. Henning a franchise to furnish gas.

Bessemer, Ala.—The City Council is stated to have granted T. J. Cornwell a franchise for a gas plant.

***Huntsville, Ala.*—Du Pont & Waters**, of Johnstown, Pa., are stated to have acquired the property of the Huntsville Electric Ry., Light & Power Co., and will expend about $10,000 in improvements.

***Ruston, La.*—Mayor B. F. Thompson** writes that bids are wanted for a 90 kw., 60 cycle alternating generator transformer, switchboards and engine, 140 H.P., to drive generator.

Baton Rouge, La.—The time for receiving bids, for furnishing arc lamps, as advertised in The Engineering Record, has been extended from Nov. 1 to Nov. 15. Notice of change was received too late to correct advertisement.

***Eldorado, Colo.*—The Boulder Creek Mining & Power Co.** is reported organized at Bay City, Mich., with a capital of $2,000,000, by W. C. Penoyar of Bay City, Mich.; W. V. Penoyar, Saginaw, Mich.; Frank R. Jeffrey, of Colorado Springs, and others. A press report states that this company will build a plant of 10,000 H.-P. on Boulder Creek, and also a dam. The company propose to furnish electricity to the mines in the Sugar Loaf Dist.

Sterling, Colo.—Town Clk. C. L. Goodwin writes that the Town Council is now considering two propositions asking for franchises for light and power plants.

Ballard, Wash.—C. F. Wallace is stated to have petitioned the Council for a franchise to furnish light to the city for 50 years.

***Long Beach, Cal.*—It is reported** that the Long Beach Gas Co. is about to establish a new generating plant, with a sufficient capacity to supply this town and San Pedro.

Lincoln, Neb.—Andrew Rosewater, C. E., Omaha, Neb., has been given the appropriation of the water of Platte and Elkhorn Rivers by the State Bd. of Irrigation, and press reports state that he will start work immediately upon a 20,000-H.-P. power plant.

Sedro-Woolley, Wash.—W. R. Morgan, Pres., writes that the Skagit Improv. Co. proposes to construct an electric light plant at a cost of $20,000.

ELECTRIC RAILWAYS.

***Boston, Mass.*—The State R. R. Comrs.** are stated to have granted petitions for locations to the following companies: The Uxbridge & Blackstone St. Ry. Co. (Theo. S. Johnson, Pres., Worcester) in Uxbridge; the Boston & Northern Ry. Co. (E. C. Foster, Mgr., Boston) in Billerica, Methuen, Winchester, Stoneham, Gloucester, Salem and Woburn; the Old Colony St. Ry. Co. (C. F. Bancroft, Ch. Engr., Boston) in Quincy; the Springfield St. Ry. Co. (G. W. Cook, Supt., Springfield) in Ludlow, Wilbraham and Hampden, and the Lawrence & Methuen St. Ry. Co. (J. R. Simpson, Pres., Lawrence), to run over private land in Methuen near Slough Rd. and North St.

***Poultney, Vt.*—The Granville & Poultney Electric R. R. Co.** is reported to have been formed to construct an electric railway between Poultney and Granville. Wm. Nathaniel, of Poultney, is the Pres., and Chas. L. Baker, of Troy, N. Y., is the attorney.

New York, N. Y.—Plans have been filed with the Bldg. Dept. for five 3-story brick and stone subway stations to be erected by the Rapid Transit Subway Const. Co., each to cost $55,000. Architects, Van Vleck & Hunter, 21 Park Row.

***Richmond, S. I., N. Y.*—The Bulls Head & Annadale Beach R. R. Co.** has been incorporated with a capital of $250,000 to operate an electric railway 8 miles long in Richmond Boro., from Bulls Head in the 3d Ward to Annadale Beach. Directors: J. W. Hughes and Harcourt Bull, of N. Y. City, and David Murphy, of Jersey City, N. J.

***Batavia, N. Y.*—The Buffalo & Depew Ry. Co.** is stated to have secured franchises in Batavia, Pembroke and Corfu. John T. Mooney, Supt., Depew.

***Atlantic City, N. J.*—The Council** is stated to have granted a franchise to the Suburban Ry. Co. It provides in the contract that the company is to light, pave and sprinkle the streets in which the line is built.

Du Bois, Pa.—The Town Council is stated to have granted the Du Bois St. Car Co. a franchise to Falls Creek, a distance of about 2 miles.

***Pottstown, Pa.*—J. C. Bricker, Dr. S. C. Dolley** and others are about to apply for a charter for the Pottstown & Reading Electric Ry. Co. to construct a line between Pottstown and Reading.

Cokeville, Pa.—J. A. C. Ruffner, of Greensburg, Geo. W. McHenry, of Latrobe, and M. E. Brown, of Blairsville, are reported interested in the construction of a trolley line from Cokeville, Hillside, Millwood, Derry and Bradenville to Latrobe. There will also be an extension to Indiana; total length of the line will be 35 miles.

***Dover, Del.*—The Delaware Suburban Ry. Co.** is reported incorporated at Dover with a capital of $100,000, to build a line connecting with that of the Wilmington City Railway's extension to Stanton, and to go to Chesapeake City through Newark, Elkton and other places. The Cherry Hill, Elkton and Chesapeake City Railway will operate the line in Cecil County, Md. Geo. E. Schlegelmilch, Vice-Pres. of the German American Trust Co., of Philadelphia, Pa., is one of the incorporators.

***Newark, Del.*—The Town Council** is stated to have granted franchises to the Cecil & Kent Trolley Co. and to the Elkton & Chesapeake City Electric Ry. Co.

***Dickeyville, Md.*—The United Rys. & Electric Co.** is reported to have decided to extend its North Ave. line to Dickeyville. W. C. Ludwig, Supt., Baltimore.

Volney, N. Y.—The Town Bd. is stated to have granted a franchise to Adolph Manz of Syracuse.

***Norwood, O.*—A new interurban railway**, to be known as the Norwood, Oakley, Madisonville & Red Bank Traction Co., is about to be formed with a capital of $100,000, to construct a line from Norwood, connecting with the Cincinnati & Norwood and the Rapid Transit route at Oakley, and with the Cincinnati and Oakley route. It will cross the Madisonville line and connect with the East End line at Red Bank.

***Oxford, O.*—The Cincinnati & Hamilton Traction Co.** is stated to have secured a franchise in Oxford.

***Dayton, O.*—The Dayton Eastern Consolidated Traction Co.**, of Dayton, has been incorporated with a capital of $10,000 by M. L. Mowser, F. E. Jones and others, to operate a street railway in Dayton and an interurban line between Dayton and Xenia.

***Mansfield, O.*—The City Council has granted a franchise** to the Mansfield, Mt. Gilead & Delaware Traction Co.

The Mansfield-Ashland Traction Co., composed of J. J. McGuire and Wm. Galbraith, of Mansfield, and W. J. Pentz, of Cleveland, has petitioned the Council for a franchise.

***Ft. Wayne, Ind.*—The Ft. Wayne & Southwestern R. R. Co.** has been incorporated with a capital of $125,000 by W. H. Ogden, Tipton; J. F. Spaunhyrst, Indianapolis; Isaac Booth, Tipton, and others. The road will be 125 miles in length and will run from Indianapolis through the counties of Marion, Hamilton, Tipton, Madison, Grant, Huntington and Allen, through the State of Ohio to the town of Hicksville, O. Principal office to be in Indianapolis.

***Muncie, Ind.*—The Chicago, Indiana & Eastern Ry. Co.** is stated to have filed with the Secretary of State notice of an increase in capital stock from $420,000 to $1,000,000. The road is now built from Muncie to Converse, and it will probably be extended to Chicago.

The Union Traction Co. is stated to have secured from the Comrs. of Delaware County a franchise to operate a line from Muncie to Anderson and from Daleville to Middletown.

Lagrange, Ind.—A press report states that L. D. Fleming, of Ligonier, has secured a franchise for an electric railway through Lagrange, Noble and Kosciusko Counties.

***New Albany, Ind.*—The New Albany, Paoli & French Lick Valley Traction Co.** has been incorporated, with a capital of $100,000, to construct an electric line from New Albany to French Lick and West Baden Springs by way of Paoli. Principal office to be located at French Lick. Incorporators: Thos. Taggart, Indianapolis; Thos. B. Buskirk, Paoli; Crawford Fairbanks, Terre Haute, and others.

***Pekin, Ill.*—The City Council** is stated to have granted J. W. Knight and Levi Johnston franchise to construct and operate an electric railway through Pekin.

***Duluth, Minn.*—The Missabe Electric Ry. Co.** has petitioned the Co. Comrs. for a franchise to construct and operate an electric railway in St. Louis County. G. G. Hartley, Pres.

***Eau Claire, Wis.*—The Chippewa Valley Electric R. R. Co.** is reported to be considering the construction of an electric railway to connect Eau Claire and Menomonie and also Eau Claire and Mondovi. H. G. Lawrence, Mgr., Eau Claire.

Evansville, Ind.—The Evansville, Boonville & Rockport Ry. Co. of Evansville has been incorporated; capital, $30,000. Incorporators, Wm. Threlkeld, Delaud Maley, Daniel Werz and others.

Pleasant View, Tenn.—The Cheatham Co. Comrs. are stated to have granted T. N. Watson, of Clarksville, and W. W. Scott, of Pleasant View, representing the Nashville & Clarksville Electric Ry. Co., a franchise through Pleasant View.

***Columbia, Mo.*—Wm. H. Chase**, of Toledo, O.; E. W. Price, of Salisbury, and Geo. B. Harrison, of Glasgow, are reported to be conferring with the citizens of Boone County regarding the construction of an electric railway through Linn, Chariton, Howard, Boone, Callaway, Montgomery, Warren and St. Charles Counties.

***Carl Junction, Mo.*—The Southwest Missouri Electric Ry. Co.** is reported to be planning to extend its line to Carl Junction by way of Chitwood. A. H. Rogers, Pres., Joplin.

***Franklin, Tenn.*—The City Council is stated to have** granted a franchise to the Tennessee Interurban Electric Ry. Co.

Clarksville, Tenn.—The Montgomery Co. Comrs. are stated to have granted franchise for two electric railways, one to T. N. Watson for a line from Clarksville through Pleasant View to Nashville, and the other to H. N. Leech and H. C. Merritt for a line from Clarksville to Hopkinsville and Guthrie, Ky.

***Beaumont, Tex.*—The City Council is stated to have** granted Harry K. Johnson a franchise to construct and operate an electric railway to connect with the present system in which he is reported interested.

Pasadena, Cal.—Attorney H. M. Magee is stated to have petitioned the City Trus. for a franchise.

Salem, Utah.—Reed Smoot is stated to have secured a franchise for an electric railway through the town.

London, Ont.—The London, Aylmer & North Shore Electric Ry. Co. has been incorporated, with a capital of $500,000, to construct an electric road 50 miles long in Canada with termini in London, Ont., and Port Burwell, and passing through Middlesex and Essex Counties. Directors: Jas. H. Hitchcock, of N. Y. City, N. Y.; Fredck. Hitchcock, Detroit, Mich.; C. R. Luton, Grand Rapids, Mich.; W. E. Stevens, Alymer, Ont., and others.

RAILROADS.

Pittsburg, Pa.—Five ordinances have been introduced in Common Council as follows: One granting the Pennsylvania R. R. (W. H. Brown, Ch. Engr., Philadelphia) the right to build an elevated railroad along Duquesne Way to the Monongahela Wharf; the 2d providing for the new Negley Run branch, including overhead bridges over Hamilton and Kelly Aves.; the 3d providing for the continuation of that branch through Highland Park; the 4th providing for the overhead crossing at 2d Ave. and Try St., and the 5th conferring on the Pittsburg, Carnegie & Western R. R., the Wabash R. R. extension (W. S. Newhall, Ch. Engr., St. Louis, Mo.), franchises to enter the city and connect with the South Side manufacturing establishments.

Suffolk, Va.—At the annual meeting of the stockholders of the Suffolk & Carolina R. R. Co. Oct. 9, the proposition to have the road changed to a broad gauge line was confirmed, and it was decided to run an extension to Elizabeth City, N. C., about 23 miles, the extension to start from a point near Bosley, N. C. The new improvements will cost about $800,000. Geo. L. Barton, Gen. Mgr., Suffolk.

Joliet, Ill.—The Joliet & Northwestern R. R. Co. has been incorporated, with a capital of $500,000, to construct a line from Joliet, Ill., to Newkirk, Plattville, Morris, Plano, Aurora and Sandwich. Incorporators, E. H. Young, Yorkville; F. G. Young, Bristol; S. E. Overhiser, Chicago, and others.

Sandridge, Ill.—The Groves & Sandridge Ry. Co. has been incorporated, with a capital of $10,000, to construct a railroad from a point on the line of the St. Louis, Alton & Terre Haute Ry. at Groves, through the counties of Perry and Jackson, to a connection with the Chicago & Texas R. R., at or near Sandridge. Incorporators: F. G. Van Dusen, F. L. De Lay and others, all of Chicago.

Tony, Wis.—The Tony & Northeastern Ry. Co. has been incorporated, with a capital of $25,000, to construct a railway from Tony 18 miles n. e. Incorporators: John Hein, W F. O'Connor, and others, all of Tony.

Wichita, Kan.—The City Council has granted a franchise to the Kansas City, Mexico & Orient Ry. Co., with a provision that its depot be erected on Douglas Ave. M. P. Paret, Ch. Engr., Bryant Bldg., Kansas City, Mo.

Charleston, Tenn.—A charter has been granted to the Tennessee, Georgia and South Carolina R. R. Co., with a capital of $50,000, to construct a railroad from Charleston to Anderson, S. C. John F. Stone and W. C. Patrick, both of Cummings, S. C., are among the incorporators.

Sellersville, Ala.—The directors of the Chattahoochee & Gulf R. R. Co. are stated to have decided to extend the road from Sellersville to Flovala, Ala., a distance of 24 miles.

Muskogee, Ind. Ter.—A charter has been granted to the Muskogee Southern Ry. Co., with a capital of $2,000,000, to construct a railroad about 260 miles in length. Incorporators: Wm. T. Hutchings, of Muskogee, Horace Speed, of Guthrie, Okla. Ter., and others.

Colgate, Ind. Ter.—The Directors of the Missouri, Kansas & Oklahoma R. R. Co. are stated to have decided to extend the line to Colgate.

El Reno, Okla. Ter.—A press report states that the Oklahoma Central & St. Louis R. R. Co. has been incorporated, with a capital of $15,000,000, to construct a railroad about 600 miles in length, from El Reno, where it will connect with the Choctaw & Rock Island, through Guthrie, to Joplin, Mo., Jefferson City or St. Louis, crossing the Kansas City line of the Rock Island at Versailles, Mo. W. S. McCaul, of Kansas City, Mo., is reported interested.

Guatemala, So. America.—The McDonald Construction Co. of Knoxville, Tenn. (Jas. B. McDonald, Pres.), is stated to have secured the contract for constructing about 70 miles of railroad in Guatemala.

PUBLIC BUILDINGS.

Northampton, Mass.—Mr. Hubbard, of Utica, N. Y., is the architect for a $25,000 brick (with brown stone trimmings) church to be built for the Baptist Society. The building is to be steam heated.

New York, N. Y.—The Bd. of Estimate on Oct. 13 is stated to have authorized an extra appropriation for public baths in Manhattan.

Ludlow & Valentine, 100 Broadway, have been appointed architects for new brick and stone church buildings to be erected for the Lenox Presbyterian Church, at St. Nicholas Ave. and 141st St.; size of plot, 114x127 ft.

Brooklyn, N. Y.—Plans have been filed for remodeling the interior of the Brooklyn Boro. Hall, to cost $20,000. Architect, A. S. Hedman, 371 Fulton St.

Bids will be received Oct. 29 (extension of date) by J. Edw. Swanstrom, Pres. Boro. of Brooklyn, for furnishing material and erecting an interior public bath building on Hicks St., near Degraw St.

Trenton, N. J.—David R. Burns, of Philadelphia, Pa., is stated to have secured the contract for installing the heating apparatus in the Mercer County Court House, for $9,713.

Paterson, N. J.—The plans of S. M. Holden are stated to have been accepted for a 2-story brick and terra cotta edifice for the Park Ave. Baptist Church. Rev. J. W. Lissenden, pastor.

Natrona, Pa.—Sidney F. Heckert, 341 6th Ave., Pittsburg, is stated to have completed plans for an edifice for St. Ladislaus R. C. Church, to cost $35,000.

Newark, N. J.—The Electric Motor & Equipment Co., 13 Beaver St., is stated to have secured the contract for installing the electrical equipment and telephone tubing in the new City Hall, for $59,200.

Philadelphia, Pa.—Bids are wanted Oct. 23 for equipping three new buildings at the Phila. Hospital with steam, hot water generators, electric lighting, power cables, etc. W. J. McLaughlin, Pres. pro tem, Dept. of Charities and Correction.

Baltimore, Md.—The contract for erecting No. 23 Engine House is stated to have been awarded to C. R. Parlett, for $20,298.

The congregation of the Fuller Memorial Baptist Church are stated to have decided to erect an edifice on North Ave. and Mount St., to cost about $20,000.

Miami, Fla.—Architect Chas. C. Wilson, of Columbia, S. C., writes that the contract for erecting a court house has been awarded to the Capital City Building Co. of Montgomery, Ala., for $44,000, with right reserved to add within 6 months items omitted, bringing the total up to $52,650.

Richmond, Va.—The Presbyterian Synod of Virginia will erect, as soon as site is determined upon, an orphanage building to accommodate about 400 children. Rev. C. W. Maxwell, of Norfolk, is Chmn. of Com.

Atlanta, Ga.—The First M. E. Church is about to erect a $70,000 building.

Springfield, O.—Henry Harrig & Co., of Cincinnati, are stated to have secured the contract for erecting the new county building, for $61,980.

Marion, O.—W. T. Mills, 73 Wesley Blk., is stated to have been selected to prepare plans for an Old Ladies' Home at Marion, to cost about $30,000.

Fond du Lac, Wis.—The plans of Van Ryn & De Gelleke, 211 Grand Ave., Milwaukee, are stated to have been accepted for the Public Library.

Park Rapids, Minn.—The Hubbard Co. Comrs. are reported to be considering the erection of a jail, to cost about $10,000.

Spirit Lake, Ia.—The Superv. are stated to have decided to erect a 2-story jail.

St. Louis, Mo.—The plans of Watson & Hazelton, 305 Dearborn St., Chicago, Ill., are stated to have been accepted for the Illinois Building, to be erected on the grounds of the La. Purchase Exposition; the building to cost about $50,000, and interior decorations, $25,000.

Mississippi City, Miss.—The Superv. of Harrison County are stated to have postponed the selection of plans for the court house to be erected at Gulfport until Nov. 3.

Hazlehurst, Miss.—The Pauly Jail & Bldg. Co., of St. Louis, Mo., is stated to have secured the contract for erecting the Copiah Co. Jail, for $11,600.

Trenton, Mo.—It is reported that bids will be received Oct. 23 by the Co. Clk. for erecting a court house, jail and jailer's residence.

Seattle, Wash.—Local press reports state that Washington State Architects and six outside architects have been asked to submit competitive plans for the Carnegie Library, to cost $200,000.

Salt Lake City, Utah.—The Van Dorn Iron Works Co., of Cleveland, O., is stated to have secured the contract for erecting the city jail, for $34,875.

Oakland, Cal.—It is stated that the congregation of the First Baptist Church will erect a $75,000 edifice on 21st St. and Telegraph Ave.

BUSINESS BUILDINGS.

Boston, Mass.—Plans have been filed for a 1 and 2-story wooden building, 292x853 ft., to be located on Summer St. Estimated cost, $40,000. Owner, Boston Molasses Co.; architect, M. D. Safford, 274 A St., So. Boston. There will be a brick boiler house.

Plans have been filed by Clinton J. Warren, Archt., 7 Water St., for a 7-story addition to the Massachusetts Chambers, Mass. Ave. Estimated cost, $150,000; owners, The Metropolitan Trust, Geo. Cabot and E. A. Bangs, Trus.

New Britain, Conn.—A brick block 5 stories high, 50x100 ft., is to be built on Main St. at a cost of $22,000.

Portland, Me.—Bids are wanted Oct. 27 for erecting a passenger station for the Grand Trunk at Portland. Address Mr. M. S. Blaiklock, Supt. Eastern Div., Grand Trunk Ry., Montreal, P. Q.

New York, N. Y.—V. Hugo Koehler is stated to have prepared plans for a theatre to be erected in 42d St., west of 7th Ave., for Reginald De Koven. It will have a seating capacity of about 1,500 persons.

Ballston Spa, N. Y.—The Ballston Spa Improv. Assoc. is stated to have received plans for a new summer hotel, to cost about $60,000.

Buffalo, N. Y.—It is stated that the Richard Realty Co., of Buffalo, will erect a 10-story steel fireproof building on Main and Niagara Sts., to cost about $250,000. Mark Rafalsky, 170 Bway., N. Y. City, is reported to be the architect.

Philadelphia, Pa.—Amos W. Barnes is reported to be preparing plans for a 10-story apartment hotel to be erected in the central section of the city.

The Angus S. Wade Co. is stated to have secured the contract for the erection of a building at 10th St. and Columbia Ave., for Andrew Cochran, to be used by Post Office Station O and for offices and apartments. It will be 3 stories high, 64x144 ft., and cost about $50,000. J. Franklin Stuckert & Son, 1421 Chestnut St., are the architects.

Jos. Bird is stated to have secured the contract for erecting the Lu Lu Temple of the Mystic Shrine on Spring Garden and Broad Sts.; cost to be about $100,000. Architects, Mulligan & Webber, 520 Walnut St.

Pittsburg, Pa.—It is stated that Hawkins Bros. are considering the erection of an 8-story warehouse on Wood St. and 1st Ave., to cost about $50,000.

The Jones & Laughlins Steel Co. is stated to have decided to erect a 10-story office building on Ross and 3d Sts.

McKeesport, Pa.—E. J. Carlisle & Co., 700 Lewis Blk., Pittsburg, are stated to have been commissioned to prepare plans for a 4-story addition, 56x101 ft., to the National Hotel at McKeesport; cost, $20,000.

Greensburg, Pa.—The Pittsburg, McKeesport & Greensburg Ry. Co. is stated to have purchased a site in South Greensburg and will begin at once the erection of a barn, 310x85 ft.

Baltimore, Md.—Local press reports state that Jas. L. Kernan will erect a theatre and possibly a hotel on Howard and Franklin Sts. Architect, D. W. Thomas, 506 Maryland Trust Bldg.

Norfolk, Va.—D. Lowenberg, of Norfolk, is stated to have decided to erect a 10-story building on Granby St.

It is stated that plans have been completed and the contract will soon be let for the Atlantic Hotel, to be erected on Main and Granby Sts. for C. M. Randolph.

Albany, Ga.—Artesian City Lodge No. 30, Knights of Pythias, is reported to be considering the erection of a store and office building with lodge room, to cost about $20,000.

Merrill, Wis.—Wm. H. Nelson, 1100 E. Main St., is stated to have secured the contract for erecting the Masonic Temple for about $20,000.

Muscatine, Ia.—Wm. Kincaid is stated to have secured the contract for erecting the Y. M. C. A. building for $30,264, and J. G. Gunzenhauser, of Muscatine, secured the contract for the plumbing at $4,680.

Ft. Dodge, Ia.—It is stated that the Chicago Great Western R. R. will erect a $30,000 freight depot here. O. Cornelisen, Div. Supt., Ft. Dodge.

St. Paul, Minn.—The Chicago, Milwaukee & St. Paul R. R. has taken out a permit for the erection of an extension to the present freight house on 3d St. between Sibley and Bway. Sts. Cost, $20,000.

Saginaw, Mich.—W. T. Cooper, 305 Hayden St., is preparing plans for a 6-story business building for Issac Bearinger of Saginaw.

The Y. M. C. A. is reported to be taking steps toward erecting a $40,000 building. A. S. Hopper, secretary.

Houston, Tex.—A correspondent writes that a 7-story fireproof office building is to be erected for the Southern Pacific System; cost, $200,000. Olle J. Lorehn, Binz Bldg., Archt.

Jennings, La.—Bids are wanted Oct. 28 for erecting a 3-story brick hotel, 180x140 ft., for T. C. Mahaffey. W. L. Stevens, Archt., Crowley, La.

Kansas City, Mo.—Root & Siemens, Postal Telegraph Bldg., have prepared plans for a brick store building, to be erected on Baltimore Ave. and 10th St. for John Taylor, to cost $40,000; also for a brick warehouse, to be erected on Hickory St. for Studebaker Bros., to cost about $150,000.

The Adams Transfer Co. will erect a brick warehouse on 4th and Central Sts., to cost $20,000.

The Chicago, Milwaukee & St. Paul Ry. Co. will erect a brick office building on Liberty and 14th Sts., to cost $40,000.

J. W. McKicknie, N. Y. Life Bldg., has prepared plans for a brick store for the C. L. Chase Co. at 1423 9th St., to cost $20,000.

The Advance Thresher Co. will erect a brick store on 10th and Santa Fe Sts., to cost $40,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

8 Cannon St, 7-story br factory; c, $20,000; o, Jacob Cohen; a, G F Pelham.

112 to 116 Ave C, 6-story br tenemt and stores; c, $42,000; o, Saml Brasch; a, Geo F Pelham.

21st St and 4th Ave, 9-story br and stone lofts, stores and offices; c, $50,000; o, Simon Haberman; a, G A Schellenger.

7th Ave and 126th St, 5-story br theatre; c, $200,000; o, Associate Realty Concern; a, J. B. McElfatrick & Son.

174th St and 3d Ave, 4 5-story br tenemts and stores; c, total, $106,000; o, Stephen M Anderson; a, F W Hester.

BROOKLYN, N. Y.

Kingsland Ave and Lombardy St, 3-story br ice factory; c, $35,000; o, A. Gliesner; a, Th Engelhardt.

Varet St and Graham Ave, 5-story br store, etc; c, $18,000; o, M J Annenberg; a, H Smith.

DWELLINGS.

Torresdale, Pa.—It is stated that Robt. H. Foerderer's mansion is to be remodeled, at a cost of $75,000.

Pittsburg, Pa.—Harry L. Kreusler is stated to have secured the contract for erecting a residence on Beacon and Murdoch Sts. for A. A. Frauenheim, to cost $100,000.

Washington, D. C.—Marsh & Peter, 520 13th St. n. w., are stated to have completed plans for a 4-story white stone residence for Dr. C. Alex. Crawford, U. S. N., to be erected on New Hampshire Ave. n. of Dupont Circle.

Jas. M. Green is about to have plans prepared for a residence for his own use, to be erected on Massachusetts Ave. and 17th St

Wilmington, Del.—Frank S. Zane, of Philadelphia, Pa., will shortly commence the erection of a block of dwellings on Vandever Ave. and Church St.; cost, about $40,000.

Newark, N. J.—Wm. F. Lehman, 224 Market St., is stated to be preparing plans for an 8-story fireproof apartment house to be erected at 25 Central Ave. for S. Leschziner & Co., to cost about $100,000.

Austin, Tex.—Dr. E. P. Wilmot is to erect a residence, to cost $14,000, on Congress Ave. and 16th St.

Kansas City, Mo.—J. M. McKicknie, N. Y. Life Bldg., has prepared plans for brick residences to be erected on Armour Boule. and Baltl. Ave. for W. H. Collins, to cost $40,000.

Salt Lake City, Utah.—W. E. Ware, 62 Hooper Bldg., is stated to have completed plans for a residence for M. H. Walker, to be erected on 6th, E. and S Temple St., to cost about $50,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

235 and 237 E 25th St, 6-story br tenemt; c, $40,000; o, Leopold Kaufmann; a, Geo A O'Rourke.

Jackson Ave and 166th St, 5 3-story br dwells; c, $37,500; o, C A Lavelle; a, J H Lavelle.

414 5th Ave, extension to 5-story br dwell; c, $20,000; o, Estate John C Duncan; a, Clarence L Sefert.

BROOKLYN, N. Y.

McDougal St and Stone Ave, 5 3-story br dwells; c, $30,000; o, E Brooks; a, H Vollweiler.

Union St and Brooklyn Ave, 4 2-story and attic br dwells; c, total, $32,000; o, Eastern Parkway Co; a, H M Congdon & Son; b, H B Moore.

Union St and Brooklyn Ave, 6 2-story and attic br dwells; c, total, $48,000; o, Eastern Parkway Co; a, H M Congdon & Son; b, H B Moore.

SCHOOLS.

Middletown, Conn.—It is stated that an astronomical observatory is to be erected at the Wesleyan Univ., to cost about $40,000.

New York, N. Y.—Bids will be received Oct. 24 by C. B. J. Snyder, Supt. of School Bldgs., for installing electric elevators in new High School of Commerce, 65th St. and Amsterdam Ave.

The following bids were opened Oct. 13 at the Dept. of Educ. for the general construction of Public School 110, Boro. of Manhattan: Peter Cleary, 195 Bainbridge St., Brooklyn, $222,640 (awarded); Thos. B. Leahy, $233,495; Patk. Sullivan, $227,800; Luke A. Burke, $236,775.

Brooklyn, N. Y.—The following bids were opened Oct. 10 by Supt. of School Bldgs., C. B. J. Snyder, Dept. of Education, New York City, for heating and ventilating apparatus in School 141, Boro. of Brooklyn: Walker & Chambers, $33,500; John Neal's Sons, $31,421; Williams & Gerstle, $29,696; Frank Dobson, 218 E. 42d St., N. Y. City, $28,645; Blake & Williams, $29,389; United Htg. Co., $29,232; E. Rutzler, $30,600.

Bryn Mawr, Pa.—A press report states that bids will be received Oct. 23 for a dormitory to be erected for Bryn Mawr College, to be known as Rockefeller Hall, to cost about $130,000. Architects, Cope & Stewardson, 320 Walnut St., Philadelphia.

Philadelphia, Pa.—Bids are wanted Oct. 21 for the erection of 18 division schools in the 25th and 40th Sections, also for an addition to Manayunk Grammar School. A. F. Hammond, Secy. Com. on Property, Bd. of Pub. Educ.

McKeesport, Pa.—Bids are wanted Oct. 30 for $25,000 school bonds. W. J. Roseborough, Secy. Bd. of Educ.

Summit, N. J.—The Bd. of Educ. is stated to have accepted the plans of Richard Shapter, of Summit, for a 3-story brick school 60x80 ft., to contain 6 rooms.

Newark, N. J.—Bids will be received Oct. 21 by the Com. of Schoolhouses of Bd. of Educ. for erecting 2 schools and 2 school additions. R. D. Argue, Secy.

Trenton, N. J.—Bids will be received Oct. 31 by the Com. on Grounds and Bldgs. for mason and carpenter work, heating and plumbing, separately, or for the whole or any part of work, of a brick and stone school on Fillmore St. J. C. Bloom, Chmn. Com.; Architect, S. A. Brouse, First Natl. Bank Bldg.

Charleston, W. Va.—A. B. Calderwood is stated to have secured the contract for erecting a school, for $34,206.

Cleveland, O.—Bids are wanted Nov. 3 for erecting Woodridge School; bids will also be received for heating and ventilating and concrete fireproof construction. Starr Cadwallader, School Dir.

Chicago, Ill.—Shepley, Rutan & Coolidge, 84 Van Buren St., are reported to be preparing plans for the school of law to be erected for the Univ. of Chicago, west of Haskell Museum. It will be 3 stories high, 170x60 ft., of fireproof construction, with stone exterior, and will cost about $200,000.

Bids are wanted Oct. 24 for erecting an addition to Pickard School, 21st Place and Oakley Ave. Address Com. on Bldgs. and Grounds.

Milwaukee, Wis.—Bids are wanted Oct. 22 for furnishing and erecting a school on Walnut and 37th St. in the 19th Ward. Chas. J. Poetsch, Chmn. Comrs. of Pub. Wks.

Council Bluffs, Ia.—The Roman Catholic Sisters will build an addition to the St. Francis Academy for Young Ladies next spring, at a cost of $30,000 to $35,000.

Davenport, Ia.—The Northern Bldg. Co. is stated to have secured the contract for erecting School No. 14, for $46,802.

Versailles, Ky.—John Rump & Son are stated to have secured the contract for erecting the school and dormitory for Ashland Seminary, for $25,000.

Oklahoma City, Okla. Ter.—L. F. Lee, of Oklahoma City, is stated to have secured the contract for erecting a building for the Epworth Univ., for $39,150.

Ft. Collins, Colo.—The plans of M. W. Fuller are stated to have been accepted for a $35,000 high school.

Rugby, N. D.—It is stated that bids are wanted Oct. 28 for erecting 4 schools. W. McPeek, Clk.

STREET CLEANING AND GARBAGE DISPOSAL.

Manchester, N. H.—The Local Bd. of Trade is said to be considering the question of garbage disposal.

Brooklyn, N. Y.—J. Milton Kennedy, 1110 Temple Bar, was the only bidder Oct. 13 for the final disposition of ashes, street sweepings, rubbish and light refuse in Brooklyn Boro. His bid was 35 cts. per cu. yd.

Newark, N. J.—Wm. R. Swan, Clk. Com. of Pub. Markets, writes that the Common Council has awarded to Patrick Jones, 9 Oxford St., the contract for removing garbage and waste matter which may accumulate in and about the grounds of the Centre Market and streets adjoining, for $1,080 per year.

New York, N. Y.—The only bid received Oct. 17 for the removal of snow and ice in Manhattan Boro. till April 15, 1903, was that of the Century Construction Co., 21 Park Row, at 39c. per cu. yd.

GOVERNMENT WORK.

Ft. Banks, Winthrop, Mass.—Bids are wanted Nov. 10 for constructing, plumbing and electric wiring, Administration building. Address H. B. Grant, Q. M.

Portsmouth, N. H.—Bids will be received Nov. 22 by Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C., for erecting a coal storage and coal handling plant at Navy Yard. Appropriation available, $9,500; also on the same date for reconstructing building No. 60, Navy Yard. Estimated cost, $65,000.

Washington, D. C.—The following bids were received by the Bureau of Engraving and Printing, Treasury Dept., for safety vaults: York Safe & Lock Co., York, Pa., $48,935; L. H. Miller Safe & Iron Co., Baltimore, Md., $42,699.

Philadelphia, Pa.—The following bids were opened Oct. 11 at the Bureau of Yards & Docks, Navy Dept., for constructing a brick and steel building at the League Island Navy Yard: Penn Erecting Co., Philadelphia, $210,000; Henderson & Co., $211,434; American Paving & Constr. Co., $248,500; Colonial Constr. Co., $213,800; Penn Bridge Co., Beaver Falls, $220,970.

Washington, D. C.—The Interior Dept. has awarded contracts for the construction of additional buildings at the Government Hospital for the Insane as follows: Power house, chimney and tunnels, to W. E. Speir, of Washington, $82,620; heating plant, to Blake & Williams, of New York, $77,334; electrical machinery and wiring, to the F. P. Little Electrical Constr. & Supply Co., Buffalo, for $89,295; administration building, to Horton & Hemenway, Providence, R. I.

Rome, N. Y.—Bids are wanted Nov. 20 for erecting the U. S. Post Office Building at Rome. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Ft. Monroe, Va.—Bids are wanted Nov. 7 for heating by steam, Quarters No. 50. C. P. Townsley, Q. M.

Charleston, S. C.—Bids were opened Oct. 11 at the Navy Dept., Washington, D. C., for the construction of concrete and granite dry dock No. 1 at the Charleston Navy Yard. Bids submitted for construction according to the Department's plans and specifications were as follows: Virginia Engineering & Construction Co., Richmond, Va., $1,189,450; Southern Engineering & Contracting Co., Charleston, S. C., $1,213,500; N. Y. Continental Jewell Filtration Co., New York City, $1,224,617; Norcross Bros. Co., Worcester, Mass., $1,320,000; P. J. Carlin & Co., Brooklyn, N. Y., $1,320,981; John Peirce, New York City, $1,406,924, and H. E. Talbott & Co., Dayton, O., $1,613,000. Each of the bidders submitted additional bids, for the work, on his own plans. Limit of cost set down in specifications, $1,200,000.

Ft. Gelly, S. C.—Capt. David Price, Q. M., writes it has been recommended that the contract for heating, by hot air system, barracks and officers quarters at this post, be awarded the Moncrief Furnace & Fdy. Co. of Atlanta, Ga., for $11,680.

Newport News, Va.—The following bids were opened Oct. 9 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Custom House and Post Office at Newport News: Doyle & Doak, Phila., Pa., $211,900; Cramp & Co., Phila., Pa., $181,000; Chas. McCaul Co., $174,627; Penn Bridge Co., Beaver Falls, Pa., $206,300; Arthur Cowsill, Washington, D. C., $179,441; W. E. Spier, Washington, D. C., $192,190; Richardson & Burgess, Washington, D. C., $189,243; A. B. Stannard, New York City, $167,350; Holtclaw Bros., Hampton, Va., $200,786; J. H. Bronson, Hampton, Va., $251,437; Congress Const. Co., Chicago, Ill., $185,383; West Richardson, Newport News, $167,628.

Tampa, Fla.—The following bids were opened Oct. 6 by Capt. Francis R. Shunk, Corps of Engrs., U. S. A., St. Augustine, Fla., for dredging in Orange Mills Flats, St. Johns River: D. M. Baker, Jacksonville, Fla., 29c. per cu. yd.; Geo. T. Warner, Savannah, Ga., 14.4c.; P. Sanford Ross, Jersey City, N. J., 12c.

Norfolk, Va.—Bids will be received Nov. 20 at the Engr.'s Office, U. S. Army Bldg., Custom House, Norfolk, for dredging waterway from Norfolk Harbor to Albemarle Sound, N. C.

Chicago, Ill.—The following bids were received at the Treasury Dept., Washington, D. C., for drainage, plumbing, etc., for the Chicago Government Building: F. P. Gleason & Co., Chicago, $71,554; Boyd & Co., Chicago, $74,460; M. J. Corboy, Chicago, $82,000; Hanley-Casey Co., Chicago, $62,283; P. Nacey Co., Chicago, $68,091; E. Baggott Co., Chicago, $65,793; Edw. Joy, Syracuse, N. Y., $105,000; Wells & Newton Co., New York City, $53,700.

Indianapolis, Ind.—The following bids were opened Sept. 30 at the Treasury Dept., Washington, D. C., for the mechanical and electrical equipment for the U. S. Court House and Post Office, Indianapolis: C. B. Kruse Htg. Co., Milwaukee, $111,790; J. S. Farrell, Indianapolis, $131,330; Jos. McWilliams & Co., Louisville, $111,028; Thomas & Smith, Chicago, $115,143; Sandmeyer & Co., Peoria, $137,090; W. H. Crane Estate, Cincinnati, $120,765; Jno. Peirce, New York, $134,459; A. A. Sanborn, Boston, $114,500; J. F. Buchanan & Co., Philadelphia, $149,700; S. Faith, Philadelphia, $134,400.

Mobile, Ala.—Bids are wanted Nov. 12 at the U. S. Engineer Office for dredging on Outer Bar of Mobile Harbor, as advertised in The Engineering Record.

The following bids are stated to have been received Oct. 10 for dredging in Mobile Bay and River, Ala.: National Dredging Co., Wilmington, Del., 8.3 cts. per cu. yd.; Fred E. Jones, Washington, D. C., 8.75 cts.; Bowers Southern Dredging Co., Galveston, Tex., 8.9 cts.

Joplin, Mo.—The following bids were opened Oct. 7 for the construction (except heating apparatus, electric wiring and conduits), of the U. S. Post Office at Joplin: Dieter & Wenzel, Joplin, $123,932; B. Jobst & Sons, Peoria, $108,873; Congress Const. Co., Chicago, Ill., $112,234; C. Stafford Bldg. & Const. Co., St. Louis, $113,121; Zabey, Nathans & Co., St. Louis $152,618.

St. Louis, Mo.—The following bids were opened Oct. 15 at the Treasury Dept., Washington, D. C., for the structural steel work of the U. S. Government Bldg. at the Louisiana Purchase Exposition, St. Louis: Brown-Ketcham Iron Wks., Indianapolis, Ind., $109,870; Penn Bridge Co., Beaver Falls, Pa., $102,370; Champion Iron Wks., Canton O., $99,493.

Shreveport, La.—Bids are wanted Nov. 1 for constructing dikes, etc., in Red River. Capt. Chas. L. Potter, Corps Engr., Vicksburg, Miss.

Lawrence, Kan.—Bids are wanted for furnishing and delivering at the Haskell Inst., Lawrence, during the fiscal year ending June 30, 1903, a quantity of building supplies, including about 252,000 brick, 603 bbls. cement, 4 tons plastering cement, etc. Address H. B. Pacirs, Supt.

Aberdeen, S. D.—The following bids were opened Oct. 14 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits), of the U. S. Post Office at Aberdeen: Congress Const. Co., Chicago, Ill., $137,793; E. Miller, Aberdeen, $139,400; P. M. Hennessy, St. Paul, Minn., $145,597; Butler Bros., St. Paul, $143,846; General Const. Co., Milwaukee, Wis., $146,500.

Salem, Ore.—Bids are wanted Nov. 12 for constructing sewer and drainage system at the Salem School, Chemawa. Address Comrs. of Indian Affairs, Washington, D. C.

MISCELLANEOUS.

Boston, Mass.—The following bids, opened Oct. 9 by the Bd. of Harbor & Land Comrs. for dredging in Dorchester Bay, about 395,000 cu. yds., were all rejected: New England Dredging Co. and Eastern Dredging Co., both of Boston, 22 9/10c. per cu. yd.; Bay State Dredging Co., of Boston, 24½c. per cu. yd.

Rochester, N. Y.—The coal chutes of the New York Central R. R., recently erected at a cost of over $100,000, are reported to have been destroyed by fire.

Washington, D. C.—In a recent report to the Engineer Commissioner, W. P. Richards, Asst. Engr., recommends the following improvements in Rock Creek Park during the coming year: Completing, grading and macadamizing Beach driveway, 11,000 ft. in length, $19,350; two arches across Rock Creek on line of Beach driveway, $25,000; completing Ross Rd., 6,000 ft. long, $10,000; completing roadway leading from north end of Daniels Rd. to Beach driveway, $5,000; Blagden Ave. extension, $5,000; protecting Rock Creek banks, $5,000; footpaths and shelters, $10,000, and other small items, making a total of $104,225.

Brooklyn, N. Y.—Bids are wanted Oct. 23 for building shore protection and bulkhead at end of Ocean Parkway, Coney Island Concourse. Wm. R. Willcox, Comr. of Parks.

New York, N. Y.—Bids are wanted Oct. 24 for preparing for and building a new pier with appurtenances at the foot of E. 132d St., East River. McDougall Hawkes, Comr. of Docks.

Philadelphia, Pa.—The Councils' Com. on Municipal Goverment is considering four ordinances for parks in various sections of the city.

Augusta, Ga.—Nesbit Wingfield, Comr. of Pub. Wks., has submitted his report to the Council upon the river front protection matter. He estimates the cost of levees as follows: For protection from a 34-ft. 7-in. river, $64,513; for protection against a 36-ft. river, $73,315; for protection from a 40-ft. river, $528,385.

Cleveland, O.—An ordinance introduced in the Council provides for the straightening of Cuyahoga River at the Jefferson St. bend by cutting a 200-ft. wide channel; estimated cost, $180,000.

Wellsville, O.—It is stated that bids are wanted Oct. 25, for building a retaining wall on Water St., requiring about 800 cu. yds. excavation and 2,100 cu. yds. masonry. J. W. McQueen, City Clk.

Abbeville, La.—Bids are wanted for excavating $34,000 lin. ft. of ditches, aggregating approximately 68,000 cu. yds. Address Guerard & Hassinger, 223 North Peters St., New Orleans.

Gueydan, La.—Bids are wanted Nov. 4 for approximately 500,000 cu. yds. of dredge work on Canals A, also 43,000 cu. yds. of dredge or scraper work on Canals B, Vermilion Parish. W. D. Parish, Pres. Bd. of Comrs., Gueydan Drainage Dist.

Bossier City, La.—Bids are wanted Nov. 6 for constructing Willow Chute Levee, approximate contents 25,000 cu. yds., and Christiana Levee, approximate contents 20,000 cu. yds., in the Parish of Bossier. T. N. Braden, Sec'y Bd. of Comrs., Bossier Levee Dist., Curtis P. O., La.

New Orleans, La.—The engineers of the Bd. of Port Comrs. have submitted plans and specifications for steel sheds on wharfs as follows: Clouet St., cost about $15,000; Picayune Tier about $20,000, and Market-Orange St., about $40,000.

Pointe-a-la-Hache, La.—The Back Levee District Bd. is stated to have accepted the bid of John Dowdle, of New Orleans, to construct the new back gulf levee for 9½ cts. per cu. yd. It will require twenty months to complete levee. The issue of $135,000 bonds as authorized by special election of property owners, has all been sold.

Hannibal, Mo.—A press report states that the proposition to levy an assessment of $160,000 for improvements in the Sni levee district in Illinois, across the Mississippi river from Hannibal, has met with the approval of a majority of the property owners. A petition asking for the assessment has been presented to the county court.

Portland, Ore.—Consulting Engr. Jas E. Blackwell, of Seattle, Wash., writes that the following bids were opened by the Port Comrs. on Oct. 9, for machinery for the proposed dry dock: Williamette Iron & Steel Works, Portland, Ore., $58,000 (decline to accept penalty clause); Columbia Engineering Wks., Portland, Ore., $61,775 (awarded); Oakland Iron Wks., Oakland, Cal., $65,937; Phoenix Iron Wks., Portland, Ore., $67,294; Great Lakes Engineering Wks., Detroit, Mich., $94,500; R. D. Wood & Co., Philadelphia, Pa., $94,540.

NEW INDUSTRIAL PLANTS.

The Ideal Heating Co., Oskaloosa Ia., is erecting a 30x44-ft. molding room, and will be in the market for a 1,200 to 1,600-lb. cupola and a blower.

The Alexander Furnace & Mfg. Co., Lansing, Mich., is erecting a 2-story, 72x75-ft. shop, and intends to install a gas engine of about 20 H.-P. The company will be in the market for shafting, pulleys, belts, elevator, emery grinder and drill press.

The Dublin, Ga., Machine & Wagon Co. will erect a 35x80-ft. machine shop and a 35x100-ft. wagon shop. The company is in the market for an engine of about 60 H.-P. and 80-H.-P. boiler.

The Pioneer Flouring Mill Co., Island City, Ore., will probably erect a 150 to 200-bbl. mill, run by water power, to replace that recently burned, and install an auxiliary engine.

The Hall Signal Co., 25 Broad St., New York, has let a contract for the extension of its 3-story machine shop, at Garwood, N. J., 100 ft., which will make the size of the building 250x60 ft.

The F. S. Walton Co., 136 So. Front St., Philadelphia, has let contracts for the erection of a plant for pressing, refining and shipping animal oils, which will include a 100x40-ft. press house and refinery, with bleaching tanks on top; 40x26-ft. cold-storage plant; 20x40-ft. engine house; 20x40-ft. boiler house; 24x40 and 40x60-ft. shipping houses and a 105x20-ft. cooper shop. No contracts for equipment have been let.

The Russell & Erwin Mfg. Co., New Britain, Conn., intends to erect a 7-story, 175x50 ft. addition and install a 750-H.-P. engine.

James W. Woods, 64-66 Queen St., Ottawa, Can., maker of lumbermen's supplies, will erect a 6-story, 70x140 ft. factory.

R. S. Hill, president of the Farmers' and Merchants' Bank and the Farmers' Loan & Trust Co., Anderson, S. C., contemplates erecting a 25,000-spindle cotton mill to be driven by steam.

The London, Ont., Fence Machine Co., Ltd., has secured a site for a branch plant in Cleveland, O.

The Red Wing, Minn., Linseed Mills, has been incorporated with a capital of $100,000 and intends installing a 6-press mill for the present. N. K. Simmons, Pres.

The Burrows Mfg. Co., York, Pa., intends to erect a large plant for making steam specialties, which will probably not be erected before next spring or summer.

The Union Grain & Hay Co., Cincinnati, O., intends beginning about Jan. 1 to erect a 150,000-bu. elevator.

The Binner-Wells Co., 21-25 Plymouth Court, Chicago, will erect an 8-story, 50x120-ft. building. The capacity of the power plant will be 100 H.P., and motors will be installed.

J. L. Lovvorn, Bowdon, Ga., is interested in the organization of a company to erect a cottonseed-oil mill.

Robt. L. Steele, Rockingham, N. C., has bought a cotton mill building at Mammoth Spring, Ark., and intends to install new machinery.

BUSINESS NOTES.

The New York Continental Jewell Filtration Co., 15 Broad St., New York, reports the following among recent contracts: Water-works filter plants for Pontiac, Ill., Light & Water Co.; Freeport, Ill., Water Co.; Carthage, Mo., Water Co.; Danville, Ill., Water Co.; Camden, S. C., Water, Light & Ice Co.; U. S. Government, Presidio, San Francisco, Cal. Water-softening plants for the Cincinnati, Lawrenceburg & Aurora El. St. Ry. Co., North Bend, O.; Lackawanna Iron & Steel Co., Lebanon, Pa.; Columbia Chemical Co., Barberton, O.; Calumet & Hecla Mining Co., Lake Linden, Mich.; Chicago & Eastern Illinois R. R. Co., plants at Villa Grove, Holland, Salem, Marion, St. Elmo, Benton and Cypress, Ill.

Sargent, Conant & Co., Boston, will shortly complete the electric power and lighting equipment of the Hampton Co., Easthampton, Mass. The entire plant will be electrically driven, current being supplied by two multiphase generators, one direct coupled to a Corliss type engine, and the other belted from a water wheel, either or both of which can be used for operating motors, are or incandescent lamps.

The Snider-Hughes Co., Cleveland, O., builders of pumping machinery, have commenced the erection of a new plant, to include an 80x200-ft. machine shop, 36x60-ft. power house, 50x100-ft. pattern and storage building, and 38x45-ft. office building, and expect to erect a 60x150-ft. foundry in the spring. Two 100-H.-P. boilers, a 125-H.-P. engine and a 500-light dynamo, which have been bought, will be installed.

The Ball Engine Co., Erie, Pa., reports recently receiving orders from the following: Osborn, O., Water & Light Co.; Vose Piano Co., Boston, Mass.; Grand Crossing Tack Co., Chicago.

The New England Structural Co., Boston, has contracted to furnish in four months the steel framework for the new India Building, Boston, comprising 1,300 tons. Peabody & Stearns, Archts.

The Rhode Island Suburban Ry. has revised its contract with the Green Economizer Co., increasing the order to five complete machines.

The Alberger Condenser Co., 95 Liberty St., New York, reports the following among orders recently received: Belt Light & Power Co.; Pennsylvania Sugar Refinery; Sharon Steel Co.; Port Huron Light & Power Co.; Hartford Street Ry. Co.; Binghamton Light, Heat & Power Co. The equipment for the above plants consists of Alberger barometric or surface condensers with improved vacuum and circulating pumps, and the necessary appurtenances for producing the high vacuum required by the use of steam turbines which are being installed in most of the above plants.

The annual meeting of the stockholders of the Sprague Electric Co. was held Oct. 14, at the office of the company in Watsessing, N. J., and the following directors were elected for the ensuing year: Allan C. Bakewell, D. C. Durland, S. M. Hamill, J. R. Lovejoy, John Markle, J. R. McKee and E. G. Waters. At a meeting of the directors held later in the day, officers were elected as follows: Pres., Allan C. Bakewell; 1st Vice-Pres., S. M. Hamill; 2nd Vice-Pres., D. C. Durland; Sec. and Treas., Harry R. Swartz.

The Allis-Chalmers Co. has just sublet to the Coffin Valve Co. a contract for large sluice gates to be used in connection with the new Chicago sewerage plant. Two of these gates are 11 ft. in diameter, heavily bronze mounted, and are to be operated by hydraulic cylinders, and there are also included in the contract two check valves of 9 ft. diameter.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Oct. 21.	Filters, Annapolis, Md	Oct. 11
Oct. 21.	East Dundee, Ill.	Oct. 4
	Adv., Eng. Record, Oct. 4.	
Oct. 22.	Charleston, S. C.	Oct. 18
Oct. 22.	El Paso, Tex.	Sept. 6
Oct. 23.	Pig lead, Columbus, O.	Oct. 18
Oct. 24.	Troy, N. Y.	Oct. 18
Oct. 25.	Savannah, Ga.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Oct. 26.	Irrigation, Caldwell, Idaho	Oct. 18
Oct. 28.	Tank and tower, Truman, Minn.	Oct. 18
Oct. 27.	Mineral City, O.	Oct. 11
Oct. 28.	Ft. McRee, Fla	Oct. 11
Oct. 29.	Moline, Ill.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 30.	Kiester, Minn.	Oct. 18
Oct. 30.	Westbrook, Minn.	Oct. 18
Oct. 31.	Hamilton, Ont.	Oct. 11
Nov. 1.	Irrigation plant, Vinton, La.	Oct. 18
Nov. 1.	Miami, Ind. Ter.	Oct. 11
Nov. 4.	Gueydan, La.	Oct. 4
Nov. 5.	Lawton, Okla. Ter.	Oct. 11
Nov. 8.	Pipe, etc., Bremerton, Wash.	Oct. 11
Nov. 8.	Pumping plant, Brockton, Mass.	Sept. 27
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Dec 1.	Pumpa, Seguin, Tex.	July 26

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 20.	Ottumwa, Ia.	Oct. 18
Oct. 20.	Brackenridge, Pa.	Oct. 18
Oct. 20.	Millburn, N. J.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Oct. 21.	Bayonne, N. J.	Oct. 18
Oct. 21.	Allentown, Pa.	Oct. 11
Oct. 21.	Marion, Ind.	Oct. 4
Oct. 22.	Elkhart, Ind.	Oct. 11
Oct. 23.	Columbus, O.	Oct. 18
Oct. 23.	Revillo, S. D.	Oct. 18
Oct. 23.	Rapid City, S. D.	Oct. 11
Oct. 24.	Etna, Pa.	Oct. 18
Oct. 25.	Youngstown, O.	Oct. 18
Oct. 25.	Seattle, Wash.	Oct. 11
Oct. 27.	Cincinnati, O.	Oct. 18
Oct. 27.	Wabash, Ind.	Oct. 11
Oct. 27.	Vincennes, Ind.	Oct. 4
Oct. 28.	Columbus, Neb.	Oct. 18
Oct. 28.	Ft. McRee, Fla	Oct. 11
Oct. 28.	Binghamton, N. Y.	Oct. 11
Oct. 28.	Cincinnati, O.	Oct. 4
Oct. 29.	Niles, O.	Oct. 18
Oct. 29.	Brooklyn, N. Y.	Oct. 11
Oct. 30.	Columbus, O.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Oct. 30.	Cleveland, O.	Oct. 11
Nov. 4.	Bessemer, Ala.	Oct. 18
Nov. 5.	Westfield, Mass.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Nov. 6.	Nashville, Tenn.	Oct. 11
Nov. 8.	Roselle Park, N. J.	Oct. 18
Dec. 15.	Montevideo, Uruguay	Sept. 13

BRIDGES.

Oct. 21.	Chippewa, Ont.	Oct. 18
Oct. 24.	St. Louis, Mo.	Oct. 11
Oct. 24.	Sullivan, Ind.	Oct. 11
Oct. 27.	Victoria, B. C.	Sept. 6
	Adv., Eng. Record, Sept. 6 to Oct. 11.	
Oct. 31.	Hilo, Hawaii	Oct. 18
Nov. 5.	Cordova, Ala.	Oct. 11
Nov. 5.	Chicago, Ill.	Sept. 6
Nov. 6.	Indianapolis, Ind.	Oct. 18
Nov. 10.	Topeka, Kan.	Oct. 18
Dec. 1.	Bigtimber, Mont.	Sept. 27

PAVING AND ROADMAKING.

Oct. 21.	Dayton, O.	Oct. 18
Oct. 21.	Allentown, Pa.	Oct. 18
Oct. 21.	Trenton, N. J.	Oct. 18
Oct. 21.	Buffalo, N. Y.	Oct. 11
Oct. 22.	Boston, Mass.	Oct. 18
Oct. 22.	New York, N. Y.	Oct. 18
Oct. 22.	Des Moines, Ia.	Oct. 11
Oct. 22.	Elmwood Place, O.	Oct. 11
Oct. 23.	Brooklyn, N. Y.	Oct. 18
Oct. 23.	Columbus, O.	Oct. 18
Oct. 23.	Curbing, Des Moines, Ia.	Oct. 11
Oct. 23.	Terre Haute, Ind.	Oct. 11
Oct. 24.	New Brighton, S. I., N. Y.	Oct. 18
Oct. 24.	Des Moines, Ia.	Oct. 11
Oct. 24.	St. Louis, Mo.	Oct. 11
Oct. 27.	Laporte, Ind.	Oct. 18
Oct. 27.	Kent, O.	Oct. 18
Oct. 28.	Cincinnati, O.	Oct. 4
Oct. 29.	Elkhart, Ind.	Oct. 18
Oct. 29.	Cincinnati, O.	Oct. 18
Oct. 29.	Brooklyn, N. Y.	Oct. 18
Nov. 3.	Toledo, O.	Oct. 4
Nov. 3.	Vincennes, Ind.	Oct. 11
Nov. 12.	Cincinnati, O.	Oct. 18
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18.	

POWER, GAS AND ELECTRICITY.

Oct. 23.	Brooklyn, N. Y.	Oct. 18
Oct. 23.	Hanford, Cal.	Sept. 27
Oct. 24.	Wiring schools, Brooklyn, N. Y.	Oct. 18
Oct. 28.	Chattanooga, Tenn.	Sept. 13
	Adv., Eng. Record, Sept. 13 to Oct. 11.	
Nov. 1.	Miami, Ind. Ter.	Oct. 11
Nov. 1.	Macon, Ga.	Aug. 30
Nov. 15.	Baton Rouge, La.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 15	Norfolk, Va.	Sept. 13
Jan. 15.	Rome, Ga.	Oct. 11

GOVERNMENT WORK.

Oct. 20.	Portland, Me.	Oct. 4
	Adv., Eng. Record, Oct. 4 to 18.	
Oct. 20.	Ft. Riley, Kan.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 20.	San Francisco, Cal.	Sept. 27
Oct. 20.	New York, N. Y.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 18.	
Oct. 21.	Cement, etc., Portsmouth, N. H.	Oct. 11
Oct. 21.	Filters, Annapolis, Md	Oct. 11
Oct. 21.	(Conneaut Harbor), Cleveland, O.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 22.	(Ft. Rodman), Newport, R. I.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 22.	(Ludington), Grand Rapids, Mich.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 22.	Dredging, Annapolis, Md	Oct. 11
Oct. 23.	Watertown, Mass.	Oct. 4
Oct. 23.	(Brunswick Harbor), Savannah, Ga.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 23.	(Savannah Harbor), Savannah, Ga.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 23.	(Chesapeake Bay), Wilmington, Del.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 24.	Tompkinsville, N. Y.	Oct. 11
Oct. 24.	Wharf, Boston, Mass.	Oct. 11
Oct. 25.	Ft. Snelling, Minn.	Oct. 4
Oct. 25.	Los Angeles, Cal.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 25.	Bremerton, Wash.	Sept. 27
Oct. 28.	Ft. McRee, Fla	Oct. 11
Oct. 29.	Ft. Yates, N. D.	Oct. 11
Oct. 29.	(Ft. Greble) Newport, R. I.	Oct. 11
	Adv., Eng. Record, Oct. 11.	
Oct. 29.	Chicago, Ill.	Oct. 4
	Adv., Eng. Record, Oct. 4 to 18.	
Oct. 29.	Pier, Manistee, Mich.	Sept. 27
	Adv., Eng. Record, Sept. 27 to Oct. 18.	
Oct. 30.	Wheeling, W. Va	Oct. 4
	Adv., Eng. Record, Oct. 4 to 18.	
Oct. 30.	Dredging, Boston, Mass.	Sept. 20
	Adv., Eng. Record, Sept. 20, Oct. 18.	
Oct. 31.	Dredging, Norfolk, Va.	Oct. 4
	Adv., Eng. Record, Oct. 11.	
Nov. 1.	Shreveport, La.	Oct. 18
Nov. 1.	Bldg. at Navy Yard, Philadelphia, Pa.	Oct. 11
Nov. 1.	Quay Wall, San Francisco, Cal.	Oct. 11
Nov. 1.	West Point, N. Y.	Sept. 20
	Adv., Eng. Record, Sept. 20 to Oct. 18.	
Nov. 1.	Light-house, Philadelphia, Pa.	Oct. 4
	Adv., Eng. Record, Oct. 4, 11.	
Nov. 4.	Htg Hosp., Flandreau, S. D.	Oct. 11
Nov. 4.	Cheyenne, Wyo.	Oct. 4
	Adv., Eng. Record, Oct. 4, 11.	
Nov. 5.	Floor in Post Office, New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 6.	Breakwater, Cleveland, O.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 6.	Entrance to harbor, Cleveland, O.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 6.	Chicago, Ill.	Oct. 11
Nov. 7.	Ft. Monroe, Va.	Oct. 18
Nov. 8.	(Ft. Greble) Newport, R. I.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 8.	Completing Post Office, Chicago, Ill.	Oct. 11
Nov. 8.	Water mains, Bremerton, Wash.	Oct. 11
Nov. 10.	Ft. Banks, Winthrop, Mass.	Oct. 18
Nov. 10.	Ft. Ethan Allen, Vt.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Nov. 10.	La Purchase Expo. Bldgs., St. Louis, Mo.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 10.	(Lemon Creek) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 10.	Newport, R. I.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18	
Nov. 10.	(Raritan Bay) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 10.	(Woodbridge Creek) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 10.	Removal of ledge, New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 12.	Mobile, Ala.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Nov. 12.	Sewer, Salem, Ore.	Oct. 18
Nov. 12.	Denver, Colo.	Oct. 4
	Adv., Eng. Record, Oct. 4, 11.	
Nov. 12.	Charleston, S. C.	Oct. 4
	Adv., Eng. Record, Oct. 4 to 18.	
Nov. 13.	Dredging, New York, N. Y.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Nov. 17.	Shed, Buffalo, N. Y.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Nov. 20.	Post Office Bldg., Rome, N. Y.	Oct. 18
Nov. 20.	Dredging, Norfolk, Va.	Oct. 18
Nov. 22.	Coal plant, Portsmouth, N. H.	Oct. 18
Nov. 22.	Navy Bldg., Portsmouth, N. H.	Oct. 18
Dec. 6.	Dredging, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Dec. 10.	Jetty work, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
——	Brick, cement, etc., Lawrence, Kan.	Oct. 18

BUILDINGS.

Oct. 21.	Schools, Philadelphia, Pa.	Oct. 18
Oct. 21.	Schools, Newark, N. J.	Oct. 18
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Oct. 21.	Hospital, New York, N. Y.	Oct. 11
Oct. 21.	School, Delray, Mich.	Oct. 11
Oct. 21.	Htg. Court House, New York, N. Y.	Oct. 11
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THE ENGINEERING RECORD.

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General and Separate Contracts.

The growth of engineering projects to the enormous dimensions prevailing at the present time in many works, both public and private, has naturally led to the most complicated conditions in tendering for the contracts and in the execution of the work after the award of contracts. This development in the execution of large structural enterprises has not only necessitated the use of great mechanical plants, far beyond anything considered practicable a comparatively few years ago, but it has also made unavoidable either the consecutive or the concurrent performance of different classes of work, many of them differing radically in character. These various classes of materials and structural operations in the same completed whole emanate from different sources and require different treatment and plant, yet they must be so handled and conducted as to contribute harmoniously to unity of plan, both in construction and in the final results. This diversity of elements in modern great constructions has become so marked that it is a matter of much moment to many civil engineers whether one general contract should be made to cover all the component parts of such works, or whether separate contracts should be arranged to cover the different portions, each of which would be executed under those conditions of specialization which have contributed so effectively to excellence in all branches of modern structural operations.

This broad question has already been actively discussed by both engineers and engineering contractors. In some prominent engineering circles, the consensus of opinion as expressed has been largely in favor of separate contracts, and yet there may be conditions under which that judgment, even when assumed to be mainly correct, may be wisely modified. The main difficulty arising in connection with general contracts covering a number of classes of special work is due to the fact that one contractor seldom has had experience in more than one line of operations or in one given line and those lines closely affiliated with it. Furthermore, one contractor usually does not possess the requisite plant for different classes of structural operations. When, therefore, he is obliged to tender for a general contract, he finds himself compelled to seek prices from others for the materials and the labor which he is unable to furnish or perform. As there are ordinarily a number of general bidders in the field who must secure the same set of prices, competition becomes somewhat demoralized. The general contractor is uncertain as to the reliability of his prices, excepting those based on his own material and labor. He frequently is unable to secure from sub-contractors figures to which they can be held, and he is never certain whether he may not ultimately have to pay more than he contemplates, or whether he may not be able, by a fortunate turn of the market or for some other reason, to secure lower prices than those named. Under such conditions, it may, on the one hand, be a legitimate business risk to use lower prices than those furnished, or, on the other hand, it may be necessary to guard against prospective adverse market developments by increasing the prices quoted by sub-contractors.

A comprehensive view of these circumstances indicates that in either event they are not such as favor economy in construction. In the one case, the contract price may include an unreasonably large profit, or, in the other, the margin may be insufficient, tempting the contractor to make exertions to save himself from loss. Neither result would contribute to the excellence of the work nor to the peace of the supervising engineering organization.

These are considerations which have a most important bearing on the administration of contracts for great engineering works and which are many times insufficiently recognized. It seems plausible to the owner, whether private or public, to execute a general contract for the entire work, thus dealing with one party only and apparently avoiding what may seem like petty details connected with different portions of the project. This trend of opinion is frequently encouraged by the engineer, under the same view of the case. As a matter of fact, however, it is rare that the engineering supervision is relieved by such a procedure; indeed, there is little or no reason why it should be. The duty of the engineering organization is to see that every portion of the work is constructed and put in place with the degree of excellence required by the contract and specifications. It really makes no difference with the engineering supervision whether the separate sub-contractors are recognized in the general contract or not; the work of each must be carefully scrutinized and each must be dealt with in actual construction to all intents and purposes as if he were formally recognized in the general contract, although the general contractor only be held directly responsible. It is a matter of serious doubt, therefore, whether the amount of trouble attending the execution of the contract is reduced to any extent below that which would be entailed by a number of separate contracts. It may be argued that experience has shown the difficulty of securing schedule completion of different, separately contracted portions of a large work and that serious friction and even lawsuits may result when that is not accomplished. While there may be some slight basis for such observations, the difficulties mentioned may be reduced to small dimensions by tact and good management. As a matter of fact, schedule completion of work is just as necessary under one general contract as under a number of separate contracts, and practically the same good management and tact are required in both cases. It is a question whether the owner does not eventually have about as much trouble in the one case as in the other.

Again, wherever sub-letting by a general contractor occurs, it is not infrequent that he realizes large profits on his sub-contracts that would have been saved to the owner had tenders been made for separate portions of the work. This is particularly true of large public works, one of which now in progress is a most marked instance of this kind.

Under certain circumstances there may be material modifications of the conditions outlined above, although such exceptions are probably more likely to exist in the future than in the present. General contracting firms or contracting syndicates for large and special projects are intended to include organizations and plants adapted to the supplying of all material and the performance of all labor required under a general contract. In such cases there is obviously no lost motion, nor channels for diversion of profits to those who do not perform the work. As a business proposition it would seem to be most judicious, and, in the long run, most satisfactory to both parties to award a contract to those who are to execute it; and it is believed that public corporations or municipalities will in the end find that procedure to lead to both the highest degree of economy and to the greatest excellence.

Elsewhere in this issue is printed a valuable discussion on this subject recently presented to the American Society of Civil Engineers.

State Supervision of Sewerage Work seems to be feared by many engineers in Ohio, who believe they see a menace to the satisfactory design of sewer systems in a bill now before the legislature requiring that a copy of the plan for any sewer "with a certified copy of the ordinance of the Council approving and adopting such plan shall be forwarded to the State Board of Health, and the said ordinance shall not be valid until approved by the said State Board of Health." Such legislation ought to be prevented. The State Board of Health is very properly given the right of veto in all matters relating to sewage disposal, not only on sanitary grounds but also because the control of methods of disposal by a State Board tends to prevent the injury of several communities by the improper disposal of the sewage of a single town. But the control of the sewer network by such a board can have no useful result and will simply wrap red tape around purely engineering matters, thereby causing delay and tending to produce friction between officials whose work should be carried on harmoniously.

American Appreciation of American Anthracite is an ancient subject for British jokes, and the English engineer is always ready to assert that Americans are sure, when the last trump is blown and the universe perishes in fire, that a little unconsumed remnant will survive which analysis will show to be Pennsylvania anthracite. Mr. Charles H. Haswell, the veteran engineer still practicing his profession although ninety-four years old, has recently explained what may have been the first enunciation of this quip. When he was a boy some alleged coal was mined in Rhode Island by a company organized for the purpose, and samples distributed to well-known New Yorkers for test. One of them, Martin S. Wilkins, gave his opinion as follows: "I am willing to certify that, under favorable circumstances, this coal is capable of ignition; and I am willing further to certify that, if Rhode Island is underlaid with such coal, at the general conflagration which our ministers predict, it will be the last place to burn." This Rhode Island coal, it may be said, has been the cause of the loss of much money, and the same is true of the coal in the part of the Blackstone valley in Massachusetts, where, in one place at least, a large sum was spent to open a colliery furnishing material which would burn only under a blowpipe.

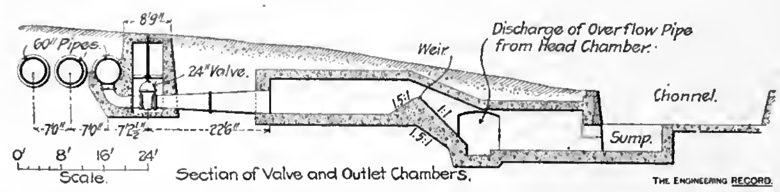
The Weston Aqueduct of the Metropolitan Water-Works, Boston—II.

By Alfred D. Flinn, Engineer, Designing and Drafting Department.

Headworks.—The headworks of the aqueduct might have been designed somewhat differently if the plans for them had been drawn before the construction of the Sudbury Dam, but this dam was begun in 1893 and completed in 1898. The middle part of the dam, for a length of 300 feet, is of solid masonry, built on the ledge rock, and serves as a waste weir for the discharge of surplus water from the reservoir. Its cross-section was outlined in The Engineering Record of November 4, 1893. At one end of this masonry portion of the dam, adjoining the earth embankment, a gate chamber was formed on the up-stream face and three 48-inch cast iron pipes laid through the bottom of the dam, in the masonry, to a 55-foot diameter circular basin just below the toe of the dam and in the spillway through which the water flows to the brook. The pipes ended in three quarter curves which turned up through the bottom of this basin so as to discharge the water vertically. Of course the purpose in turning the discharge upwards and allowing the water to fall back into the masonry basin was to dissipate the force due to the great head and thus prevent erosion of the brook channel. Incidentally the large jets which issued, if the gates were opened to any considerable extent, formed an imposing fountain. From the basin all water coming through the pipes, as well as all that spills over the top of the dam, flows away in the old brook channel to Framingham Reservoir No. 3, and thence through pipes or channels to the Sudbury Aqueduct, which conveys it to the Chestnut Hill distributing reservoir in Boston.

The head chamber, at which the 10-foot diameter masonry portion of the Weston Aqueduct begins, is located on the hillside near the northerly end of the dam, with its invert 25 feet above the bottom of the brook channel. The old masonry is being removed from around the ends of the 48-inch pipes, and the quarter curves will be taken off. Connections will be made by means of increaser castings and the pipe lines continued as three 60-inch lines to the head chamber. At a convenient place four 24-inch side outlets are provided on each of two of the 60-inch lines, through which water may be discharged at will into the brook channel to flow to the reservoirs below and thus supply the Sudbury Aqueduct. Each 24-inch outlet is controlled by a 24-inch valve, and beyond the valves the pipes are increased in diameter, at the rate of one inch per 10.6 inches of length, to a diameter of 48 inches at the ends. The pipes are thus flared in order to reduce the velocity of the water at the points of discharge so that it will not do damage and at the same time to take advantage of the Venturi principle to increase the discharging capacity of the pipes.

These eight outlet pipes end in a concrete outlet chamber, one side of which is parallel to the 60-inch pipe lines and the other coincident with the northerly side wall of the brook channel, the angular difference of about 51.5 degrees between the directions of the pipe lines and the channel being overcome in the chamber, as shown in the diagram. The outlet chamber is roofed with concrete 18 inches thick reinforced with 1½-inch round steel rods having 8-inch square steel washers on their ends, and is covered with earth. A partition wall divides the chamber so that water from four pipes flows each side. Each half is divided into a low level and a high level part by a round crested concrete weir with the center of its crest 8 feet from the end of the pipe at one side of the chamber and 27 feet at the other side. The crest is 3 feet above the bottoms of the pipes. The purpose of the weir is to cause the water to completely fill the large ends of the pipes and to further check the force of the jets. The floor of the lower part of the chamber is 5 feet below the bottom of the brook channel. The water will issue through four arches of 10-foot span into a depressed rectangular basin 12x46 feet, formed in the bottom of the channel, and overflow into the channel. The soffits of the arches at the crowns are 4 inches below the level of the bottom of the channel, so that the openings will always be sealed by the water standing in the depressed basin, or sump. The space above the weir is drained by two 6-inch pipes, without valves, laid through the weir so that at times when no water is flowing through the large outlet pipes they will be empty and can be entered as far as the 24-inch valves without shutting down the 60-inch mains. During any considerable flow from the large pipes, however, the quantity passing through the 6-inch pipes will not be sufficient to have any material effect.



Outlet from Pipe Lines of Head Works to Channel Leading to Lower Reservoirs.

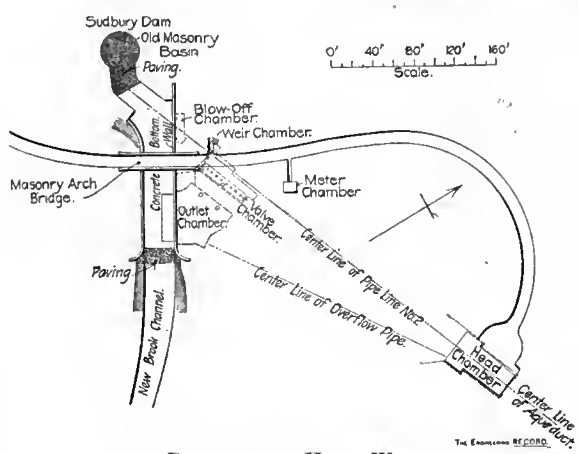
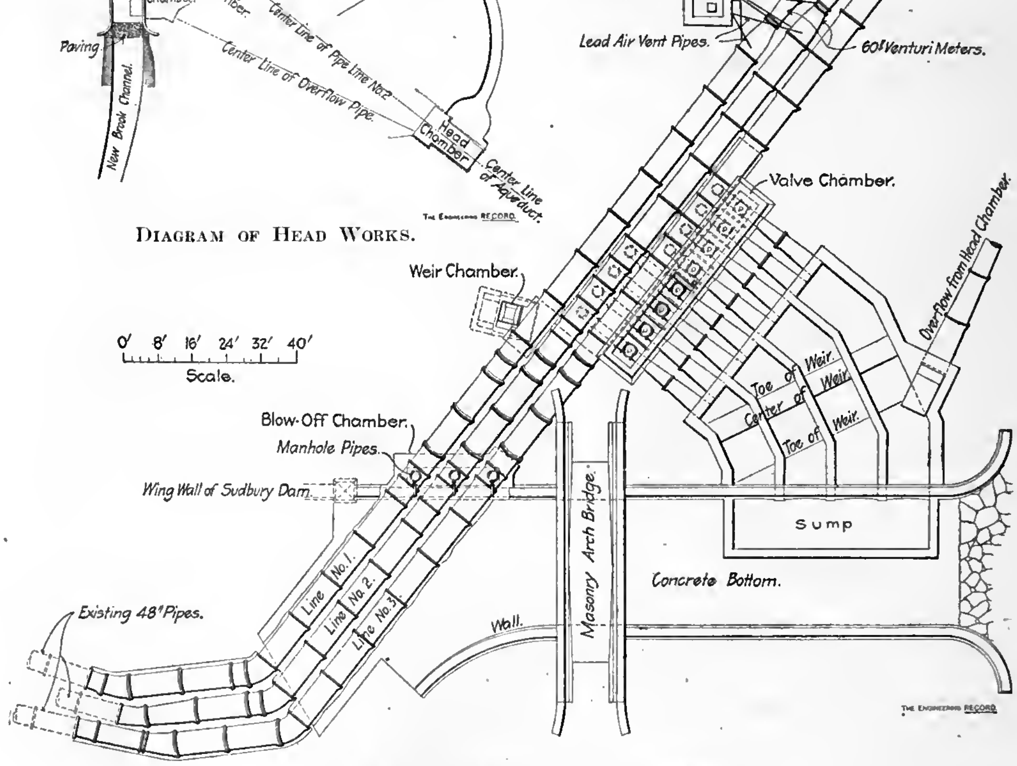


Diagram of Head Works.



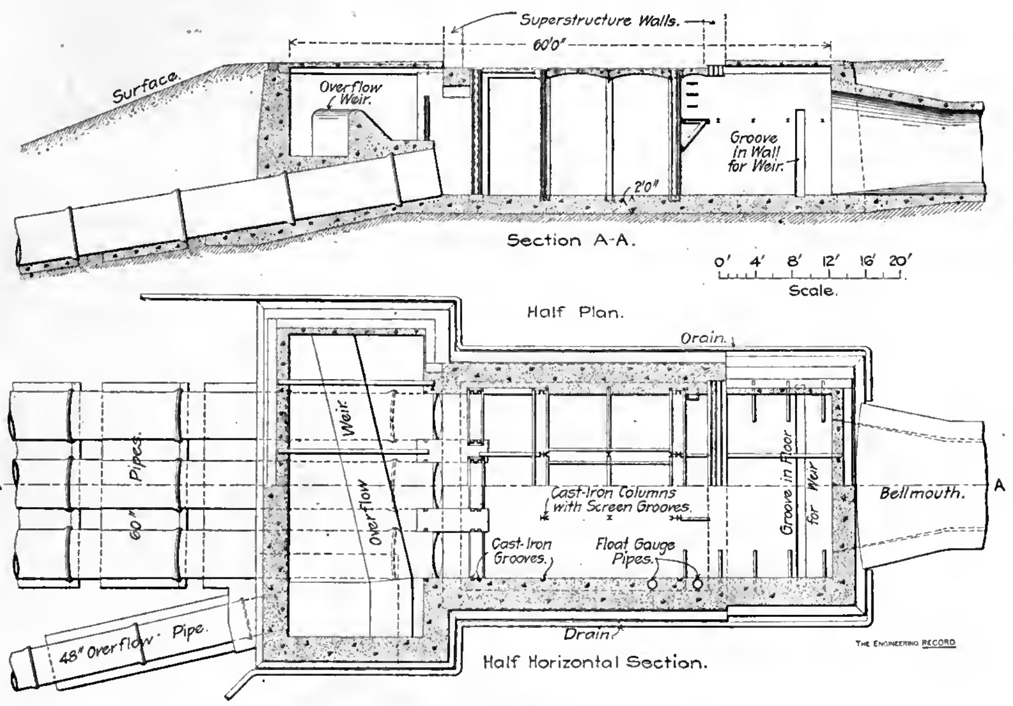
Head Works, excepting Head Chamber.

The brook channel is to be relocated, paved and walled from the dam to a point about 20 feet downstream from the outlet chamber, and for the remaining 1,600 feet to Reservoir No. 3 is to be rectified and improved to such extent as may be necessary. The old circular masonry basin is to be done away with, since there is no longer any need for it.

In the 60-inch pipe line which has no 24-inch side outlets and in one of the two which have there are two 60-inch Venturi meters made by the Builders' Iron Foundry, of Providence, R. I. A small building will be erected near the meters, for the registers. These registers are fitted with the new chart recorders, attachments designed to register the rate of flow on a band of slowly traveling paper which is ruled to indicate millions of gallons per day. A roll of paper will last a month, and the record may be torn off daily or at such intervals as may be desired. The paper is 3½ inches wide, and a 24-hour record is 8 inches long. Figures printed along the bottom of the chart indicate the hours of the day. The meter tubes are 32 feet 7½ inches long and consist of five pieces each, with bell and spigot joints, excepting the two flanged joints at the throat. The diameter of the throat is 38 inches. By the usual method of rating, on the basis of 36 feet throat velocity, the maximum capacity of these meters is 185 million gallons per day each, which is greater than that of any other meter in this country. The Jersey City water-works have a 72-inch meter with 31-inch throat. There are two 93½-inch Venturi meters in London, but the writer does not know their throat diameter.

There are no valves in the main pipes between the Sudbury Dam and the head chamber. The flow from the reservoir into these pipes and through them to the aqueduct will be controlled by the gate-house on the dam. The size of the main pipes was determined by balancing the cost of pipes against the value of water stored in the reservoir, and they are large enough to draw considerable quantities at very low stages of the reservoir. Consequently at the higher stages of the reservoir which ordinarily obtain, the capacity of the three pipes greatly exceeds that of the aqueduct.

The substructure of the head chamber is 66 x27 feet, but only the central portion, 31x29 feet, is to be covered by the superstructure. The part of the substructure in front of the superstructure is an overflow well, beneath which the three 60-inch pipes enter the chamber on a rising grade. Three arched openings over the pipes, in the wall of the chamber through which they enter, give access for the water to the overflow well. A round-crested concrete weir extends diagonally nearly across the well and then bends and continues to the front wall. The crest is 34 feet long and at such an elevation that a depth of 3 feet over it will cause a head of not over 3 feet on the soffit of the aqueduct arch just beyond the head chamber. This provides for an overflow at the rate of about 230 million gallons per day. Any water which may flow over the weir will fall into a channel which terminates in a deep well formed in the concrete, from which a 48-inch pipe leads to one corner of the outlet chamber at the brook. At the outlet chamber the overflow pipe increases at a rate of one inch per 10.6 inches to a diameter of 72 inches, for the purpose of reducing the velocity and taking advantage of the Venturi effect for increasing the discharge. If the gates at the dam are always properly manipulated, there should never be any use for this overflow, but to guard against ignorance and carelessness, as an extreme precaution, and because of the importance of the situation, it has been provided.



Head Chamber.

The head chamber contains grooves for stop-planks to make it possible to enter any one of the 60-inch pipes while the others are in use, and other grooves for vertical screens so placed that the screens can be arranged in re-entrant bays in order to give a greater area than would be afforded by a set of screens directly across the chamber. The screen grooves are iron castings. Some of them are embedded in the masonry of the walls, but those at intermediate points are combined to form columns to support the steel beams of the main floor. For the immediate future, however, until the usual rate of flow in the aqueduct shall become about 150 million gallons per day, it is intended to use inclined screens. In the row of stop-plank grooves 11 feet in front of the ends of the 60-inch pipes, a plank bulkhead 6 feet high will be placed, and from the top of this the supports for the screens will slope upward one foot in 6 to within 16 feet of the back of the chamber. Such screens have been in use for a number of years at the Farm Pond gate-house of the Sudbury Aqueduct and can be cleaned ordinarily by a push broom, without removing them, as the water tends to accumulate the leaves, twigs, grass and other rubbish at the high water line on the screens. If at times leaves or other things clog the screens, or for any reason it becomes necessary to remove the screens, each one can be taken up easily, being only 37x38 inches in size. The screens are to be made strong enough for a man to walk upon them, the copper wire netting being supported by wooden ribs ½ inch wide and 2¾ inches deep spaced 5 inches apart.

In the underground extension of the chamber at the rear of the superstructure a measuring weir is to be installed, which, like the inclined screens, will probably be maintained until such time as the ordinary flow in the aqueduct reaches 150 million gallons per day. The weir is intended to provide an additional means for measuring the water to check or supplement the Venturi meters and the current meters.

A driveway leads from the main highway to the Sudbury Dam, and is to be extended along the toe of the dam, up the hillside to the head chamber. Where this driveway crosses the brook channel a masonry arch bridge of 30 feet span and 6 feet rise is being built to replace an old bridge which has been removed. The bridge will be 14 feet wide between railings and built of Portland cement concrete, mixed 1:2:5 in the arch and 1:4:10 in the abutments, with facings and copings of gray granite. The crown thickness is to be 18 inches, and the granite facing, excepting the headers and voussoirs, is to be only about 12 inches thick. The waste channel, along the toe of the masonry portion of the Sudbury Dam, through the bridge and as far as the downstream end of the outlet chamber, is to be paved and walled with masonry excepting where sound ledge is exposed. The channel has a depth of 6 feet below the springing line of the bridge arch, and the passage through the bridge is calculated to be large enough to safely pass a flow equivalent to a run-off of 4 inches from the watershed above the dam.

Contractors' Plant.—On many of the sections of cut-and-cover work, the contractors' methods and equipment have no especial interest, being the ordinary hand operations with pick and shovel, horse and cart, and very little machinery. Messrs. Winston & Company, however, have installed some plants which are innovations in this class of work and worthy of description. Crushing, screening and mixing machinery, with the necessary engines and boilers, have been assembled in a very compact way near the middle of a stretch of aqueduct and tracks laid to bring materials from the pits and carry concrete to the forms, mules being employed to haul the cars. On Section 11 a 7-ton locomotive is also in use. There are three similar plants, on Sections 8, 11 and 15.

The plant on Section 11 is the largest, and a description of it will give the essential features found in all. There is a No. 5 Austin stone crusher near the ground level discharging into a belt-and-bucket conveyor, which elevates the broken stone to a rotary screen at the top of a tall wooden structure. From the screen the stone passes by gravity into storage bins, and the rejected large pieces are returned to the crusher. Near the top of the structure, also, are some large, inclined, stationary screens for sand and gravel which likewise discharge into suitable storage bins and send the rejected stones to the crusher. The bins are at a sufficient elevation to discharge by gravity into cars or carts beneath or onto an elevated measuring platform. To reach the bins above the measuring platform, however, the sand and gravel have to be elevated by the conveyor. A large mast and boom derrick fitted with a bull wheel has been set up conveniently near a corner of the structure where it can reach the skips of gravel, stone and cement brought on the cars and deliver them to the crusher, the screens or the measuring platform, as desired. There is a small platform attached to the mast about six feet above its base, where the operator stands who controls all the movements of the derrick. In the middle of the measuring platform is a large, conical, steel measuring hopper with a dropping bottom controlled by a latch, and with its top flush with the surface of the platform. The hopper empties into a cubical concrete mixer immediately below it, and the mixer in turn can be dumped into cars or carts which pass beneath. Three men are employed on the measuring platform, and there is an inspector here, and one man takes care of the mixer. Several charges of cement in bags are kept on the platform during the day. The stone for concrete is measured in the hopper, into which it is discharged directly from the storage bins by gravity, through a chute. The proper number of bags of cement is emptied on to the stone and spread over it. The sand is drawn from the bin into a measuring box, hung on trunnions, which, when filled, is tipped so as to dump its contents into the hopper. The sand is spread over the cement with shovels, and then the charge is let into the mixer. It has been found that spreading the sand promptly on top of the cement saves considerable loss of cement, especially in windy days. The water is measured in a small cylindrical steel tank, fitted with a gage glass, and admitted to the concrete mixer through its perforated hollow shaft, gradually from the beginning of the mixing. This water tank is beneath the measuring platform. The mixer is revolved from 25 to 35 times, and each batch contains about 32 to 34 cubic feet of concrete. The capacity of the concrete cars is 44 cubic feet. The capacity of the plant is estimated to be about 200 cubic yards of concrete per day, but so far the conditions of the work have never been such as to realize this output. An 80-horse-power return-tubular boiler, which is fired mostly with wood, supplies steam for the three engines, one for the derrick, one to revolve the concrete mixer and the third, of 25-horse-power, to operate the main part of the plant.

In constructing aqueduct by this method, as used on Section 11, the side embankments are first built up and the cuts made so that the place for the construction railroad can be graded and the rails laid very close to the edge of the trench. The cars are used also for moving the excavated materials. The track is laid at about the level of the springing line of the arch, and when a piece of trench or embankment is ready for concrete, dumping platforms are placed at frequent intervals to receive the concrete from the cars. For the invert the concrete is shoveled into chutes which deliver it by gravity to the bottom of the trench, where it is spread by shovels and brought to proper form by the aid of guides and screed boards. After the invert has set, the forms for the side walls are placed in position and the concrete deposited in them from wheelbarrows loaded at the dumping platforms. For this operation, foot boards are laid across and along the aqueduct in circuits from each dumping platform so that the men always go forward and do not have to return or get in one another's way. Having constructed a sufficient stretch of side walls to keep well ahead of the bricklayers, who place the brick lining in the invert and sides, the concrete gangs set the arch centers and forms, where the brick lining has been completed, and build the arch.

On Section 8 twelve men at the trench have placed as much as 130 cubic yards of concrete in the invert in one day, and the same gang has built 100 linear feet of arch, which requires 100 cubic yards of concrete, in a day. Much difficulty is experienced in screening sand in damp weather because the sand adheres to the wires and tends to clog the screens. Sand for the brick work is rescreened by hand through finer screens.

On Section 15, which includes rock tunnel number 5 and a great deal of rock excavation in trench, an air compressor plant was established at the east end of the tunnel and the concrete plant erected near by.

Steel Siphon Pipes.—The four siphon chambers which form the connecting links between the steel pipes and the masonry aqueduct were shown and described in the article of May 4, 1901. Other details of the pipes and chambers are shown in the accompanying illustrations. At the crossing of the Sudbury River, the pipe will be given the form of an arch with a span of 80 feet and a rise of 5.5 feet between substantial, granite-faced, concrete masonry abutments. The vertical reversed curves adjoining the arch are to be imbedded in the concrete of the abutments and have 6x6-inch steel angles riveted to them circumferentially and longitudinally to anchor them the more securely. All seams in the arch are to be double riveted and all rivet holes drilled. A light wooden foot bridge with iron pipe railings is to be attached to the top of the arch by means of short pieces of steel angle. A similar arch of about 164 feet span and 11.5 feet rise, in a pipe line of very nearly the same diameter, was built across the Arc River, in France, in 1897, and is described and illustrated in "Le Genie Civil" for June 23, 1900.

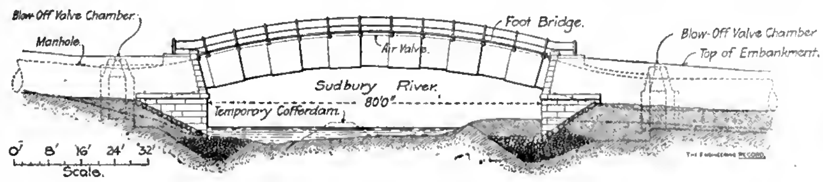
Plant for Laying Steel Pipes, Happy Hollow Siphon.

Castings at Siphon Chamber for Connecting with Steel Pipes.

The 7½-foot steel pipes for the siphons are being made in 30-foot lengths of four plates each, excepting for some curves, in alternate large and small courses. The plates are 7/16 inch thick, excepting for the arch of pipe which is to span the Sudbury River, in which they are ⅝ inch thick. All plates are basic open hearth steel containing not over .5 per cent. manganese, and .05 per cent. phosphorus, sulphur and silicon; having a tensile strength of not less than 52,000 nor more than 62,000 pounds, and an elastic limit of not less than 30,000 pounds per square inch; an elongation of not less than 25 per cent. in 8 inches, and a reduction of area of not less than 50 per cent. The Central Iron and Steel Co., of Harrisburg, Pa., is rolling the plates and the Pittsburgh Testing Laboratory is inspecting them. The plates average about 91 by 290 inches in size, and the 7/16-inch plates weigh about 3,500 pounds each. The plates are shipped from the mill on covered flat cars, teamed to the shop, unloaded under cover, and kept under cover until the pipe is ready for testing. All rivets are 1-inch Victor rivets, with conical heads, made by the Champion Rivet Co., of Cleveland, Ohio.

In the shed where the plates are unloaded, they are first prick-punched, then beveled and then heated for scarfing. The prick-punching for the rivet holes is done from steel plate templates. The edges on both sides and ends are beveled by means of a rotary beveling machine made by the Lenox Machine Co., of Marshalltown, Iowa, which at one operation for each edge, whether it is the straight edge of a regular piece or the curved edge of a special, removes a sufficient strip of metal to make the distance from the rivet holes to the edge uniform and bevels the edge to about 60 degrees. The two corners to be hammered down thin for the lap are heated simultaneously in two small forges, and then the plate is passed immediately into the adjoining shop to the blacksmiths. After being scarfed, the plates are punched and rolled and then passed to the riveting shop, where they are assembled into 30-foot sections of pipe of four plates each, except in the case of specials for curves. Hydraulic riveting machines with vertical jaws are used capable of exerting a pressure of about 80 tons on each rivet. There is a man to operate the riveter and a boy to heat rivets outside the pipe as it is being assembled, and a man and a rivet boy inside the pipe. The boy outside throws heated rivets into a box sunk in the floor beneath and extending outside of the pipe, and the boy inside, standing on the floor, takes the rivets from the box and passes them to the man, who inserts them into the rivet holes from the inside. The plates are cut so correctly to dimensions and the punching is so accurately done that the holes usually match perfectly and very little reaming is necessary.

All calking is done with pneumatic tools. After calking and inspection, the pipes are rolled to the testing stand and subjected to a water pressure of 75 pounds per square inch. Trolley tracks supported by a timber frame, on each side of the testing stand, carry two sets of testing heads, so that one pipe may be filling while another is being tested. The water is pumped and after being used drains back to the pump well to be pumped over again. The test heads are ¾-inch dished and flanged plates in one piece, provided with manholes and pump and gage connections. They are held in place in the pipe by pins and bolts through the flange and the rivet holes in the ends of the pipe.



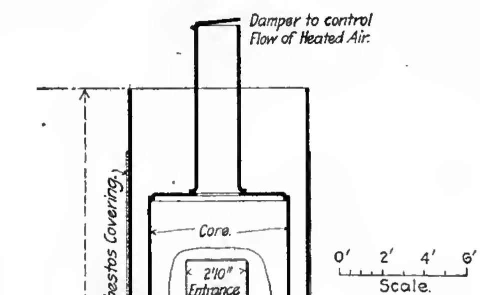
Sudbury River Pipe Arch Bridge.

They are made tight by calking inside with oakum. Similar heads are to be used for testing portions of the pipe lines after they shall have been laid.

From the testing stand the pipes are rolled to the dipping tower and immersed vertically in a bath of Mineral Rubber pipe coating manufactured by the Commercial Asphalt Co., of New York. The bath is heated to a temperature of 500 to 550 degrees Fahrenheit, as determined by a pyrometer inserted at the top of the tank. The pipes are not previously heated, but are left in the dip twenty minutes or more so as to attain the temperature of the bath. Immersing a cold pipe drops the temperature of the bath only about 30 degrees. A very satisfactory coating is being obtained, which is especially smooth on the inside of the pipe. It is about 1/32 to 3/64 of an inch thick and adheres tenaciously to the steel. The dipping tank is shown in one of the illustrations with sufficient clearness to need no explanation. Heat is applied to the full height of the dipping tank through the core, or inner cylinder, and, in addition, to about half its height through the jacket, or outer cylinder. The jacket was not provided at first, but was added because it was found difficult to maintain the proper temperature at the bottom of the bath. The tank is covered with asbestos, as shown, and enclosed in a wooden tower about 35 feet square at the base and 80 feet high. A hand traveling crane in the top of the tower lifts the pipes from a horizontal position on the floor, lowers them into the tank and holds them there. A pneumatic cylinder attached to the side of the tower about 20 feet above the ground is used to trip the bottoms of the pipes when they are being lowered from the tank and aid in placing them in a horizontal position on the skids. Petroleum gas made on the premises is used for heating the dipping tank and in the rivet and scarfing forges.

The finished pipes are carried from the shop to the railroad on high, flat wagons and loaded on to flat cars provided with bolsters. At the railroad destination the pipes are placed on special wagons and hauled to the trench. These wagons measure 20 feet from center to center of axles, and have 6-inch tires and heavy running gear supporting four pieces of 7x8-inch spruce, which form the bed, and on which there are bolsters and triangular blocks covered with split rubber-lined hose, rubber side out. The top of the wagon is nearly on a level with the top of a flat car, but the front is a few inches higher than the back. Six horses are hitched to the wagon.

On Section 9, the greater part of which is on the steep grades of the hillsides of the narrow valley, the pipes were unloaded at the trench on to a wooden incline, the higher end of which was at the level of the top of the wagon, and rolled down on to a small steel-framed car running on a track laid along the bottom of the trench. A hoisting engine and an air compressor were located at the bottom of the valley. The pipe on the car was hauled into position by the hoisting engine and a wire cable working through a pulley at the top of the incline. Jacks were used to elevate the downhill end of the pipe so as to bring the rivet holes at top to correspond with those of the pipe previously laid and permit a bolt or two to be inserted, and then the car was withdrawn and the pipe lowered, with the jacks, until the joint was brought to a fit all around. The same method is being used on Section 7. The car frame is provided with rollers, upon which the pipe lies and which permit it to be revolved so as to adjust the rivet holes. Field riveting is done by means of a heavy pneumatic riveting machine inside the pipe, mounted at the intersection of vertical and horizontal extension braces which are attached to a plate and



Dipping Tank for Steel Pipes.

screwed out to bear firmly against the pipe. The holding-on is done with a pneumatic cylinder mounted in a stiff steel frame, which is connected into two chains that encircle the pipe. The chains are supported, so that they do not touch the pipe, by rubber-bound iron wheels, about 8 inches in diameter, the axles of which pass through the chain. The field joints and places abraded by transportation and other operations are promptly covered with Gilsonite paint, made by the Commercial Asphalt Company.

Mr. Frederic P. Stearns, M. Am. Soc. C. E., is Chief Engineer of the Metropolitan Water and Sewerage Board, and Mr. Horace Ropes is Engineer of the Weston Aqueduct Department. Messrs. Dan. B. Clark, Frank E. Winsor, Marshall Nevers and George W. Booth are division engineers.

Single-Phase Alternating-Current Electric Railway Operation.

The interurban electric railway, which the Washington, Baltimore & Annapolis Railway Company is to operate at high speeds with a single-phase alternating current equipment throughout, from generating station to driving axle, was described at some length in The Engineering Record of September 20. At that time no details were at hand as to the character and construction of the motor to be used nor any extended account of the method of its control. Since then, however, a paper on the subject has been presented to the American Institute of Electrical Engineers by Mr. B. G. Lamme, under whose supervision the system has been developed and tested for several years by the Westinghouse Electric & Manufacturing Company, and from this the following additional information has been obtained:

The type of motor to be used is similar in general construction to a direct-current series motor, but with its magnetic circuit laminated throughout and with such proportions that it can successfully commutate alternating current. The problem was to provide a single-phase motor having the variable speed characteristic of a direct-current series motor, such as is now in use for electric traction, the limitation to a single phase making more than one trolley line unnecessary. For the regulation of voltage, instead of the direct-current rheostatic series-parallel controller, an induction regulator, resembling an induction motor in general appearance and construction, is employed. This acts as a transformer, the secondary winding, which is placed on the stator, being connected to the motors and the voltage in the secondary, and consequently that supplied at the motors, being varied by shifting the angular position of the secondary in relation to the primary or rotor.

Single-phase alternating current will be supplied to the car at a frequency of 16⅔ cycles per second, or 2,000 alternations per minute. The current from the overhead trolley wire is normally fed in by one trolley at approximately 1,000 volts. Within the limits of the District of Columbia two trolleys are employed, as by Act of Congress the use of rails as conductors is prohibited in this District. The range of voltage at the motor is to be varied from approximately 200 volts up to 400 volts or slightly higher. The transformer on the car will supply 315 volts, and the secondary circuit of the regulator will be wound to generate slightly more than 100 volts when turned to the position of its maximum voltage. This voltage of the regulator is about one-fourth of that of the motors at full voltage. The regulator can consequently be made relatively small, in comparison with the motor capacity of the equipment.

There will be four motors of 100 horse-power on each car. The full rated voltage of each motor is approximately 220 volts. The motors are arranged in two pairs, each consisting of two armatures in series, and two fields in series, and the two pairs are connected in parallel. That is, the fields are arranged in two pairs, with two fields in series and two pairs in multiple. This parallels the fields independently of the armatures.

The Rio Grande Bridge of the Pacific Railway of Costa Rica.

The people of the United States are particularly interested at this time in their near neighbor, the Republic of Costa Rica, on account of the building of the Interoceanic Canal. The population of Costa Rica is composed, in the main, of small farmers, who own their lands. The soil is particularly rich and fertile, the principal products are coffee, bananas, cocoa, rubber and lumber. The coffee and bananas are considered the finest in the world, and command the highest prices in the American and European markets.

The country is far from being opened up, owing largely to the present poor facilities for transporting merchandise to the east coast. A large proportion of this merchandise is exported, and considerable is imported by way of the Pacific coast, notwithstanding that the only means of transportation at present is the slow-going ox cart, at a cost of $1.60 per cwt. The fact that hundreds of these primitive conveyances can be seen daily on the national highway between the Pacific coast and the interior is more than sufficient to demonstrate to even a casual observer the great advantages that will accrue to the country and its commerce by the completion of the Interoceanic Railway, as nearly all the principal towns and villages, and all the mining camps and centers, with fully two-thirds of the population of the entire country are situated on the Pacific slope.

In connection with this matter, it is of interest to state that the present tariff of the Atlantic Railway from Port Limon to San Jose is as follows: $19.78 American gold per ton, first class; $17.90 American gold, second class; $12.43 American gold, third class, for a haul of about 100 miles. The passenger tariff is four cents per mile.

The Pacific Railway of Costa Rica is needed, and, when completed, will be 60 miles long. It will extend from San Jose, the capital of the republic, which is connected by rail with the Atlantic coast, to the Pacific coast, passing through the richest and most thickly populated section of the country. This connecting line will give easy and quick communication between the Atlantic and Pacific coasts. It is located about 60 miles north of the Nicaragua canal route and, when completed, will be the only trans-continental line south of the Southern Pacific Railway, although another line is now under construction by the Mexican Government and its bridges are being built by the contractors for the bridge described in this article. The gauge of the road is 3½ feet, with a maximum grade not exceeding 2½ per cent. through the mountain district. The total cost of the road, when completed and equipped, will be $3,000,000.00 American gold. The government has paid, up to April 1, 1902, $1,126,925.75 American gold, in cash, and has issued a corresponding amount in bonds.

The road is now completed and in operation from San Jose to a point 20 miles beyond the Rio Grande River crossing, a total distance of about 46 miles. The grading and masonry is also finished for some distance beyond this point, and includes all the heavy and mountainous work. There are a few small bridges, but the great obstacle to be overcome was the crossing of the Rio Grande River. At the particular point where this crossing was made, it required a bridge approximately 685 feet long, with the rails not less than 340 feet above the water.

The height alone is not unprecedented, and the span, although considerable, has been exceeded by many recent structures. The combination, however, of length of span and height is remarkable and is exceeded by only two structures, the Garabit Viaduct and the Mungsten Bridge. A third bridge, that across the Noceschlacht valley at St. Giustans in the Tyrol, which is probably the highest in the world, is 453 feet above the water, but has a span of only about 197 feet.

A comparison between the Rio Grande River bridge and the Birriz viaduct, also in Costa Rica, shows in a very striking manner the radical difference in design and erection of two structures in the same locality and under similar conditions which were built by foreign engineers of different nationalities. The Birriz viaduct has four 156-foot single-track lattice-girder deck spans supported on three iron towers from the bottom of a valley about 200 feet deep. The spans were erected in the axis of the bridge on a level platform beyond one abutment, and when two of them were completed they were fastened together to make a continuous structure and were projected across the abutment on rollers until the pilot trusses 54 feet long, which were temporarily attached to the advance span, engaged rollers on top of the first pier and took bearing there. The second and third spans were successively erected and connected to those previously built and the increasing mass was pulled across the valley by a wire rope and windlass on the opposite abutment, the pilot successively engaging the rollers on the pier tops and farther abutment.

The Rio Grande River bridge is of special

THE RIO GRANDE RIVER BRIDGE.

interest as being the latest and probably the largest span in Central America, and on account of the location and conditions, as well as many difficult engineering problems connected with its dimensions and design. Realizing the many difficult engineering problems connected with a cantilever-arch bridge the railroad company did not attempt to directly undertake its construction, but placed the order for all the steel work with the export department of Milliken Brothers, No. 11 Broadway, New York, and the entire work was executed by them. They called in consultation Mr. Theodore Cooper, who, in conjunction with Mr. Gunvald Aus, M. Am. Soc. C. E., made all the calculations.

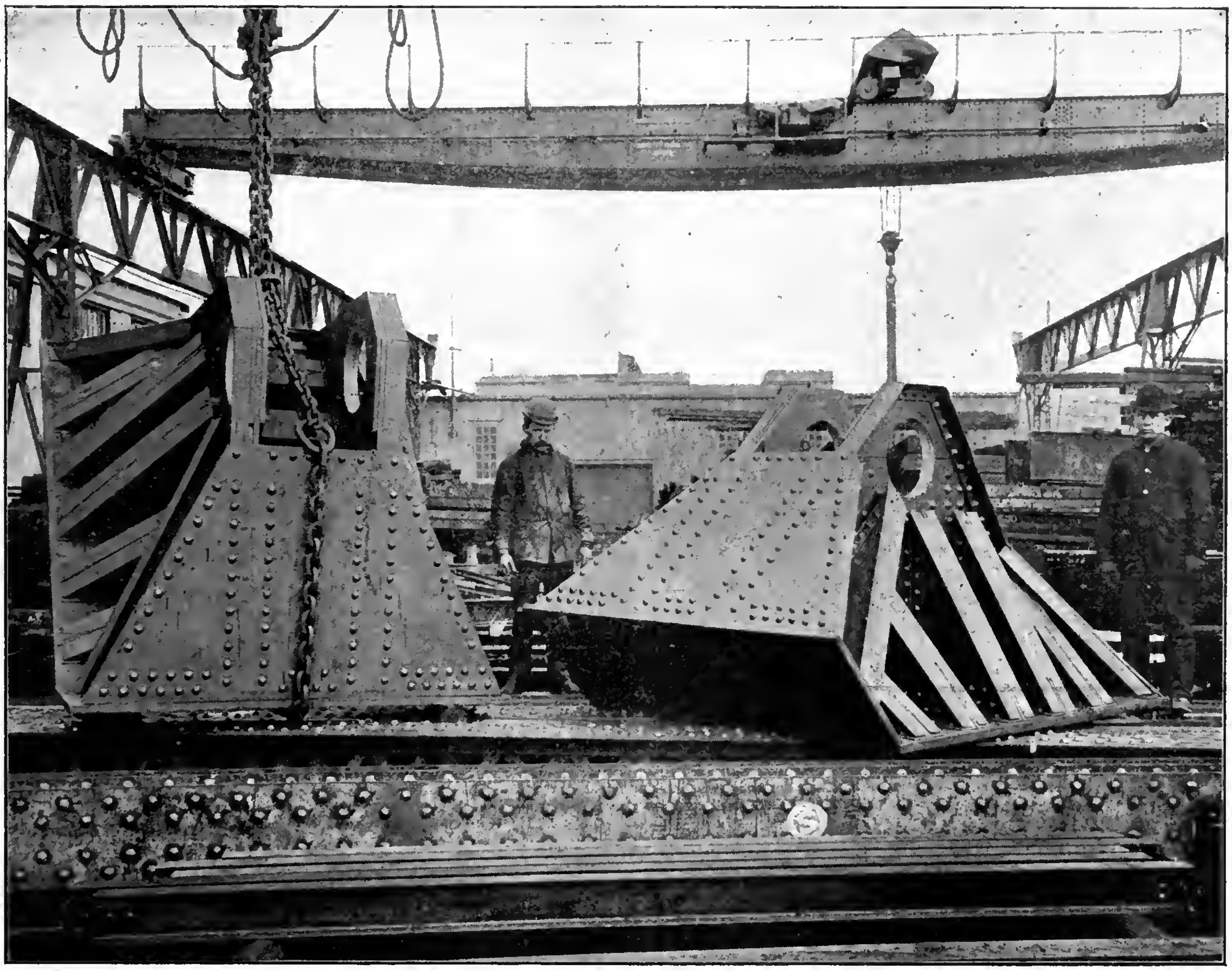
It was decided to adopt a design calling for a riveted truss single-track deck bridge, consisting of a two-hinge spandrel braced arch with eighteen 24-foot 10-inch panels, making a span of 448 feet 8¼ inches center to center of skewback pins, two cantilever spans, each with two 23-foot 7½-inch panels, and two 70-foot 10½-inch suspended shore spans, making a total length between end pins at the abutments of 684 feet 11¼ inches.

The bridge is designed under Cooper's Specification for a live load of 2,800 pounds per linear foot of span, and a dead load of 3,000 pounds per foot of span. The top lateral system is proportioned to resist a stationary wind load of 150 pounds per foot of bridge. The moving wind load is assumed to be transmitted through the sway bracing into the bottom lateral system, so that this latter is proportioned for a stationary wind load of 150 pounds per linear foot of bridge, and a moving wind load of 300 pounds per foot of bridge. The three panels at each end were formed into supported spans, to prevent the possibility of any hammering at the abutments.

The braced arch was originally figured in strict accordance with the method given in Professor Greene's book on arches, using the general formula first presented by Professor Clerk Maxwell. On account of a change in the distance between piers the arch had to be refigured and a modified method was used which had in the meantime been developed by Mr. Cooper. The modification consisted in developing the formula for H for two symmetrical panels and summarizing them, thus obtaining a very simple formula by which formulæ could be immediately written for all the remaining panels. The modified formula suggested economic proportions of depth to length of span and saved a great amount of labor in computations. As no greater range of temperature variations occurs in Costa Rica the temperature stresses were calculated for a difference of only 70 degrees, but even this amount made them form a very considerable percentage of the total stresses.

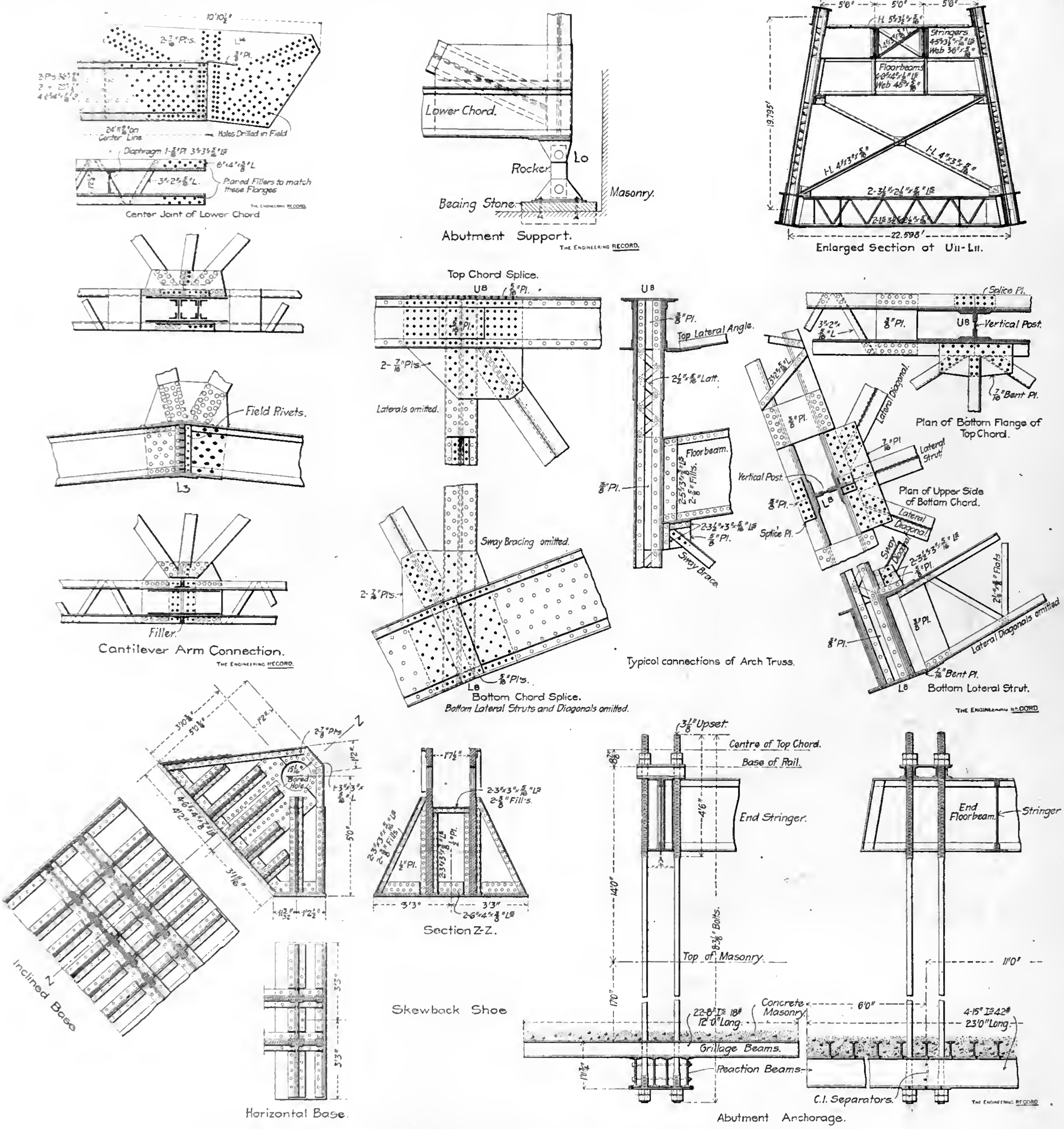
The design of this bridge differs in some respects from that usually adopted for arches of this type. The most radical difference was in the character and shape of the skewback shoes and their masonry seats. They are made entirely of riveted steel instead of being cast as usual, and have the pin bearings thoroughly braced by solid transverse diaphragms which also serve to distribute the load over a widely extended base plate. The shoes were set in the planes of the trusses and symmetrical with them, instead of being set as usual in vertical planes, thus permitting the 15-inch pins to be at right angles to the planes of the trusses. The base plates were made in two planes, one normal to the pressure from the completed arch, and the other horizontal to receive vertical erection stress and to improve the stability of the shoe on the masonry which was built with a beveled seat to correspond with the inclined base.

The total weight of the superstructure was 932½ tons, and although it was built in the shops in one month the work was so accurately done and carefully inspected that no errors whatever were discovered in the field and it was assembled there without difficulty. This accuracy was secured by the use of special standards of measurement for the shops and for the field work, and by the greatest care in laying out the masonry and locating the shoes and truss centers. The principal points were determined by many repetitions of transit and level lines which were conducted on both sides of the canon, and tied together by triangulation but which could not have the main span directly measured until after its erection was nearly complete.



THE SKEWBACK SHOES BEFORE SHIPMENT.

At the bridge site the almost vertical banks of the canon are of weathered shale which was excavated to sound rock for the foundations of the skewback piers and abutments. On one side the slope between the pier and the abutment was steeper than that of the lower chord of the shore span and chases were cut in the surface wide enough to receive the lower part of the trusses and give clearance for inspection, painting and free drainage of surface water past the piers to the canon. The main piers were made out of cut stone masonry on concrete footings, but the abutments were made entirely of concrete enclosing, near the base, grillages of I-beams for anchorage platforms. These were about 8 feet below the tops of the reaction rods which had screw bearings on top of the end floorbeams and were proportioned for a maximum tension of 280,000 pounds per truss, erection stress. In order to diminish this stress and reduce the great friction on the adjustment nuts when the center panel was connected the shore arms were heavily counterweighted and, the projecting ends of the semi-trusses being kept high during erection, were easily lowered to position at the center panel by slacking off the eight nuts on each end floorbeam.



DETAILS OF THE RIO GRANDE BRIDGE OF THE PACIFIC RAILWAY OF COSTA RICA.

Two steel tapes were purchased in the United States, sent to Washington and standardized by the United States Government, corrected for every ten degrees of variation in temperature, and were furnished with spring tension arrangements so that exact measurements could be made under the same tension. One of these tapes was sent to Costa Rica to be used as the standard in laying out the work, the other was retained in the United States and was used in the shops as a standard.

The work of erection in the field was carried on under great difficulty. All of the steel for one-half of the bridge had to be transported across the valley by cableway. The crudest kind of false work was used to save the expense of sending down lumber for the erection of the shore spans.

In order to allow a certain amount of leeway, to make up for any possible small errors in the placing of the shoes, the center panel members were made somewhat shorter than the calculated length, the holes in one side of the center gussets and splice plates left blank, to be drilled in the field after all parts had come to a full bearing, and a number of planed shimming plates were shipped to be used as needed.

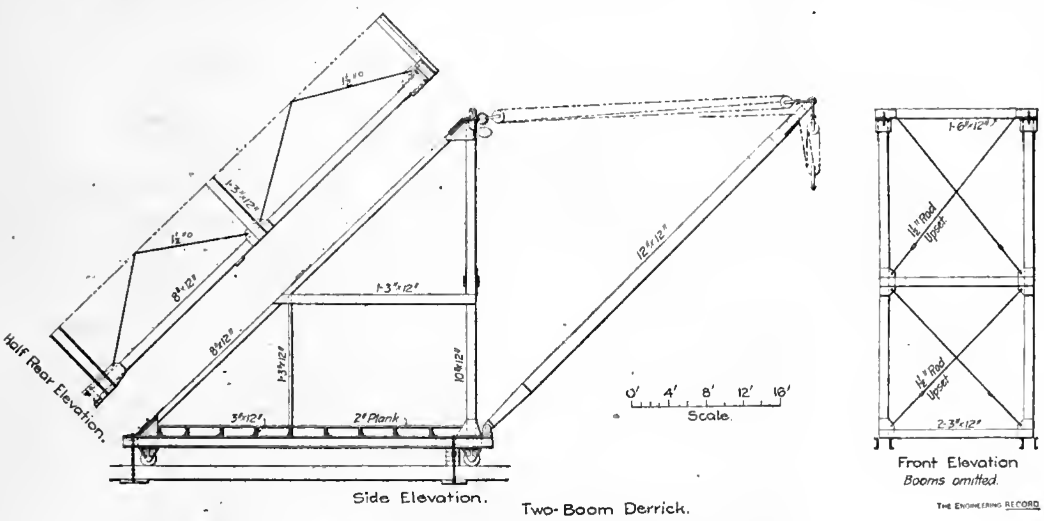
As a further safeguard, the center chord sections were held at the shop until the arms came sufficiently close together to allow of direct exact measurements, and thus correct any errors in that shop before shipment. It was, however, found that no corrections of any kind were necessary, and the works were telegraphed to ship the center sections exactly as designed, thus demonstrating the great accuracy obtained in the shop and in the field in the execution of this work.

During erection, the shore arms were bolted up solid to form continuous trusses so that the center arch could be erected from each abutment with only vertical anchorages, the top chords being designed to carry the entire tension from erection loads. After erection, the splice plates were removed from the bottom chord panels at the ends of the supported spans. The top panels were left solidly riveted up, as it is not thought serious to allow a slight bending in the comparatively shallow chord under partial loading, and a much more rigid structure is obtained by not interrupting the top lateral system at this point.

The Pacific Railway of Costa Rica are very proud of the successful completion without a hitch, of this important piece of engineering work, and are now regularly using the bridge to carry their traffic.

Theoretically the superstructure consists of a pair of spandrel braced arch trusses continued beyond the skewback piers to form cantilever arms 47¼ feet long which support the river ends of the two approach spans and reduce their lengths from 118 feet 1½ inches to 70 feet 10½ inches. For the practical reasons already stated the top chord is a continuous riveted member 684 feet 11¼ inches long between centers of abutment pins, and is designed to resist maximum tension and compression stresses. The cantilever arms are two panels long, and at their ends the bottom chords are spliced to those of the shore spans with bolts in slotted holes for longitudinal expansion. Except for a camber of 3 inches in the center the top chord is horizontal and the bottom chord changes inclination at every panel point, conforming to the chords of segments of a parabolic arc of 55.924 feet rise and 448 feet 8¼ inches chord. The lower chord, from the skewback to the abutment, corresponds to the chords of segments of one-half a parabola with a rise of 58.14 feet and a chord of 236 feet 3 inches.

The arch trusses are battered 1:6 and are 40 feet apart on centers of shoes and 16 feet apart on centers of top chords. They have, as shown in the strain sheet diagram, vertical posts and single panel tension diagonals arranged like the web members of a Pratt truss, and having the same arrangement continued through the cantilever arms and shore spans so as to prevent a similar though unsymmetrical appearance, and resemble semi-arch trusses balancing the main arch thrusts. The track is carried on two lines of stringers just below the top chord level, and the trusses are braced together with top and bottom laterals and bracing in the vertical transverse planes through all panel points.



Traveler for Erecting Arch and Shore Spans.

The top lateral system consists of single 5x3½-inch angle horizontal transverse struts and X-brace angles field-riveted to connection plates on the lower inside flanges of the top chords and to the top flanges of the stringers. The bottom lateral system consists of horizontal transverse struts and X-braces in the planes of the bottom chord. All of these members are I-shaped struts made of two pairs of angles latticed, and are of equal depth with the bottom chord of the arch truss and field riveted to it with bent connection plates across the top and bottom flanges. Between the bottom transverse struts and the floorbeams there are in each panel, from one to three panels of X-bracing of single angles which are all 4x3x5/16-inch except at the skewback piers where they are 6x4-inch. Where there are two or more panels of X-bracing there are intermediate horizontal struts 18 inches deep with rectangular cross sections made with four 4x3x5/16 angles, latticed. Panel U6 L6 is like U5 L5, panels U4 L4 and U8 L8 are like U7 L7 and panels U2 L2, U3 L3, U10 L10, U11 L11, U12 L12, and U13 L13 are like U9 L9.

The top chord is made in single panel sections with milled ends abutting on the center lines of the vertical posts and spliced with top and bottom flange cover plates, outside web plates and inside gusset plates which receive the vertical and diagonal posts as shown in the detail at U6. All splices were assembled, fitted and reamed in the shops, all splice plates were shipped loose and all their rivets were driven in the field. The bottom chords are also made in single panel lengths, similarly spliced, but they have no cover plates. The webs are connected by vertical transverse diaphragm plates near each end and the flanges are latticed by zig-zag 3x2½-inch angles.

At the center joint only, there are vertical angles riveted to the ends of the webs of both sections and these were connected by rivets through their outstanding flanges after the two chord pieces were assembled. Here, too, half the holes in the gusset plates were drilled in the field by pneumatic tools so as to be certain to match the corresponding holes in the chord pieces which were drilled in the shops. At bottom chord panel points L3 the gusset and splice plates were all field-riveted to the chord section nearest the skewback, and bolted, through slotted holes, to the other chord section so as to allow longitudinal and prevent transverse motion as shown in the detail drawing.

At the abutments shoes are riveted to the under sides of the lower chords and receive the upper pins of short vertical rocker posts which have lower pins in ordinary pedestals bolted to the masonry as shown in the detail elevation at L0. The floorbeams are made with 45x5/16-inch web plates and 6x4x½-inch flange angles and are divided into three nearly equal panels by two pairs of 3x3-inch vertical web stiffener angles. The ends of the floorbeams are beveled to correspond with the batter of the trusses and are riveted to the faces of the vertical posts with 40 rivets in four vertical rows at each connection. The stringers have 36x7/16-inch webs and 5x3½x7/16-inch flange angles and are seated on the top flanges of the intermediate floorbeams to which they are riveted with two rivets at each end. They are web connected to the end floorbeams which are set correspondingly higher. The top lateral diagonal angles were cut to clear the bottom flanges of the stringers, and were riveted to them with short connection plates. Between the stringers one of the middle sections of the diagonals in each panel is continuous and the intersecting one is cut to clear it and spliced by a flat plate riveted to the bottom flanges of both angles.

All the web members of the arch truss have I-shaped cross sections made with four flange angles, which, except for U0 L0 and U13 L14 have latticed webs. These two members have solid plate webs and solid cover plates riveted to the flanges. The longest members are made in two or three sections each, spliced with web and flange cover plates, the latter being extended for connection with the horizontal longitudinal struts. The rocker posts at the abutments are 18⅞ inches long on centers, with rectangular closed cross section made with two 8-inch channels and two 11-inch cover plates. Both pins are horizontal, and the upper one engages a shoe with vertical web plates of unequal heights, riveted to a top plate which is set obliquely to engage the inclined surface of the bottom chord of the battered truss.

Material for the superstructure was shipped from New York direct to Port Limon, in three invoices, two by regular line boats and one by a chartered steamer. It was thence shipped by rail to the site and unloaded by steam derricks in a storage yard on the east side of the canon. A cableway with a main cable about 2½ inches in diameter and 900 feet long was erected across the canon and by it all the material for the west half of the bridge; which was painted red, to distinguish it from that for the eastern half which was painted white; was transferred to the opposite side in readiness for simultaneous erection. The 8-ton skewback shoes on the main piers were first set on mats ⅝-inch thick which were made of layers of felt soaked in hot coal tar. These covered the whole top of the masonry and were used to bed the base plates instead of grouting them, because of the difficulty of injecting the grout thoroughly under so large a base plate without vent holes for the escape of the air.

Between the piers and the abutments the trusses were erected in their required position on timber blocking by the use of the two overhead traveling derricks which were designed for the cantilever erection of the arch trusses. The joints at L3 were bolted tight and all other joints were riveted permanently and the arch trusses were built out panel by panel until their increasing moment produced a slight uplift at the abutments. All blocking was then removed from under the shore trusses and the nuts on top of the vertical anchor bars were screwed down until the points Uo were depressed about four inches below their final positions. The erection was continued to the center panel and the last sections of top chords were inserted several inches above their final positions. The shore ends of the trusses were then loaded with several hundred tons of ballast so as to partly balance the moment of the overhanging arms and reduce the tension on the anchorage arms and the nuts of the latter were slacked off, allowing the top chords to assume their required positions when the last joints took the calculated compression and the blank web splice plates were drilled and riveted and the rivets were driven in the rest of the top chords and in the floor system where the holes had before been filled with bolts exclusively. The other field rivets, including those in the bottom-chord splices, were driven as soon as possible after the joints were assembled and nearly all of them were driven by pneumatic hammers operated from steel pipes run to a Chicago Pneumatic Tool Company's compressor, which was driven by steam from a locomotive boiler.

The erection travelers were duplicates, shipped with the steel trusses from New York, each consisting essentially of a horizontal platform about 18 feet wide and 40 feet long which carried two stiff-leg derricks, one on each front corner. The 34-foot masts, the 50-foot booms, the stiff legs and their horizontal braces were of timber. The diagonals, longitudinal sills and all connection plates were of steel. The traveler wheels had a tread 15 inches wide between the two flanges, and had a diameter of 18 inches. They rolled on the horizontal flanges of a pair of 3x3-inch angles covering the upper corners of 12x12-inch longitudinal timbers which were beveled to fit the top chords of the arch trusses and give horizontal upper surfaces. These timbers were countersunk bolted on top of short cross ties which projected beyond the edges of the longitudinals and were countersunk to clear the rivets in the top chords to which they were clamped with steel yokes and set screws engaging the ends of upper flange angles. Each boom had a normal capacity of 17,000 pounds, and the heaviest pieces lifted weighed about 18,000 pounds.

The construction of the travelers was somewhat modified from the design shown in the accompanying elevations, by the addition of a horizontal strut about 40 feet long and 5 feet below the tops of the masts, beyond which it projected equally on both sides. The extremities of these struts were braced to the tops of the masts and to the working platform, by inclined struts. This gave additional transverse stiffness to the traveler and afforded a connection for whip lines and light tackles outside the top chords for convenience in handling members in the inclined planes of the trusses. The transverse floorbeams of the working platform were 12 feet beyond the sills on each side and were permanently braced. The working platform was elevated about 6 feet above the tops of the wheels and its transverse floorbeams projected about 12 feet each side of the traveler sills and were kneebraced to them, inside and outside, thus affording clearance under the floor for small cars on the permanent bridge track to deliver material through the traveler, under the floor to the derrick booms.

When in service the traveler was anchored to the top chords by chains around the sills and the top chords, which were tightened by pairs of wedges, and the front wheels were blocked up clear of the rails. Temporary kneebraces were also set between the ends of the floorbeams and the top chords, and the tops of the masts were guyed to the top chords several panels back, by wire ropes with adjusting tackles. The derrick booms were rigged with manilla rope tackles operated by one six spool Lidgerwood hoisting engine on each traveler. The total weight of one traveler, engine and rigging was about 22 tons. The bridge was erected by fifty men in about three months, and although only a dozen of the men were experienced bridge erectors sent out by the contractors, no casualties were reported.

(To be continued.)

Sewage Disposal at West Bromwich, England.

About three years ago the town council of West Bromwich, Eng., acting on the suggestion of the borough engineer, Mr. A. D. Greatorex, caused three large bacteria or contact beds to be constructed, in order to determine whether the sewage of the locality could be successfully treated by that method at all times of the year, and further, to determine whether by means of a double contact an effluent could be obtained of sufficient purity to render unnecessary any further purification. The results of this investigation are embodied in a report by Mr. Greatorex to the town council some time ago, from which the following notes have been condensed:

For the low-level sewage, double contact is used, the beds being 120x60 feet in size. The average depth of filtering material in the coarse-grained bed is 3 feet, consisting of screened engine ashes from ½ to 2 inches in size. In the fine-grained bed the material is 3 feet deep and from ¼ to ½ inch in size. The sewage reaches the coarse-grained bed by means of three 15-inch gates. The iron troughs for distributing the sewage are 15 inches wide and laid on the surface of the filtering medium. The beds are not underdrained but have six 4-inch sluice valves on either side connected to 6 and 9-inch cast-iron pipes, which discharge into manholes at the lower end of the beds. This system of emptying the beds has been found to be satisfactory. The coarse-grained bed discharges into the fine-grained bed, and the latter discharges into a 12-inch earthenware pipe connected to a pump well near the engine house, from which it is pumped to the land filtration area.

The single coarse-grained bed for the high level sewage is 60x42 feet in size, with an average depth of material of 3 feet. The sewage passes first through the detritus tanks, then through two 15-inch valves onto the bed, being distributed by means of two 15-inch cast iron troughs. The outlets for the filtrate are six 4-inch valves connected to cast iron pipes leading to two manholes from which the liquid flows through a 9-inch earthenware pipe to the land filtration area. The latter takes the place of the fine bed used for the low level sewage.

The method of working the beds is as follows: The sewage is allowed to flow into the coarse-grained bed until the level has nearly reached that of the bed material. The inlet valves are then closed, and the bed allowed to stand full for about two hours. The same period of resting full is given for the fine-grained bed. After being used the beds are allowed to stand empty for three hours, and are used three times every 24 hours.

The analyses made showed that the average amount of suspended matter contained in the sewage was 77.39 parts per 100,000, which was reduced in the coarse-grained beds to 9.34, and in the fine-grained bed to 0.95 parts per 100,000. The effluent from the land contained traces only. The reduction of the oxidizable matters in solution was from 3.251 to 1.512 parts per 100,000 and then to 0.457, thus showing an average reduction of 53.4 per. cent. by the coarse-grained bed and a total reduction of 85.9 per cent. by the combined beds. The total purification after land treatment was 88.9 per cent. The reduction of the nitrogenous organic matters, as indicated by the albuminoid ammonia was 47 per cent. by the coarse-grained bed, 78.6 per cent. by the combined system, and 82.4 after land treatment. The accompanying table shows in parts per 100,000 the results of the treatment on both the high and low levels.

	High. level, land.	Low level. Fine. bed.	Land.
Oxygen consumed	0.369	0.457	0.360
Albuminoid ammonia	0.042	0.068	0.056
Total suspended matter....	0.660	0.950	None.
Nitric nitrogen	1.260	0.447	1.239

The capacity of the beds has been found to remain practically constant after they have been in operation for a period of about three months, and in round numbers is said to be about one-third of the tank capacity. It is stated that the final effluent is clear, entirely without odor, remains perfectly sweet on keeping, and is fit to discharge into the river, however small the relative volume. Since the beds became regular in their action, neither the effluent nor the beds have become foul. Analyses taken later than those given here have shown that the effectiveness of the treatment has in no way diminished.

The conclusions drawn from these experiments were: (1) That the sewage of West Bromwich can be successfully purified by the bacterial process; (2) that this process is efficacious at all seasons of the year; (3) that the final effluent from the fine-grained bed on the low level is sufficiently pure to discharge into the stream without further purification; and (4) that detritus tanks should be provided on both levels to remove as much mineral and suspended matter as possible. These investigations led to the recommendation of a system of contact beds of sufficient capacity to deal with the entire flow of sewage.

The average daily dry weather flow from the low level system is stated to be 800,000 imperial gallons, and from the high level, 400,000 gallons, making a total of 1,200,000 imperial gallons to be treated. The low level sewage is comparatively weak, although it contains a certain amount of manufacturing wastes. The corporation does not allow acid or wash water from galvanizing works to discharge into the sewers. The high level sewage is also dilute, though of rather a stronger character than the low level. It is free from admixture with manufacturers' waste, except that from breweries.

The scheme finally adopted for the treatment of the whole of this sewage and which is now being carried out, was described by Mr. Greatorex at a recent meeting of the Association of Municipal and County Engineers held at West Bromwich, substantially as follows:

Low Level.—Three detritus or open septic tanks, each 160x30 feet in size, with an average depth of 5 feet 6 inches will be provided, giving a total capacity of about 500,000 imperial gallons. Eight coarse-grained and eight fine-grained contact beds, each 120x60 feet, will give with the existing ones a total area of 14,400 square yards, capable of treating 1,600,000 imperial gallons per 24 hours on an 8-hour cycle. The effluent from the fine-grained beds is to be collected and passed over an ærating bed having an area of about 1,000 square yards. All storm water up to four times the dry weather flow will be treated on land areas which have been underdrained and have a collective area of about 34 acres. This will allow for the treatment of about 3,000,000 imperial gallons of storm water per day.

High Level.—The existing detritus or open septic tanks will be extended so as to have a capacity of about 240,000 imperial gallons. Nine coarse-grained bacteria contact beds, each 100x60 feet, will be constructed, capable of dealing with about 1,444,000 imperial gallons of sewage per 24 hours on the 8-hour cycle. The effluent from the coarse-grained beds will be conveyed by means of a 12-inch earthenware pipe to some of the land areas, which have been underdrained, and treated there instead of by fine beds. This land has a collective area of about 28 acres. From this it will pass directly into the brook. In order to deal with the storm water, part of one of the areas will be filled with material to form a special storm filter capable of dealing with 2,000,000 imperial gallons per 24 hour.

As regards the storm water, storm overflows are being provided both on the low and high levels for the purpose of regulating the flow. One overflow is arranged so as to come into operation when the sewage is diluted with more than five times its volume of storm water (i. e., when the sewage is flowing at a rate exceeding six times the dry weather flow) and another is arranged so that the sewage and storm water up to twice the dry weather flow will pass to the contact beds and thence onto the land, and the balance between twice and six times the dry weather flow to the areas to be reserved for the treatment of excess storm water.

The detritus tanks are constructed with blue brick walls in cement on concrete foundations and are provided with scum boards and cast iron inlets. The bacteria or contact beds are constructed in Portland cement concrete, 6 inches thick, with cast iron outlet valves at regular intervals instead of underdrains. Blast furnace slag will be used for filling, ½ to 2 inches in size for the coarse beds and 1/16 to ½ inch for the fine beds. The cost per square yard of the coarse beds on the low and high levels complete, including filling, is about $3.35 and $3.60 respectively, and the cost of the fine beds about $3.60 per square yard.

The East Boston Tunnel, under Boston Harbor, and the Washington Street subway have been leased for a term of twenty-five years to the Boston Elevated Railway Company by the city. The rental is fixed by the contract at 4½ per cent. of the cost of construction.

An Illuminated Tracing Table in the drafting rooms of the Metropolitan Water-Works, Boston, is used for making tracings on thick paper or of drawings having weak lines. An ordinary large drafting table with a thick white pine top, having a large drawer sliding across the whole width of the table was adapted for this special purpose. A rectangular hole was cut in the middle of the top of the table and a large piece of ¼-inch French plate glass set in it so as to be flush with the surface of the table. The drawer was painted white on the inside and in it was set a 6-light cluster of incandescent lamps mounted on a base block. The lights have a white porcelain reflector beneath them and are fitted with independent keys. Lamps of any usual candle-power may be put into the sockets, but 8-candle-power lamps have been found sufficiently strong for most purposes and stronger ones are very trying to the eyes. Flexible leads are taken from a large wall switch to the cluster of lights so that the whole cluster may be lighted or shut off at one operation, but by means of the independent keys one or more lamps may be cut out separately. A number of vent holes were bored in the sides of the drawer to prevent overheating. The illumination is not quite uniform over the whole area of the glass, but by sliding the drawer or moving the block carrying the lamps in the drawer the most brilliant illumination can be obtained under that part of the work where it is most needed. A great variety of uses have been found for the table, such as comparison of alternative studies for a structure, comparison of contours of proposed surfaces with original contours, and the tracing of additions directly on to brown paper drawings and prints.

Electric Lighting in the Union Trust Company's Building, Providence, R. I.

The City Realty Corporation of Providence has recently completed a 12-story building on Westminster, Dorrance and Middle Streets of that city, with accommodations for the Union Trust Company's banking offices on the ground floor and for general offices on the other floors. The electric light wiring is of particular interest in that the three-wire system there installed makes use of its metallic conduits to replace the neutral wire. Besides saving some 40,000 feet of wire, it is claimed that this system makes it practically impossible for fire to start from an electrical source, since if a defect should develop in the insulation, allowing a leakage of current, there would be a dead short circuit, blowing the fuse at once, instead of causing arcing with its attendant dangers of heating. Like all modern buildings, it is so arranged that wires can be inserted or withdrawn from the conduits without disturbing the floors or partitions; as a matter of fact the building was completed before a single wire was drawn into place. Another commendable feature of the installation is the provision of an emergency tie circuit, on most of the floors, to be put in commission during temporary disablement of any of the regular circuits.

The conduits are of iron pipe varying in size from ½-inch to 3 inches in diameter; ½-inch pipe being used for all tap circuits. The threads on the pipe joints were cut dry and the specifications required that particular care should be taken to exclude any particles of insulating material from the joints in making them up. As a further precaution, all joints were bonded with a copper wire across the coupling. To ensure a zero potential in the conduits at all times, they are grounded to the steel frame of the building. This is expected to prevent electrolysis of the plumbing system or any other metal work in the building. Wherever a wire connection continues as the neutral line, contact is made to the pipe by inserting a brass bushing fitted with a flexible bare copper wire.

The best conception of the system as a whole is obtained from the accompanying elevation diagram. As will be seen, the three mains are brought into the building through a subway from the street mains of the Narragansett Electric Lighting Company. The neutral wire goes directly to the neutral bus bar of the main switch-board in the basement but the positive and negative leads first pass through fused knife switches before going to their respective bus bars. From the main board a riser is taken to a panel board on each floor. The lower ends of these riser conduits are tied together by a neutral iron bar. The panel boards are of Italian marble and are enclosed in cabinets with glass doors. A photograph of one is shown herewith with the door open. The board is set in an angle-iron frame which swings on hinges, giving ready access to the back.

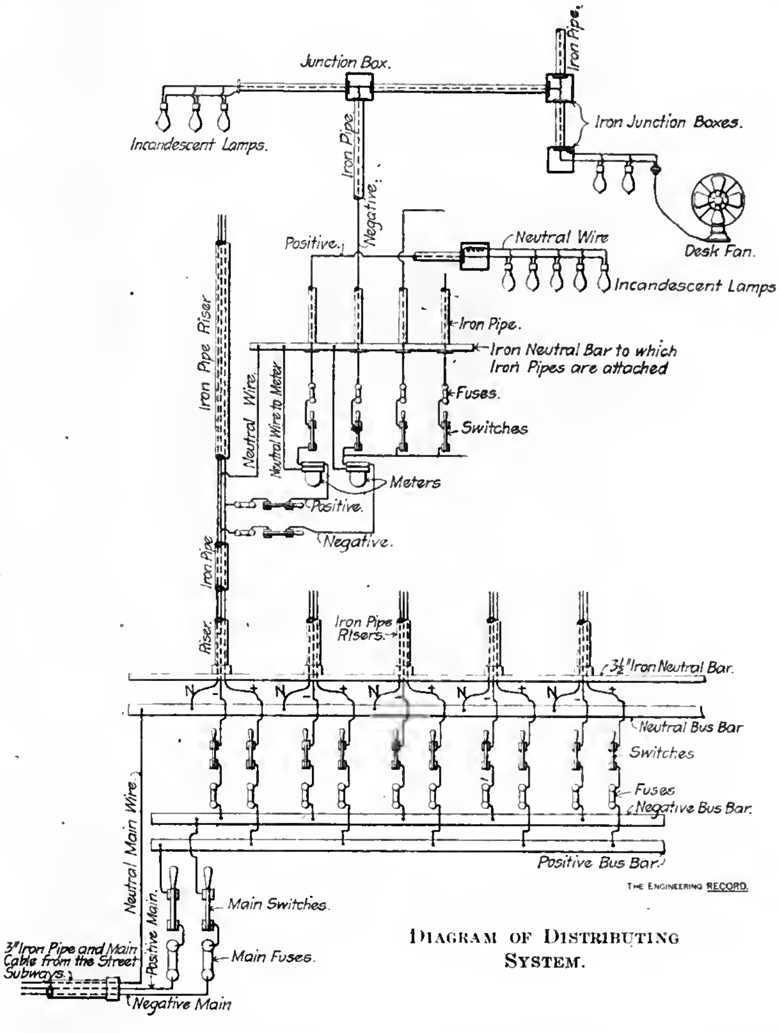
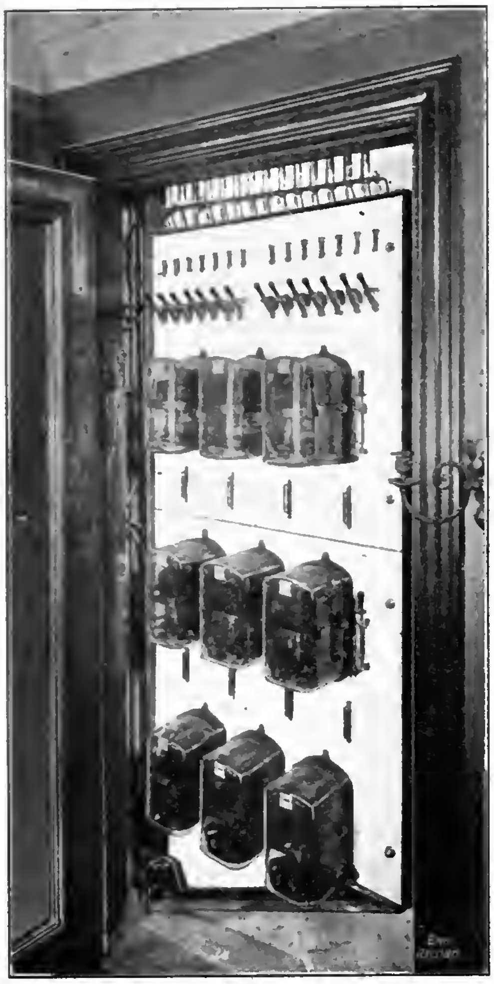
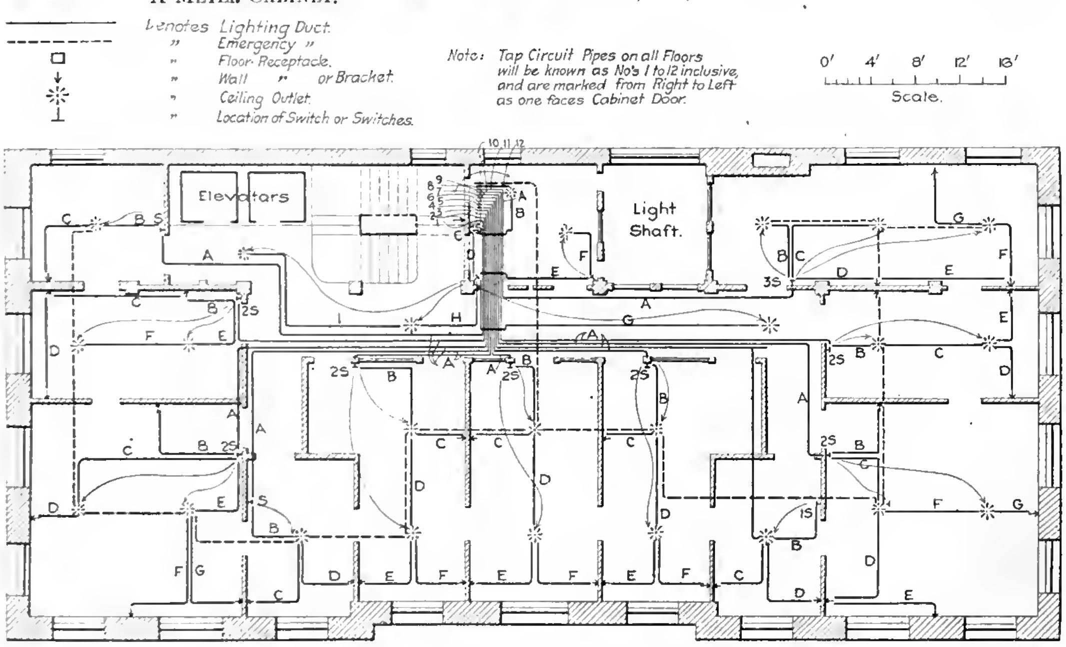


Diagram of Distributing System.

At the distributing panels the circuit is subdivided into a number of branch circuits, as a rule one for each room. This prevents the entire floor from being darkened in case of local trouble in any room and gives an opportunity for measuring through watt-meters the current used by the individual tenants. The board shown has nine General Electric Company's meters with glass cases. This number will allow one for each of the greatest number of concerns likely to occupy one floor, that is nine tenants. The meters can be connected on the back of the board into one or more circuits as may be desired. The switches at the top of the board control the various circuits for that floor. Directly above these are D. & W. enclosed fuses which protect each branch circuit. Between the rows of meters are fuses for the protection of mains for that floor and above the top of the board can be seen the ends of the conduits containing the positive and negative leads, as the case may be. Beyond the panel board the circuits are of the simple two-wire system, the conduit serving as one leg. The method of connecting the ends of the conduit by a neutral bar is also shown in the photograph and at the extreme right the attachment of the neutral wire. The positive and negative wires have long flexible ends to allow the board to be swung outward. It will be noticed that the conduits are not used for the neutral conductors except on the floor branches.



A Meter Cabinet.



Fourth and Seventh Floor Wiring.

The wiring of the various floors differs somewhat in its details but the plan here shown for the fourth and seventh floors may be taken as typical. It shows 12 regular circuits and one emergency circuit. In this particular the second to ninth floors inclusive are alike. The first floor has one more regular circuit and the tenth, one less. The basement, ground floor, eleventh floor and loft have no emergency circuits, but the eleventh has an emergency wire between all of its fixtures, so that any part of it may be connected in at will to supply a fixture from an adjoining circuit until its own can be repaired. The basement and loft have five circuits each, the eleventh floor 12 and the ground floor 13. On the plan the full lines represent regular circuits and the dotted lines the emergency circuits. In this connection it must be remembered that the lines show conduits only and that the number of conductors they contain varies. Some idea of the number of wires in any conduit may be obtained by tracing out the switches connected to that line. There is always one switch for each ceiling fixture. These switches are placed on the side walls, and where there are more than one to a circuit they are placed side by side. All side lights are controlled by the buttons on the sockets.

In general all bracket outlets and receptacles are 6 feet above the floor and all switch outlets 4 feet above. All piping, except that supplying the side wall lights in the banking room, is run on the floor above the rooms in which outlets connected to that pipe are installed. All pipes are laid at right angles to, or parallel with, the side of the building. The approximate location of the ceiling boxes is 1½ inches below the bottom of floor beams. These boxes are set flush with the completed ceiling. The space from center to back of top plate on switch boxes is filled in with expanded metal lathing leaving ⅝-inch for finish lathing and plaster.

The telephone wires connecting all of the rooms are run in 1½-inch conduit with outlets in the baseboards and risers in the halls. These are made large enough to provide for the greatest number of wires that may ever be needed.

The building contains 75,000 feet of metallic conduit, 120,000 feet of Okonite rubber insulated wire, 600 switches and 1,300 lamps. The banking rooms of the Union Trust Company alone have nearly a mile of pipe for electric wires. The system was designed by Mr. William Carpenter Woodward, of Providence, and the work was supervised by Mr. H. C. Wright. The telephone system was furnished by the Couch & Seeley Company, of Boston, and the fixtures by Messrs. Mackinney & Waterbury of the same city. The C. S. Bush Company was the contractor for the wiring.

Separate Versus General Contracts.

A paper by G. E. Gifford in the Proceedings of the American Society of Civil Engineers for August, 1902, p. 533.

The topic under discussion will be regarded by the speaker primarily from the standpoint of the contractor, and by giving the views of the contractor, he hopes to show the owner, the purchaser, or the consulting engineer, that his own interests lie with the contractor in this matter. He believes that contractors almost universally will agree that the dividing up of contract work, so that each principal branch is under original contract with the purchaser, is preferable to the making of one general contract which must be sublet to specialists in the different trades.

The speaker has talked with many contractors on this subject, and does not recollect ever hearing one say that he preferred the general contract system. It is recognized, of course, that there have been formed large contracting firms and corporations who are ready to undertake work of almost any magnitude, and involving many different trades. This has been brought about not so much from preference as from necessity, because the greater part of government and municipal work is being let in this way, and, in order to bid upon it at all, the contractor must take it as a whole. This is also true of some private work, especially the large building constructions.

In many cases the contracting firm consists simply of an office; practically all its actual operations are performed by sub-contractors, and the most important man in the whole outfit is the purchasing agent. He does what the consulting engineer or the architect should do at first hand for his clients. In other cases the contracting firm makes a specialty of some particular branch of work, we will say masonwork or steel-work, and actually carries out this portion of the contract with his own appliances or at his own shops. The remainder, which he cannot do himself, he is obliged to sublet or "farm out," as it is called, or else undertake operations with which he is not familiar and which he can only carry out at a disadvantage. He would much prefer to have only such work as he himself can perform, but is obliged to take the remainder in order to get his portion. The consequence is he is loaded up with a lot of work which he is not adapted to perform, but for which he has to be financially responsible, and he either does it at a loss to himself or at a loss to the purchaser.

It may be urged that the proper way to overcome this difficulty is by a combination of contractors in different lines who are willing to unite their bids in a grand total, including only one profit, and each one then perform his portion of the work. This is no doubt what the purchaser, the engineer, or the architect thinks will be done when he receives proposals in this way. The only trouble with this theory is that it does not harmonize with practice. There is not an entire unanimity of opinion and complete trust in one another among contractors in different trades, which is no doubt to be regretted, but which fact, nevertheless, remains. In a community-of-interest contract someone has to be the principal; someone must be designated as the main contractor, must receive the instructions, confer with the owner or his agents, draw the pay and settle with the others. There is the rub.

What is the practical way in which general contract work is actually taken?

We will assume our contract to be a large city bridge, involving substructure, possibly with pneumatic foundations, dredging, cutstone masonry, concrete, excavation, embankment, paving, sidewalks, perhaps some sewers to be extended or moved, and water pipes to be changed. Then we have the superstructure with a draw span which will involve not only the structural steel, but various kinds of machinery, electric motors, electric lighting plant, a little carpenter work, some automatic gates, fancy hand railing, asphalt paving, and painting. There have been bridges let in New York City the bidding sheet of which showed more than one hundred items for which prices had to be inserted.

We will assume further that the substructure and the superstructure (it being unnecessary to designate specifically before this Society just what items are included under the above heads) are approximately equal. The bridge builder, for example, begins to prepare his bid and finds that he must either combine with some other contractor who will take care of all parts of the work which are technically known as substructure or general contract work; or he must get prices on the separate items from tradesmen of all branches; or he may assume that he knows enough about work of this kind to make his own figures for everything.

The chances are that the first mentioned alternative will be met with the statement: "We will make you figures for our part of the work provided you will agree to tie up with us." This may be the most satisfactory way in the end, provided the bid is successful; if not, there follow the usual charges, expressed or implied, that the bidder was "thrown down" by a bid too high, and if he is the successful bidder and finds that other figures, better than those given to him, have been submitted, he regrets his inability to deal with a cheaper party.

This plan also presupposes absolute confidence between the parties to the proposal, as to fair dealing all around, and this does not always follow. Many of the largest contractors and steel workers absolutely refuse to make prices to other contractors in advance of the receipt of the contract; and in some cases will even decline to bid to another contractor, even though he holds the contract; the position of sub-contractor being so undesirable, for many reasons, particularly the inability to deal directly with the owner, and the financial delays and losses involved in case the main contractor is slow pay or becomes financially embarrassed. The speaker knows what he is saying, in making these statements, from the fact that the firm which he represents almost invariably declines to assume the position of sub-contractor on any work. He knows of others who feel the same way.

Returning to the second method of preparing a proposal, that of getting separate prices on all the different classes of work, we find a marked disinclination, on the part of dealers and tradesmen, to give their best figures for bidding purposes, if they will give them at all. An inquiry of the sort is likely to be met with the question: "Have you this contract?" The answer being "No," it is likely that an excuse will be offered, such as "too busy to figure just now," or else the statement: "We will give you a safe price with which to bid; but, in case you secure the contract, we may be able to do better, and expect to hear from you again." Is this likely to be satisfactory to the bidder desiring to make a close bid? And after he had added his 5 per cent., 10 per cent., or whatever he sees fit to cover the financing of the job, contingencies, and his profit, is it likely to be an economical method for the purchaser?

No doubt, if every contractor had the skill and knowledge of costs and conditions to make up his own figures for all classes of work, it might be best to make a general contract. Sometimes he attempts to do this, with the result that he is entirely too liberal in his estimate, and loses the work, or else makes a mistake somewhere, and, when he comes to do the work or purchase his supplies, finds that there is a corner against him, or some condition has arisen in the market or in labor which he has not accounted for. It is practically impossible for one man or one firm to be fully posted on all the branches of work entering into a large bridge or building contract. The consequence is he finds that he has a losing contract, a highly undesirable state of affairs, not only for himself, but for the purchaser. There is probably no engineer or owner who desires to see his contractor lose money; it is certainly bad for the contractor, and a source of great trouble to the purchaser, if not an actual detriment to the work. Of course, it is not right to assume that all contracts will be profitable, even if taken and prosecuted by specialists; all are likely to make mistakes; but it is fair to presume that fewer mistakes are made in one's own line of work than in something with which one is not familiar.

The subject has thus far been considered principally from the standpoint of the contractor, and the speaker has endeavored to show wherein it would benefit the contractor to take only his own kind of work. In order to bring this about it must be shown to the purchaser, or the engineer or architect who represents him, that he will benefit by dealing separately. The principal argument offered in support of the general contract system is the supposed advantage of having only one party to deal with, and the presumption that trouble among independent contractors on the same work will be avoided by having them all under one control. The first proposition practically includes the second, and, while it may avoid some clerical or office work, it surely does not avoid anything in superintendence or inspection; and the fact that the combining of a large contract under one head will eliminate a large amount of competition would seem to far outweigh a slight saving of detail in drawing up a few extra contracts or making a few extra vouchers for payment.

It is a fact that the general-contract method eliminates competition. As an example, may be quoted the bridge work for the State of New York. The bulk of this work consists of not very large bridges over the canals, some of them aggregating perhaps $50,000, but most of them much less. It is the invariable practice in the Department of Public Works to make one contract to cover each structure, and they nearly all involve a little concrete, a little excavation, a little embankment, and so on, together with the steel superstructure, which, in the case of lift-bridges, may be quite complicated. The consequence is that there is little or no competition in this State work, and in case they are so fortunate as to receive two or three bids, about half the time the bids exceed the appropriation, because excessive prices are put in for the little odds and ends of work which the bridge builder does not want, but has to take in order to get the steel-work.

A local contractor, knowing or being able to ascertain easily the conditions prevailing, could take care of these items well and economically, but he is practically debarred from bidding because he cannot bid on the bridge and cannot find any bridge company who will give him a price. The bridge companies, on the other hand, at least a good many of them, not wishing to be bothered with the substructure work, especially under present conditions, when there is plenty of more desirable work, do not prepare any estimate, and the result is as stated; there is practically no competition and the prices are excessive.

There is no doubt whatever that much better results would be obtained if this work could be divided into, perhaps, not more than two separate contracts. The speaker once took occasion to ask an official of the State why they adhered to this practice, and found that it is because when the laws making the appropriations are passed, they direct that such and such moneys be appropriated and "a contract" be entered into for the work. The officials feel that they are bound to adhere rigidly to the letter of the law. It seems to be nobody's business to change this form of wording. This is only a typical case. The speaker could quote many instances where, of his own knowledge, the method of combining different kinds of work under one contract has prevented competition and raised the cost.

It seems strange that among the chief adherents to this method is the United States, in its various departments, and the largest municipalities of the country. We scarcely ever find it among the railroad companies, who regard the economical aspect more carefully than public officials. The Navy Department, for example, in letting the contract for a building, will include all masonry, carpentry, steel-work, plumbing, etc., under one contract. This surely precludes a certain amount of competition, and presumably is an expensive method, for the reasons stated above. Some of the principal bridge companies have practically turned down Navy Department work, although quite desirable in itself; but it cannot be secured without taking much work which is not desirable, or else under a sub-contract, with its attendant disagreeable features.

Bids for Public Work are tendered by the city engineer of Toronto, Can., Mr. C. H. Rust, in competition with the regular contractors, with the result that during 1901 thirteen of his bids were the lowest, and were carried out by day labor under his supervision. The following table shows the saving to the city in the cost of paving during the year due to this practice:

Class of Pavement.	Length, feet.	City's bid.	Next. lowest bid.	Actual gain to city.
Macadam	694	$1,300	$1,369	$108.80
Macadam	362	850	915	43.61
Cedar block on concrete	108	295	345	56.27
Cedar block on tarred planks....	613	2,700	3,368	460.02
Scorla and granite.	602	5,765	6,445	1,060.96
Totals	$2,379	$10,910		$1,729 66

Portland Cement Concrete Pavements have been introduced on two minor streets in Grand Rapids. They are described substantially as follows by City Engineer L. W. Anderson: Briggs Court has a total width of 30 feet, with 23-foot roadway. The roadway has a 4-inch crown and a curb exposure of 5 inches. The upper end of the roadway was enlarged to a 30-foot radius to allow the turning of teams. Donald Street has an 18-foot roadway and 4-foot walks. The sidewalks consist of a 3¼-inch base and ¾-inch top; the pavement of a 6-inch base and 1-inch top. The concrete for the base consists of one part Portland cement, three parts sand, and five parts screened gravel, the particles ranging in size from 1 inch to ¼ inch in their largest dimensions. The top consists of one part cement and two parts sand. The following is from the specifications: "The concrete pavement shall be laid in alternate 6-foot sections, with at least a ¼-inch expansion joint at the curb, and a template-made joint at the crown. A coarse brush finish shall be given the surface." The contract prices for this paving, which aggregated 2,196 square yards, were $1.78 and $1.56 per square yard.

The Pennsylvania R. R. Bridge at Fifty-second Street, Philadelphia.

At the 52d Street station of the Pennsylvania Railroad in Philadelphia the tracks of the Schuylkill division diverge from the main line and diagonally intersect six freight tracks. In order to avoid a grade crossing and give a free passage to the passenger trains the in-bound trains will enter the station in a tunnel below main line grade, and the out-bound trains on a bridge above grade. The bridge superstructure is of open-hearth mild steel and includes two long plate girder viaduct approaches and a single pin-connected through span of 387 feet 10 inches on centers with Pratt trusses 20 feet apart on centers which have thirteen panels of 29 feet 10 inches each. The center panel has parallel chords 45 feet apart on centers; all the other panels have inclined top chords sloping down to a truss depth of 30 feet at the hips. The span weighs about 900 tons, and being designed for heavy traffic at high speeds, is proportioned for mass and rigidity to resist vibrations and deformations.

The lower chord is made up entirely of 10-inch eyebars, of which there are in the center panel four 1⅝ inches, four 1 15/16 inches and two 2 inches thick. The main diagonal ties are 10-inch eyebars from 1 5/16 to 2⅛ inches thick. There are counters in five panels and all of them are pairs of square rods with loop eyes and sleeve nut adjustments, except in the center panel, where they are stiff members riveted to gusset plates at the top and bottom of the vertical posts. The trusses are sway-braced in the usual manner in the transverse vertical plane at every panel point by intermediate horizontal struts at a uniform clear height of about 20 feet above the rail base, top lateral struts and diagonal X-bracing of single 3½x3-inch angles in the vertical panels between them. The lateral systems consist of angle X-braces in all the panels between the top and bottom chords. The track is carried at a grade of 0.9 per cent. on two lines of stringers 6½ feet apart. All the web members of the truss are packed inside the top chord sections, the diagonal ties being close to the jaw plates of the vertical posts, outside them when there is only one pair of bars in the panel and one pair outside and one pair inside when there are two pairs. The bottom chord pins have the main ties packed next to the jaw plates of the vertical posts and the counters inside the posts.

The top chords and end posts are of the regular rectangular trough section with closed sides and top and latticed bottom; they have a 36-inch cover plate and three 28-inch webs, the two outside ones being 27½ inches apart. The lower flanges of the bottom angles are reinforced with 5-inch plates, and the pins are on the center lines of the web so as to make a nearly balanced and symmetrical section. The chords are made in single panel sections about 30 feet long, and adjacent pieces have no direct bearing on each other. Their ends have half holes for the pins and are milled to a clearance of ⅜ inch. They are not, properly speaking, spliced at panel points, but the joints are covered by light outside field-riveted cover plates over the top plate and the bottom flanges and by projections of the outside web reinforcement plates which form jaw plates with full pin holes at one end only of each chord section, thus not locking the chord sections together. The webs are made up of full width plates with eleven lines of rivets and with narrower plates riveted on between the angle flanges. Both ends of each section of top chord are stiffened by transverse vertical diaphragms about 2½ feet from the pin centers which clear the vertical posts and main ties. The chord shown at U6-U5 has the same maximum cross section as that for U6-U6.

The vertical posts are all made with two built channels with their webs in longitudinal planes, their flanges turned in and latticed. At the bottom they project below the lower chord-bar heads and have wide, thick horizontal plates shop-riveted across their ends and field-riveted to the floorbeams to afford connections for the bottom lateral angles. Above the lower chord pin there is the usual transverse vertical diaphragm for the floorbeam connection, which in this case is made with 36 ⅞-inch rivets in two vertical rows The two vertical posts at U6-L6 have wide gusset plates riveted across their faces at top and bottom to form connections for the center-panel diagonal members or counters, which are I-shaped struts made with two pairs of 6x4-inch angles, latticed. One of them is made in a single continuous piece about 51 feet long, and the other one is cut to clear it at and spliced across the intersection by a pair of 14x13/16-inch flange cover plates nearly 6 feet long. These are shop-riveted to one part of the diagonal to form jaw plates, which are field-riveted to the other part of the same diagonal with 48 rivets and to the intersecting diagonal with 16 rivets. The ends of the diagonals are riveted to the vertical posts with 60 rivets each.

The chord pins are 8 and 9 inches in diameter and up to 50 inches long at L6. They are all made to project ½ inch beyond the eyebars at each end and have the ends finished with a concave cast disc 12 inches in diameter, chambered 1 inch deep on the side towards the eyebar and held in position by a nut on the end of a 1⅛-inch bolt which passes through them and the axis of the pin.

The intermediate floorbeams have the lower sides of the end sections of the web notched to clear the lower chord and extended above the top flange to form the connection to the vertical post. The web is reinforced by two side plates extending from the end to beyond the stringer connection and by a second pair extending from the end to beyond the joint to act as cover splices for the latter. The 30-inch stringers are seated on horizontal shelf angles and have 26 field rivets through their vertical flanges and the web of the floorbeam at each end. The stringers are made with a ⅝-inch web plate, four 6x4x⅝-inch flange angles and four 14x⅝-inch flange cover plates. Horizontal connection plates are field riveted to the insides of their top flanges to receive single 3x3½-inch zig-zag angles, and the bottom flanges are riveted to the lower lateral diagonals. The end floorbeam has square ends seated on pedestals extended from the shoes for the trusses. The top flange angles project to cross the inclined end posts to which they are riveted with bent connection plates and braced by bent horizontal longitudinal angles. The track is carried from the end floorbeams to the abutment masonry on brackets in the planes of the stringer webs which have their top flanges spliced to those of the end stringers by flange cover plates passing through slots in the floorbeam webs. The top lateral diagonals are I-shaped struts made with two pairs of 3½x3-inch angles, latticed, and field riveted at the ends between a pair of horizontal plates like jaw plates on the inner flanges of the top chords. One strut is continuous, and the other is out to clear it and spliced across the intersection by top and bottom flange cover plates shop-riveted to one half and field-riveted to the other half. At the intersection both struts have full web plates which are connected by four vertical plates, two of them bent to acute and two to obtuse angles corresponding to the angles between the struts and one of each shop-riveted to the end of each short diagonal so as to make projecting flanges, which are field-riveted to opposite sides of the web of the continuous strut.

The bottom lateral diagonals are T-shaped struts made of pairs of 6x4-inch angles shop-riveted together back to back, with the vertical flanges up and the horizontal flanges field-riveted at the ends to the connection plates at the feet of the vertical posts. One strut in each panel is made continuous, and the other is cut to clear it and spliced across the intersection with a 16x⅝-inch bottom flange plate shop-riveted to the under side of one of the short pieces and field-riveted to the other and to the intersecting strut. Pairs of short connection angles with their horizontal flanges up have their vertical flanges shop-riveted to the vertical flanges of the struts and their horizontal flanges field-riveted to the under sides of the bottom flanges of the stringers.

The portal bracing consists of a main strut connecting the hip joints of the two trusses, a parallel strut below it in the plane of the end posts, and three horizontal panels of X-braces between them, and has no knee braces. The main strut has a pentagonal cross section, as shown in the detail, with solid web plates on four sides and lattice bars on the fifth and narrowest side. The two sides in the planes of the top flanges of the top chord and end post are made of separate flat plates spliced by a narrow bent cover plate. These plates do not extend quite to the ends of the strut, but are spliced to short end sections which project beyond the edges of the strut and are field-riveted to the inner sides of the flanges of the top chord and end post. These plates also serve as gussets for the connection of the top lateral diagonals and the portal X-braces. The lower horizontal portal strut is simply a plate girder with two 4x3½-inch flange angles and a 26x5/16-inch web perpendicular to the axes of the end posts. Each end of the web is field-riveted to the end post web through a single bent plate. The X-braces between the horizontal struts have I-shaped cross sections made with two pairs of 3½x3-inch angles, latticed.

The shoes are special, in that each has, on the side next the bridge axis, an extension of the bottom plate with a pedestal on it having a wide top plate which serves for the seat of the end floor beam and the end lateral diagonal connection. Each shoe has three webs reinforced to give a total length of 9¼ inches pin bearing. The web plates are in the same planes as the web plates of the end posts and are cut through the center of the pin to clear them and leave only half holes except in the cases of the outside pin plates which project above the others and have full holes corresponding with the projecting jaw plates on the lower ends of the end posts on the opposite sides of the bearings, and with them serving to lock these members together to the end pins. The expansion shoes are seated on segmental rollers 12 inches in diameter and 4½ feet long with transverse grooves in the center to lock them to 2¾-inch ribs on the surfaces of the bottom plates of the shoes and the tops of the bed plates. Both ends of the rollers are connected by tapbolts to horizontal top and bottom side pieces. These are composed of 5-inch channels with their webs reinforced by 5x1-inch plates. The tapbolts are 1½ inches in diameter and 7 inches long, penetrate the roller 3 inches and have a 1⅞-inch shoulder 3/32 inch longer than the thickness of the roller frame. Outside the frame the bolt is turned down to 1¼ inches diameter and has a nut bearing on a 3x½-inch washer.

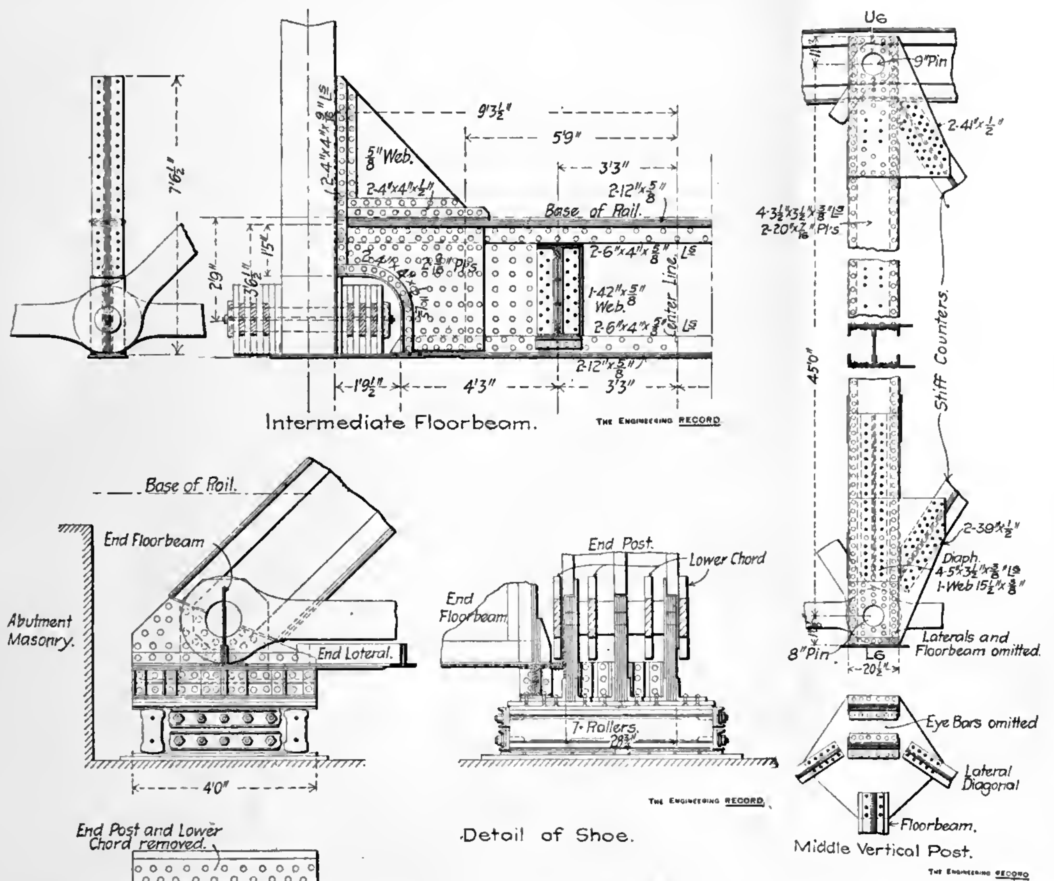
The 54x68-inch bed plate for the expansion end is 1¼ inches thick and has nine 6x¾-inch flats riveted to the upper surface for transverse bearings for the rollers. The bed plate for the fixed end is 14 inches high over all to compensate for the depth of the roller nest, and is made with a 50x68x1¼-inch bed plate, and a 48x¾x60-inch top plate separated by seven pairs of 12-inch 40-pound channels riveted together back to back. In the longitudinal center line of each bed plate there is a vertical 5x4-inch angle riveted to the web of each channel so that the outstanding flanges of angles on adjacent pairs of channels are in contact, back to back, and are shop-riveted together, making Z-shaped diaphragms stiffening and uniting the channel webs. Each bed plate is anchored to the masonry by four 1⅜-inch stone bolts.

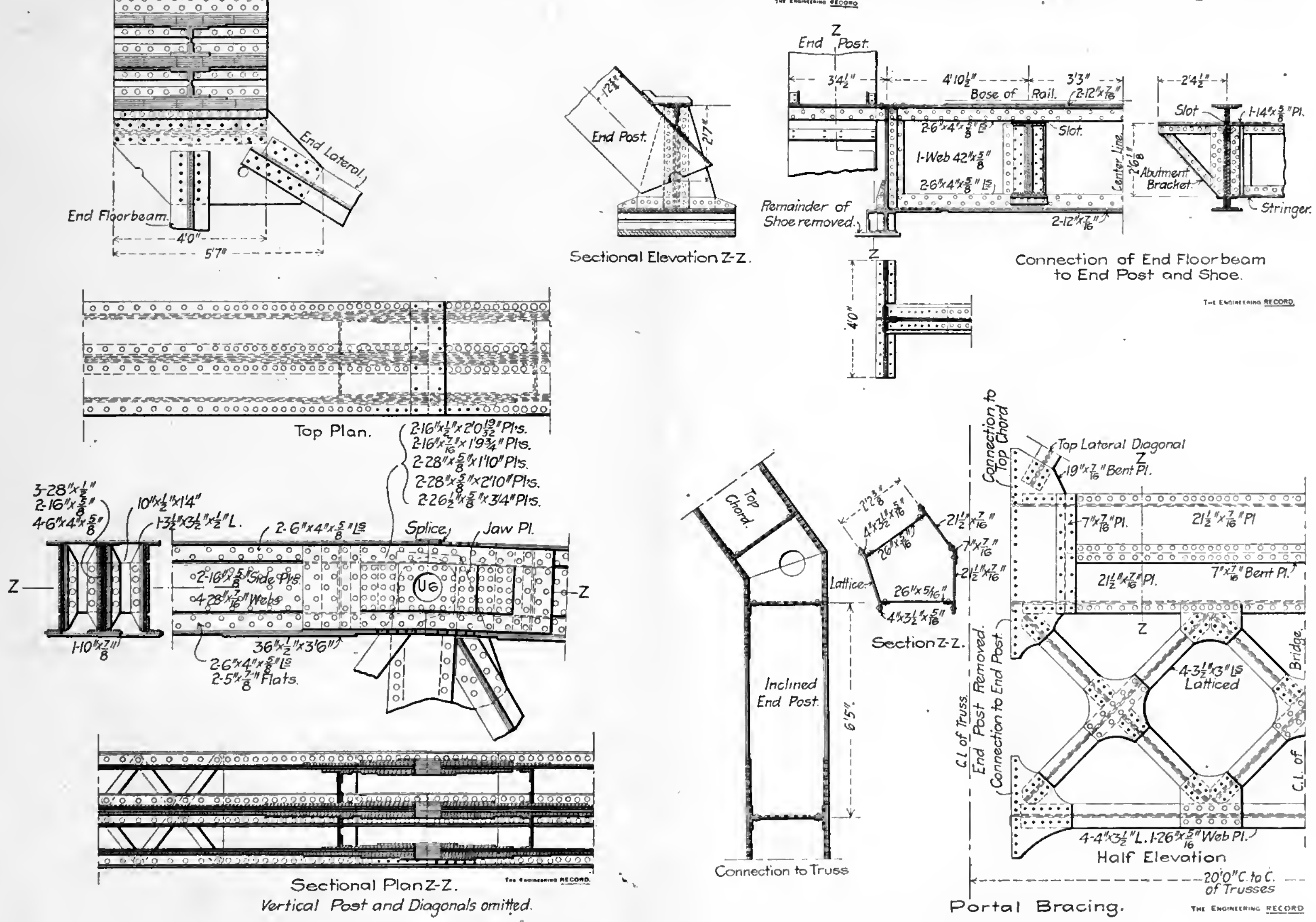
The bridge was built according to the specifications of the Pennsylvania Railroad Company, Mr. W. H. Brown, chief engineer; Mr. W. A. Pratt, assistant to chief engineer and formerly engineer of bridges, and Mr. H. R. Leonard, now engineer of bridges and buildings. The superstructure was built at the Pencoyd plant of the American Bridge Company, Mr. Paul L. Wolfel, chief engineer.

The Output of Cement in the United States has doubled in the five years from 1897 to 1901. According to the Treasury Bureau of Statistics, the output in 1901 was 20,000,000 barrels.

The World's Coal Production, according to a British exchange, is 700,000,000 tons annually. During the past three years the United Kingdom has produced an average of 221,441,000 tons, and the United States 242,816,000 tons. The total of these two countries amounts to nearly five-sevenths of the whole world's production.

Among the Smokeless Cities of Europe, Berlin ranks very high, according to consular reports. This is in spite of the fact that Berlin is a busy manufacturing place, and is accredited to three conditions: The prevailing use of coke and briquettes; the intelligent construction of boiler furnaces and chimneys; and the high standard of skill that is maintained among firemen.





DETAILS OF PENNSYLVANIA RAILROAD BRIDGE AT FIFTY-SECOND STREET, PHILADELPHIA.

Letters to the Editor.

Residential Septic Tanks.

Sir:—I can hardly agree with the ideas advanced and being put in practice for the care of the sewage of Zion City as outlined in the paper prepared by Mr. Burton J. Ashley for the American Society of Municipal Improvements and published in your issue of the 11th.

It has been considered feasible and desirable to include individual septic tanks in the scheme of sewage disposal for isolated residences and institutions, but it hardly seems advisable or economical to adopt this system in a city or village where a large number desire sewer connections and where it is necessary to use a sewer system to carry off the effluent from the isolated septic tanks. It is easy to admit that with the individual septic tanks the cost of final disposal will be lessened, that the sewers may more easily be kept clean, that the grades may be safely made a little less and that the cost of construction and maintenance of the sewer lines proper may thus be lessened to a slight extent. But over against these advantages are set the cost of constructing the individual tanks, which, it would appear, would greatly overbalance the advantages gained by this individual system, and, in addition, the cost of inspecting and cleaning the separate tanks. Furthermore, serious objection must be raised against the location of a septic tank in every yard. It seems that it would be cheaper to put in an ordinary system of sanitary sewers, with the necessary flush tanks, etc., and at the outlet provide works to care for the sewage, according to the system best suited to the locality. It is commonly believed that one large plant can be operated and maintained for a much less sum than would be necessary to care for a large number of isolated tanks. It certainly could be operated with much less friction than would be encountered in compelling individual owners to properly construct and maintain separate plants.

If septic treatment alone will sufficiently purify the sewage, then the large municipal disposal works will require practically no attention—at the most, much less than it will be necessary to bestow upon the separate tanks. If further treatment than that given by the tank must be provided, a municipal plant will be required anyway and the septic treatment could be much better given at the outfall. Leaving out all considerations of convenience and finance, this system of individual septic tanks must be unsatisfactory from a sanitary standpoint. It is possible to construct water tight tanks of brick and concrete, but it is difficult and requires considerable care. That this care will be used in the construction of every tank is extremely doubtful, and so there will ensue the use of leaky tanks in a good many cases, with the resulting pollution of the subsoil, a very undesirable condition. With improved methods these cesspools or tanks can be cleaned out without producing any great nuisance, but it is a nasty job and one which it would be well to avoid, especially in the more closely built up sections where the tanks can not be advantageously located. With the large number of septic tanks proposed, it is extremely probable that some will not work properly, with the result that an offensive effluent will be produced which may so foul the combined effluents as to make the work of the other tanks of no avail. Conditions may be such at Zion City that this method is the proper one, but it is hard to imagine just what they are.

Bowling Green, Ohio, has adopted the scheme of placing catch basins in the house connections to the sewer system, for the purpose of keeping out the solid matter and thus putting off the day when it will be necessary to provide a sewage disposal plant; but it is understood that this scheme is only a temporary expedient to be followed until the demand for connections shall have reached such a point that it will be easy to secure the money necessary for disposal. The requiring of these separate catch basins is a tax on sewer connections and tends to keep down the number. This is undesirable, also, as it usually is difficult enough in the smaller places to compel connections to be made, without placing any special obstacle in the way.

Yours truly,

BENJ. H. FLYNN.

Columbus, O., October 17.

Concrete Blocks in the Buffalo Breakwater.

Sir:—I notice on page 578 of your issue of June 21, 1902, this paragraph at the end of the editorial on "An Interesting Concrete Structure:"

"It is apparently the opinion of Major Symons that one advantage arising from the fabrication of the (concrete) blocks was the avoidance of the depositing of concrete *en masse* under water. Inasmuch as the top of the cribwork substructure was but little below mean water level, the method of first making the concrete blocks and then putting them in place undoubtedly had substantial advantages. If any one thing has been established, however, by prolonged experience during the past eight or ten years, it is that under proper conditions the best of good results may be obtained from a proper deposition of concrete *en masse* under water."

The conditions of construction at the Buffalo breakwater are evidently not well understood by the writer of the article referred to. In all engineering structures the matter of appearance and finish must be kept in mind. A slovenly piece of work reflects no credit on the engineer having it in charge. The use of the concrete blocks in the Buffalo breakwater gives character and finish to the structure, and facilitates greatly the operations subsequent to their placing. It fell to the lot of the writer of this letter to build the first section of concrete superstructure on this breakwater. The depth of water on the substructure being only a couple of feet and the toe of the concrete having to rest on wood caused all the trouble which made necessary the use of concrete blocks. The concrete toe was exposed to the constant rise and fall of little waves from the surface of the lake. The material could not be put in so fast as to prevent these little waves from washing out all the mortar from the broken stone and gravel. The result was that during the first season's work many holes were formed under the parapet. Some of these holes were more than a foot high and extended back under the wall four or five feet. As I remember the work done during that first season, I doubt whether a length of three consecutive feet can be found in which the toe of the face of the parapet has not been more or less injured in the way mentioned. Every possible care was taken to protect this angle. The joint between the sheeting and the top timber of the crib was calked; and then the two faces were lined with felt. The concrete was placed most carefully and with the least possible disturbance, but the relentless plashing of those little waves went on incessantly and finally triumphed over all the ingenuity of those who tried to vanquish it.

The holes mentioned above had to be filled as best they could. The most successful method accomplishing the work was to pack them full of small bags filled with concrete, the outside of the bags being thickly smeared with quick-setting cement mortar. The result was effective but unsightly. A cut-stone masonry face was tried, but it was found to be prohibitive in cost. Then the concrete blocks were authorized. They had a double advantage: first, they preserved the face of the work; second, they formed a small breakwater behind which the concrete work could be carried on during many days when a little roughness of the lake would otherwise have put a stop to operations.

Two points must be considered in criticising such admirable work as that of Major Symons: concrete will not bond with wood; and a clean edge cannot be put on concrete in a sea way.

Yours truly,

F. A. MAHAN,

Major of Engineers, (Retired).

Paris, September 24.

The New East River Bridge Cables.

With the approaching completion of the main cables six of the seven principal divisions of work on the great East River bridge will have been nearly or quite finished. The building of the caisson piers, of the main towers, of the anchorages, of the four shore spans, of the approaches and of the cables leaves only the roadways and trusses to be suspended between the main towers. The designs for this work have been so carefully elaborated and the contracts so long made that with all the preparations complete for its execution it should soon be possible to predict with confidence the time when the bridge will be ready for use, barring only the direct and indirect delays from labor troubles, which apparently may arise in spite of every precaution.

The four main cables, which are the largest in the world and have been built at the most rapid rate, are practically completed and adjusted and are now receiving the final covering, which, although not an element of their functions in the bridge, is expected to thoroughly protect and preserve them for many years. Each of the four main cables is about 18 inches in diameter, 3,000 feet long and weighs 2,500,000 pounds. It is composed of 10,397 straight steel wires and has an ultimate strength of about 50,000,000 pounds. The wires, about 3/16-inch in diameter, were received in 4,000-foot lengths and their ends were spliced with sleeve nuts to make them continuous throughout each of the 37 strands. They were pulled across the river in double lengths and looped over the end pins like yarn in a skein. After adjustment for length, position and stress they were solidly compacted into a cylinder, bound and covered with a mixture of oil and graphite. They are to be covered with a water-tight cylindrical steel shell, but it has just been decided to interpose a special waterproof covering inside the shell, and a $50,000.00 contract for this has been awarded to the John A. Roebling's Sons' Company, who have built the cables. Waterproofed duck will be cut in strips 7 inches wide and wrapped spirally around each cable from end to end. A second and a third wrapping will follow and then the steel shells will be put on and the cables will be ready to receive the suspended structure.

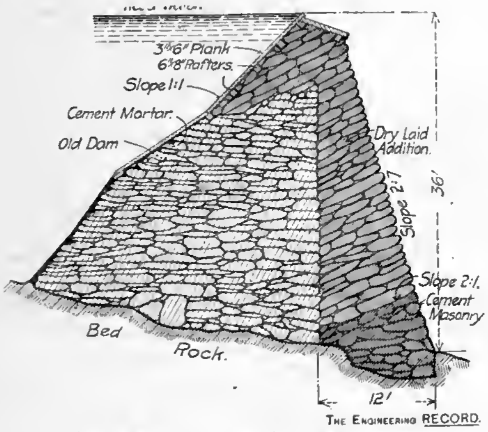
The Mileage of Electric Railways in the United States is now between 24,000 and 25,000 miles, according to a statement made by President Vreeland at the recent convention of the American Street Railway Association. The total capital invested is nearly $2,000,000,000. Eleven years ago there were only 1,800 miles of such railways representing an investment of about $75,000,000.

Reconstruction of a Stone Dam at Roswell, Ga.

The stone dam at Roswell, Ga., a section of which as finally reconstructed is shown in the accompanying cut, was first built some fifteen years before the civil war, and was then used in connection with a regular over-shot water wheel. It was built of dry laid stone, the water face being laid a few inches deep in either a cheap form of Rosendale cement or a very good quality of lime mortar. The old stonework was largely of a flat, stratified formation and was laid in horizontal courses. It is stated that in the body of the dam the stone was very poor, being little better than shale.

About ten years ago the old dam was overhauled and patched. The water slope at the spillway was coated with cement mortar, in which a plank face was laid. This dam had a sheer drop at the spillway of slightly over 27 feet and a depth of spillway of about 5 feet. The length of the spillway was the same as at present, 138 feet. The greatest thickness of the old dam at its base was roughly 30 feet.

As finally reconstructed under the direction of Messrs. Collier & Brown, consulting engineers, Atlanta, a dry rubble addition was placed on the downstream face of the dam, resting on a solid masonry foundation laid on bed rock. The mortar used on the work was composed of one part Atlas cement to three



Section through Spillway.

parts sand. The masonry foundation course was laid with its upper surface sloping toward the center of the dam in the ratio of two horizontal to one vertical, and the new dry laid stonework was placed upon this in irregular parallel courses. The crest of the dam was raised above its former level about 6 feet, and a face of 3x6-inch yellow pine planking was put on the water face and joined to what remained of the old timber face by a watertight joint. The length of the spillway is 138 feet and its depth 5 feet. The total length of the dam is 251 feet. Two head-gates of oak timber, 2 feet 8 inches by 6 feet in size are provided, and two sluice gates about 3 feet square can be used to draw off the pond.

Time was the most important consideration in the reconstruction of this dam. It was necessary to shut down the mill of the Roswell Manufacturing Company, which utilized the power developed, on account of repairs and replacements in the plant, and the company did not wish the work on the dam to cause any further delay. In order to keep the work moving at its fastest rate, six quarries were opened along the shores in the vicinity of the dam. Of these, five were in continuous operation. Two fed to the dam by means of an overhead cable conveyor stretched across the dam site from bluff to bluff, a distance of 500 feet. Three others were connected to the dam by tram lines, and from one the stone was floated down the stream in scows.

The work on the downstream face of the dam was carried on with the dam full, the water level being kept below the spillway by means of the sluice gates. The work on the crest of the dam and on the gates was carried on while the mill was shut down for its own repairs and the pond drained, thus causing no delay in the operation of the mill. The contractors for the work were Sullivan Brothers, and Lewis White, of Roswell.

As the dam at Roswell withstood the floods of last winter, which destroyed the dams at Columbus, Ga., Anderson, S. C., and elsewhere, it is to be assumed that the design is of sufficient strength to withstand the greatest flood likely to occur in that region. The foregoing notes have been prepared from information and drawings furnished by Messrs. Collier & Brown.

Personal and Obituary Notes.

Mr. Robert Maxson Greene, Assoc. M. Am. Soc. C. E., has been added to the force of the Director of Works of the Louisiana Purchase Exposition for structural engineering work.

Messrs. Robert Stockton and Frank Moses, assistant to the president and chief engineer, respectively, of the South Jersey Gas, Electric & Traction Co., at Camden, N. J., have resigned.

Lieuts. William Kelly, John R. Slattery and Paul S. Bond, Corps of Engineers, U. S. A., have been ordered to the Washington barracks for duty with the Third Battalion of Engineers.

Mr. H. S. Burroughs has withdrawn from the firm of Ballantyne & Evans and has opened an office at 27 William Street, New York, for the practice of electrical and mechanical engineering.

Mr. Reed R. Lewis has left the field of general consulting practice to accept the position as superintendent of The Century Architectural & Engineering Co., Real Estate Trust Building, Pittsburg.

Mr. Rudolph Hering has been engaged by the Board of Health of Bridgeport, Conn., to determine the condition of the city's reservoirs and advise regarding the establishment of a filter plant.

Mr. Emil Kuichling has been engaged by the Street and Water Board of Jersey City in connection with proceedings that are to be instituted to compel the Jersey City Water Supply Co. to build a dyke at the Boonton reservoir, according to the board's own plans.

Mr. N. A. Christensen has resigned as general superintendent of the Christensen Engineering Co., of Milwaukee, to manufacture air compressors for all purposes except air brakes, this work being still continued by the company, of which he will remain consulting engineer.

Messrs. G. H. Benzenberg, M. Am. Soc. C. E., of Milwaukee, Allen Hazen, M. Am. Soc. C. E., of New York, and William G. Clark, Jun. Am. Soc. C. E., of Toledo, have been employed by the water-works board of Toledo, O., in connection with the selection of a water supply for that city.

Mr. Albert S. Crane, M. Am. Soc. C. E., has resigned as chief engineer of The Lake Superior Power Co., Sault Ste. Marie, Ont., to take charge of the water-power development of the Chicago drainage canal at Lockport and Joliet, becoming one of the assistant chief engineers of the Chicago Sanitary District.

Col. Allan C. Bakewell, who was recently elected president of the Sprague Electric Co., has long been identified with the electrical industry. He was vice-president and general manager of the old Interior Conduit & Insulation Co., which was absorbed by the Sprague Electric Co., some years ago, and previous to his present office, was for three years second vice-president and general manager of the Sprague Company. Mr. D. Clarence Durland, for the past three years assistant general manager of the company, has been elected its second vice-president.

The following candidates for membership in the American Society of Civil Engineers were announced elected October 15. Associate, Merrill Watson, New York City. Juniors: E. M. Adams, Washington, D. C.; A. F. Armstrong, Ogdensburg, N. Y.; H. J. M. Baker, Port Townsend, Wash.; H. E. Boardman, New York City; O. C. Edwards, Jr., Steubenville, O.; J. W. DuB. Gould, Yonkers, N. Y.; L. T. Haney, St. Elmo, Va.; E. C. Heald, Phœnixville, Pa.; S. B. Hill, Ithaca, N. Y.; A. R. Holliday, New Castle, Pa.; S. C. Hulse, Ithaca, N. Y.; R. C. Kimball, Evart, Mich.; Kieffer Lindsey, Columbus, Ga.; H. P. McDonald, Jr., Jersey City, N. J.; J. H. Madden, New York City; D. H. Ray, New York City; R. H. Sabin, Sherman, Tex.; C. H. Snyder, Johnstown, Pa.; W. P. Taylor, Philadelphia, Pa.

George H. Mendell, M. Am. Soc. C. E., Col., Corps of Engineers, U. S. A., retired, and president of the Board of Public Works of San Francisco, died October 19. He was graduated from the Military Academy at West Point in the class of 1852, as a second lieutenant of the topographical engineers, and remained in the service throughout the Civil War, becoming finally colonel, Corps of Engineers, in 1886. For gallant and meritorious services, particularly at the siege of Petersburg, Va., and in the defenses of Baltimore, he was breveted colonel in 1865. Most of his work for the engineers' corps, both before and after the war, has been in California, with the exception of about five and one-half years as assistant professor in the Military Academy; and since 1876 he has in his civil capacity been identified from time to time with considerable municipal work of San Francisco. From 1878 to 1880 he was consulting engineer of the State of California.

The Intramural Railway at the Louisiana Purchase Exposition will be a third-rail road 9 2/3 miles long, traversing the grounds in three loops. The elevated portions will be wooden viaducts.

A 750-Horse-Power Steam Turbine, to be made by the General Electric Company, is said to have been ordered by the Massachusetts Electric Companies for their station at Newport, R. I.

Timber Dams generally have an indefinite life, but Mr. J. M. G. Watt, M. Am. Soc. C. E., has recently pointed out that it is just the few exceptions that cause great trouble; he has been compelled to tear out thousands of feet of good timber in order to get down to the rotting sticks threatening a structure's stability. Hence a concrete dam is preferable. Where timber must be used, it is sometimes advisable to build several courses in shallow water near the shore and float them into position; he has followed this plan with cribs 250 feet long, 50 feet wide and 8 to 10 feet high. He has found 10x10-inch sticks the most economical, and builds his pens on 10-foot centers. Butt joints are used everywhere. The sheathing on the upstream face is a layer of 3-inch plank covered by one of 2-inch plank, breaking joints; if placed carefully close together they do not need calking. The top layer is in two courses, the upper section being short so that when it is replaced it is unnecessary to draw the pool down more than 12 to 15 inches.

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OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvii, xviii and xxvii.

WATER.

Bridgeport, Conn.—The Bd. of Health has engaged Rudolph Hering, of New York City, to examine the condition of the reservoirs from which the city water is obtained and advise as to the best course for the city to pursue concerning a filtering plant.

Newport, R. I.—See "Government Work."

Paulsboro, N. J.—Consulting Engr. I. S. Cassin, Jr., 2906 Girard Ave., Philadelphia, writes that the following contracts were awarded for water works supplies, machinery, etc. (bids opened Oct. 11), successful bidders all of Philadelphia: R. D. Wood & Co., 330 tons 8-in., 6 in. and 4-in. pipe at $32, specials, 3 cts. per lb. $11,160; also valves and valve-boxes, $322.75; J. Thompson & Co., fire hydrants, $938.90; W. H. Boardman, pipe laying, $3,100; A. H. Haig, standpipe, etc., $4,900; Otto Gas Engine Wks., pumping machinery and plant, $2,440.

Fishkill, N. Y.—E. H. Sheaff, Supt. Fishkill & Matteawan Water Co., writes that it is proposed to lay 4,100 ft. 6-in. and 1,200 ft. of 4-in. water mains; also an additional supply has been ordered by the directors Wm. S. Bacot, Engr. in Charge.

Bradford, Pa.—Bids are wanted by the Water Comrs. until Oct. 27 for furnishing 2,000 ft. of 8-in. and 150 ft. 4-in. C. I. pipe, 6,000 lbs. specials, 6 2-nozzle hydrants and necessary fittings and valves; also for trenching and laying pipe. A. F. Bannon, Jr., City Engr.

Tarrytown, N. Y.—J. W. Ledoux, Ch. Engr. of the American Pipe Mfg. Co., Philadelphia, Pa., writes that said Co. on Oct. 22 awarded the contract for the Pocantico River pumping station, to be erected 3 miles north of Tarrytown, to Moffatt, Hewitt & Norris, 12 E. 23d St., New York City.

Pittsburg, Pa.—Wm. Glyde Wilkins, Engr. and Architect of Pittsburg, is reported to have awarded contracts to H. F. Stark, of Greensburg, for 2 reservoirs, one to be built for the Southwest Water Co., between Connellsville and Uniontown, with 6,000,000 gal. capacity, the other to be built at Hecla for the Hecla Coke Co., 9,000,000 gal. capacity. Total cost about $60,000.

Tonawanda, N. Y.—The lowest bid received by the Village Bd. for a pumping engine to be installed in the Tonawanda water works station on Goose Island is stated to have been from the Holly Mfg. Co., of Lockport, at $26,000 for an engine of 8,000,000 gal. capacity, or $21,000 for an engine of 6,000,000 gal. capacity.

Jamestown, N. J.—By a vote of the people of this city bonds will be issued on Jan. 1 for $600,000 to buy the plant of the Jamesotwn Water Supply Co.

Waynesboro, Pa.—The Waynesboro Water Co. is reported to have voted to issue bonds to the amount of $75,000.

Brooklyn, N. Y.—Comr. Monroe, of the Dept. of Water Supply, Gas & Electricity, has asked for an appropriation of $25,000 for the purchase of meters for the Boroughs of Brooklyn, Queens and Richmond.

Lyons, N. Y.—The Bd. of Aldermen is considering the question of municipal ownership of the water works.

Watertown, N. Y.—City Engr. C. O. McComb and Frank A. Hinds, Engr. of the Water Comrs., are reported to be making surveys to determine the feasibility of obtaining a water supply for Watertown from Crystal Lake.

New Hope, Pa.—G. C. Gohanear, of Carlisle, is said to be desirous of establishing a water plant for this town.

Wilmington, N. C.—A charter has been granted by the State to the Cape Fear Rice Co., which will operate a rice mill at Wilmington. Capital stock, $200,000. Stockholders: H. Burton Anderson, John H. Gore and Jas. W. Sneeden.

Columbus, Ga.—The Columbus Water Works Co. has made an offer to improve its plant at an estimated cost of $100,000 provided the city will withdraw the proposition to issue bonds for the construction of a municipal plant or the proposed issue of said bonds be defeated at the Dec. election.

Tabor, Ia.—Town Clk. A. A. Falling writes that on Oct. 14 it was voted to construct water works at a cost of $6,500.

Bennett, Ia.—The Town Clk. writes that a vote has been taken in favor of constructing a system of water works.

Toledo, O.—The Water Works Bd. has approved a resolution to construct a second water main across the river to the East Side, said main being a continuation of the 30-in. Erie St. main. Estimated cost, $20,000.

Bucyrus, O.—The City Council has voted to extend the water mains on Clark and W. Warren Sts.

Forest, O.—City Clk. Harry E. Moore writes that an ordinance has been passed providing for the construction of water works and an electric light plant, to cost $25,000.

Fremont, O.—Bids will be opened Nov. 7 by the Water Works Trus. for the installation of an air lift plant at the local pumping station to pump several wells.

Sullivan, Ill.—Bids are wanted Nov. 3 for the erection of a brick building at the city water works for the boiler and machinery of water works. D. G. Lindsay, City Clk.

Mallard, Ia.—Press reports state that this city is to build a new system of water works.

Columbus, O.—Bids are wanted Oct. 28 for the construction of a 2-span steel truss aqueduct, timber trunk, having a total length of 106 ft., to be built one mile south of St. Mary's, on the Miami and Erie Canal, crossing St. Mary's River. Chas. E. Perkins, Ch. Engr. of Pub. Wks.

Oelwein, Ia.—Press reports state that the City Council has decided to purchase a new pump of 1,000,000 gal. capacity.

Lansing, Ia.—Geo. C. Morgan, of Chicago, Ill., is reported to have prepared plans for a reservoir, pumping station, etc.

Worthington, O.—The City Council is considering the matter of constructing water, sewerage and light plants.

Ottawa, O.—Press reports state that a vote has been taken in favor of the construction of water works and a sewerage system.

Newark, O.—The City Council has passed an ordinance authorizing the issue of $300,000 bonds for the construction of a new water works system.

Youngstown, O.—The Water Works Trus. have submitted a proposition to Council for the expenditure of $250,000 for a filtration plant.

Scranton, Miss.—This city has voted to sell its water works and electric light system to Dr. L. S. Anderson, of Moss Point, Miss.

Mena, Ark.—City Engr. S. B. Robertson writes that municipal water works are to be built at a cost of $25,000. Time for receiving bids not yet fixed. J. H. Hamilton, Chmn. Bd. Water Comrs.

Purcell, Ind. Ter.—D. Carter, Pres. of the Purcell Water Co., writes that a system of water works will be constructed at a cost of $45,000. Bids not yet called for.

So. McAlester, Ind. Ter.—City Clk. Gus. A. Gill writes that on Oct. 18 it was voted to issue $150,000 bonds for the construction of water works and sewerage.

Louisville, Ky.—Bids are wanted by the Louisville Water Co. until Dec. 20 for 30,000,000-gal. and 24,000,000 gal. pumping engines, as advertised in The Engineering Record.

Birmingham, Ala.—The Birmingham Water Works Co. has signed the agreement with the city to establish a filtration plant at North Birmingham within 12 months, and one on Shades Mountain for the Cahaba supply, to be completed within 18 months.

The Hawkins Spring Water was recently incorporated, with a capital of $150,000, for the purpose of operating water works in Jefferson County and elsewhere. Morris Adler, Pres.; S. E. Thompson, Vice-Pres., and S. M. Adler, Secy.

Guthrie, O. T.—W. T. Roberts, of Austin, Tex., is one of the incorporators of the Otter Creek Irrigation Co., which was recently organized under the laws of Oklahoma, with a capital stock of $1,000,000, for the purpose of constructing an irrigation system in the southwestern part of Oklahoma, bordering on Tex. M. M. Hankins, of Quanah, Tex., is also interested.

Redding, Cal.—J. B. Devereux, of Denver, is reported to have purchased water rights along Brandy Creek with a view to supplying this city with water.

Basin, Wyo.—The Bluff Canal Co., which will operate at Basin, has been incorporated, with a capital of $25,000.

Cody, Wyo.—Press reports state that the Cody canal is to be extended 15 miles for the purpose of reclaiming 12,000 acres of land.

La Junta, Colo.—Bids are wanted Nov. 1 by the Otero Irrigation Dist. for excavating about 350,000 cu. yds. of earth and rock along the line of Otero Canal, and for constructing a timber dam across Arkansas River. M. F. Miller, Secy. F. T. Lewis, of La Junta, Ch. Engr.

The La Junta Irrigation Co. has been incorporated, with a capital of $5,000, by Clyde Turnbull, Bert Harris and G. R. Markey, Arapahoe, Neb.

Wilbur, Wash.—Press reports state that a water system is to be constructed.

Edgemont, S. D.—This town is to have a system of water works for fire protection and domestic use.

Arlington, S. D.—The citizens are said to have voted bonds for the sinking of an artesian well.

Sterling, Colo.—Town Clk. C. L. Goodwin writes that on Oct. 11 it was voted to issue $63,000 bonds for the construction of a gravity water works system.

Ordway, Colo.—Town Clk. and Recorder Wm. Edgar writes that on Oct. 10 it was voted to construct water works.

Central City, Colo.—City Clk. and Treas. M. K. Sullivan writes that the city proposes to construct a reservoir at a cost of $30,000. Contract for excavating already let at 75 cts. per cu. yd Contract for walls and cement work will be let as soon as weather permits in the spring. Geo. W. Schneider, Engr. in Charge.

Phoenix, Ariz.—The water storage conference committee of representatives of the various irrigation interests in this valley have adopted the report of the Executive Committee charged with the work of outlining a plan for harmonizing all interests in order that the Government may proceed with the building of a storage reservoir at Tonto Basin site. The plan provides for a merger corporation known as the Water Users' Asso., to deal directly with the Government, guaranteeing payment for the dam in 10 years and the proper distribution of water. Estimated cost of dam, $2,500,000, according to local press reports.

Columbia City, Wash.—Municipal Water Works bonds to the amount of $5,000 have been sold.

Montreal, Que.—The Finance Com. has decided to purchase 3 new boilers for the low level pumping station. Estimated cost, $15,000.

SEWERAGE AND SEWAGE DISPOSAL.

Bristol, R. I.—The Council has authorized the expenditure of $7,000 for sewer work.

Worcester, Mass.—The Com. on Sewers of the City Council has voted to build a sewer in Hollywood St.

Boston, Mass.—The following bids were opened Oct. 1 by the Metropolitan Water and Sewerage Bd. for Ward St. pumping station, Section 77, high-level sewer, Roxbury; bidders all of Boston.

Bidder.	Foundations and Connections. Excav., 20,000 cu. yds.	Con. Mas., Amer., 100 cu. yds.	Boulder Cement Con. Mas., Amer., 500 cu. yds.	Con. Mas., Port., 7,000 cu. yds.	Rolled Beams & Ransome Twisted Steel, 70,000 lbs.	Found. & Connec. Br. Mas., Port. 700 cu. yds.	Cut Gran. Stone, 150 cu. yds.	Superstructure complete.	Totals.
Connery & Wentworth......	$1.35	$5.50	$3.80	$6.95	$0.03¾	$22.00	$61.00	$149,187	$254,462
McNeil Brothers	1.35	6.30	7.35	8.40	0.04	18.00	55.00	164,509	278,264
The Norcross Bros. Co......	1.47	5.70	4.00	9.48	0.03 9	18.16	68.90	157,200	281,307
L. P. Soule & Son...........	.74	5.70	5.20	7.38	0.04 2	14.00	61.90	132,850	224,505
Whidden & Co..............	1.00	6.00	6.00	7.50	0.04⅛	17.00	60.00	135,832	235,719
L. D. Willcutt & Son........	.95	5.40	4.40	6.60	0.04	12.00	64.00	156,000	244,740

Big Valley, Tex.—The Big Valley Canal & Irrigation Co. has been incorporated, with a capital stock of $5,000, by J. L. Ratekin, W. H. Oglesby, C. Ballard and others.

Lancaster, Tex.—The Attorney General, Austin, Tex., has approved an issue of $10,000 city of Lancaster water works bonds.

Victoria, Tex.—The Council has under consideration the installation of a filter at the water works. Estimated cost, $8,000.

Waco, Tex.—The Colorado Power & Mfg. Co. of Waco, has been incorporated, with a capital of $12,000, to construct and maintain dams, lakes, reservoirs, canals, etc., for irrigation and milling purposes. Incorporators: N. N. Seley, R. H. Chatham and others.

Vicksburg, Miss.—Local press reports state that the city is desirous of purchasing the water works plant and constructing a system of sewerage.

Gonzales, Tex.—A vote is to be taken on the proposition to issue $32,000 bonds for the establishment of a municipal water plant.

Kansas City, Mo.—The Bd. of Pub. Wks. has approved ordinances calling for appropriations of $9,000 for improvements at Turkey Creek pumping station, and $6,000 for repair of pipes around the station.

Enid, Okla. Ter.—The proposition to issue $15,000 bonds to extend the water mains and $25,000 to build a sewer system is reported to have carried.

Golden, Colo.—The contract for constructing a gravity water works system from Beaver Brook to Golden is stated to have been awarded to M. B. McDonald, of Denver, for $95,000.

Bridgeport, Neb.—The Beerline Irrigation Co., with headquarters at Bridgeport, has filed articles of incorporation. Capital, $10,400. Incorporators: Geo. W. Beerline, John Beerline, Edgar D. Smith and others.

Canajoharie, N. Y.—Village Clk. J. C. Melick writes that on Oct. 16 it was voted to construct a sewerage system at a cost of $36,000.

Washington, D. C.—Bids are wanted Nov. 15 for constructing a portion of the Low Area Trunk sewer, as advertised in The Engineering Record.

Buffalo, N. Y.—Bids are wanted Oct. 31 for the construction of 10, 12 and 15-in. tile sewers in several streets; also for the construction of 48 to 27-in. brick sewer in Mumford Ave. Francis G. Ward, Comr. Dept. of Pub. Works.

Brackenridge, Pa.—City Engr. E. E. Maurhoff, of Tarentum, writes that the contract for sewer construction (bids opened Oct. 20) has been awarded to Hastings & Walsh, of Charleroi, Pa., as follows: Concrete, $5; manholes, $45, complete; receiving basin, $60; lumber per M., $22; 2-ring brick sewer laid in cement with terra cotta invert, 3,488 ft. 4 ft.x5 ft., at $5.40 per lin. ft.; terra cotta pipe for connections, 36-in. at $4, 24-in. $1.50, 18-in. $1.20, 15-in. $1, 12-in. 80 cts., 10-in. 65 cts., and 8-in. 50 cts.; total, $19,757. Other bids received were as follows, the prices per lin. ft. for brick sewer and the totals being given respectively: Luster Construction Co., Tarentum, $7.33, $34,905; J. H. McQuade, Pittsburg, $5.70, $20,998; Keeling & Ridge, Pittsburg, $7.75, $28,084; J. B. Sheets & Co., Pittsburg, $6.28, $23,007; Ott Bros., Pittsburg, $5.65, $20,733; Thos. Sweeney & Co., Pittsburg, $6.75, $24,596.

Butler, Pa.—The Council has passed an ordinance providing for the construction of a sewer in Mercer St.

Oneida, N. Y.—City Engr. W. R. Vedder writes that bids are wanted Nov. 11 for the construction of a trunk sewer, 8-in. to 20-in. vitrified pipe to be used. Estimated cost, $25,000.

McKeesport, Pa.—The Common Council has passed ordinances for sewers in Acheson and Powderly Sts. and Crooked Run.

Massena, N. Y.—Village Clk. J. W. Webb writes that at the recent election it was voted to construct sewers; bids for same will soon be received; work to be started early in the spring. Cost, $20,000 to $40,000.

Yonkers, N. Y.—The contract for constructing a sewer in McLean Ave. and S. B'way has been awarded to Molloy & Murray for $11,500.

Comr. Cooper has reported to the Common Council, placing his preliminary approximate estimate of the cost of constructing a drainage tunnel, 7 ft. in diameter, to provide sewage facilities for the upper portion of Saw Mill River Valley, including an outfall into the Hudson River, at $122,950.

Jamesburg, N. J.—Bids are wanted Nov. 5 for constructing sewers at the State Home for Boys. Edw. Spaeth, Pres. Bd. of Trus., 742 Broad St., Newark, N. J.

Jersey City, N. J.—The Street & Water Bd. has confirmed specifications for the proposed sewer in Harrison Ave. The city will pay $5,635, which is 4/5 of the total cost of said improvement.

Waukegan Ill.—Mayor F. Finer writes that the following bids were opened Oct. 10 for the construction of a system of sanitary sewers, the work, which calls for sewers in numerous streets, includes *a*, 31,173 ft. of 18-in. to 6-in. vit. pipe sewers, from 15.4 ft. in depth to 4 ft. in depth; *b*, 168 manholes; *c*, bulkhead and outlet with 200 ft. of cast iron pipe, 12-in. in diameter; *d*, 20 combined flush tanks; *e*, lumber left in place per M; total: Jas. Cape & Sons, Racine, Wis., *a*, $2.80 to 40 cts.; *b*, $10 each; *c*, $800; *d*, $40 each; *e*, $50 per M; *f*, $23,314. Reichert Const. Co., Racine: *a*, $2 to 35 cts.; *b*, $30 each; *c*, $150; *d*, $70 each; *f*, $25,230. John W. Barker, Melrose Park, Ill.: *a*, $1.29 to 32 cts.; *b*, $32 each; *c*, $2,603; *d*, $125 each; *e*, $25 per M; *f*, $27,073; Chas. T. Bartlet, Evanston, Ill.: *a*, $1.30 to 39 cts.; *b*, $20 each; *c*, $600; *d*, $40 each; *e*, $24 per M; *f*, $26,990. W. H. Harris, Terre Haute, Ind.: *a*, $1.50 to 45 cts.; *b*, $37.50 each; *c*, $1,000; *d*, $75 each; *e*, $25 per M; *f*, $27,684.

Toledo, O.—Bids are wanted Nov. 3 for the construction of a 10 and 12-in. pipe sewer in alley west of Hoag St., also for a 10-in. pipe sewer in alley between E. B'way and Essex St. Chas. H. Nauts, City Clk.

Millburn, N. J.—The following bids were opened Oct. 20 for building a sewerage system. Alexander Potter, New York City, Ch. Engr.

Items and Quantities.	Jas. Conway, Newark. (awarded).	United Bldg. Const. Co., Passaic.	Higginson & Shannon, Jersey City.	Harrison Const. Co., Newark
Pipe, 12 in., 0—6 ft., 435 ft.	$0.80	$0.70	$0.92	$0.90
Pipe, 12 in., 6—8 ft., 2,930 ft.	.80	.81	1.04	1.10
Pipe, 12 in., 8—10 ft., 1,140 ft.	.90	1.10	1.28	1.30
Pipe, 12 in., 10—12 ft., 280 ft.	.90	1.30	1.47	1.60
Pipe, 12 in., 12—14 ft., 160 ft.	1.00	1.32	2.10	1.80
Pipe, 12 in., 14—16 ft., 420 ft.	1.10	1.57	2.34	2.00
Pipe, 12 in., 16—18 ft., 200 ft.	1.50	1.87	2.60	2.50
Pipe, 10 in., 0—6 ft., 600 ft.	.70	58	.80	.65
Pipe, 10 in., 6—8 ft., 1,335 ft.	.75	.71	.94	.80
Pipe, 10 in., 8—10 ft., 380 ft.	.80	.87	1.18	1.00
Pipe, 8 in., 0—6 ft., 5,985 ft.	.49	.45	.62	.60
Pipe, 8 in., 6—8 ft., 33,115 ft.	.49	.52	.75	.75
Pipe, 8 in., 8—10 ft., 7,895 ft.	.55	.74	1.00	.85
Pipe, 8 in., 10—12 ft., 2,390 ft.	.60	.93	1.20	1.00
Pipe, 8 in., 12—14 ft., 1,515 ft.	.70	1.05	1.85	1.50
Pipe, 8 in., 14—16 ft., 175 ft.	.80	1.28	2.09	2.00
Manholes, under 10 ft. deep, 179	35.00	40.00	35.00	40.00
Manholes, over 10 ft. deep, 48 ft	3.00	5.00	5.00	4.00
Flush tanks, 26	60.00	60.00	75.00	100.00
Branches 8 in., 1,000	.40	1.12	.75	.50
Branches, 10 in., 100	.60	1.67	1.10	1.00
Branches, 12 in., 50	75	2.22	1.40	1.50
Sheeting, 50 M. ft.	10.00	30.00	30.00	35.00
Timber, 10 M. ft.	30.00	30.00	30.00	40.00
Tile drain, 6 in., 2,000 ft.	.30	.15	.25	.50
Tar joints, 8 in., 600	.10	.05	.48	.15
Tar joints, 10 in., 200	.15	.06	.49	.20
Tar joints, 12 in., 200	.20	.07	.50	.25
Rock, 1,000 cu. yds.	2.00	1.80	1.00	3.00
Totals	$44,749	$51,284	$64,990	$66,118

Newark, N. J.—The following bids were opened Oct. 16 for building Section 6 of the Millburn-Summit Division of the Joint Outlet sewer for Newark and other municipalities in N. J. Alexander Potter, of New York City, Ch. Engr.

Items and Quantities.	Harrison Const. Co., Newark (awarded).	Robt. J. Emmer, Hoboken.	J. J. Hart Co., New York City.	T. J. Shea, Quincy, Ill.	Higginson & Shannon, Jersey City.	J. F. Shanley, Newark.	Bruno, Salamone & Petitti, E. Boston, Mass.	Jas. Conway, Newark.
30 in. brick, 2 ring, 0—6 ft., 1,410 ft.	$3.40	$4.05	$3.75	$3.00	$3.60	$4.25	$4.15	$4.75
30 in. brick, 2 ring, 6—10 ft., 3,534 ft.	3.90	4.30	4.20	3.75	4.15	5.00	4.95	5.50
30 in. brick, 2 ring, 10—14 ft., 680 ft.	4.65	4.75	4.70	4.25	5.00	5.50	5.65	5.75
30 in. brick, 2 ring, 14—18 ft., 140 ft.	5.50	5.15	5.20	5.00	6.00	6.00	6.30	6.00
24 in. vit. pipe, under 6 ft., 1,190 ft.	1.95	2.05	1.95	2.50	2.50	2.50	2.25	2.50
24 in. vit. pipe, 6—10 ft., 4,857 ft.	2.30	2.20	2.30	3.00	3.00	2.75	2.75	3.00
24 in. vit. pipe, 10—14 ft., 2,055 ft.	2.75	2.40	2.95	3.50	3.50	3.00	3.35	3.25
24 in. vit. pipe, 14—18 ft., 555 ft.	3.25	2.70	3.36	4.00	4.00	3.50	3.85	3.50
Or alternately—								
30 in. brick, 2 ring, under 6 ft., 1,710 ft.	3.40	4.05	3.75	3.00	4.00	4.50	4.15	4.75
30 in. brick, 2 ring, 6—10 ft., 320 ft.	3.90	4.30	4.20	3.75	5.00	5.00	4.95	5.50
24 in. vit. pipe, 0—6 ft., 1,410 ft.	1.95	2.05	1.95	2.50	3.00	2.50	2.25	2.50
24 in. vit. pipe, 6—10 ft., 1,824 ft.	2.30	2.20	2.30	3.00	3.50	2.75	2.75	3.00
24 in. vit. pipe, 10—14 ft., 360 ft.	2.75	2.40	2.95	3.50	4.00	3.00	3.35	3.25
24 in. vit. pipe, 14—18 ft., 140 ft.	3.25	2.70	3.36	4.00	4.00	3.50	3.85	3.50
22 in. vit. pipe, 0—6 ft., 1,190 ft.	1.85	1.87	1.74	2.00	2.00	2.50	1.95	2.50
22 in. vit. pipe, 6—10 ft., 980 ft.	2.20	1.97	2.09	2.50	3.00	2.75	2.45	2.90
22 in. vit. pipe, 10—14 ft., 1,540 ft.	2.65	2.22	2.62	3.00	3.25	3.30	3.00	3.50
22 in. vit. pipe, 14—18 ft., 450 ft.	3.15	2.47	3.15	4.00	3.50	4.00	3.50	4.00
18 in. vit. pipe, 6—10 ft., 3,877 ft.	1.50	1.58	1.61	2.00	3.00	2.60	2.00	2.60
18 in. vit. pipe, 10—14 ft., 515 ft.	2.00	1.73	2.14	2.50	3.50	3.50	2.50	3.50
18 in. vit. pipe, 14—18 ft., 105 ft.	2.50	1.93	2.67	3.50	4.00	3.70	3.00	3.70
Embankment, 3,000 cu. yds.	0.30	0.60	0.55	0.50	0.50	0.40	0.40	0.50
Manholes, under 10 ft., 30	35.00	30.00	60.00	40.00	40.00	35.00	35.00	35.00
Manholes, 10—16 ft., 23 ft.	4.00	4.00	5.00	4.00	5.00	5.00	4.00	4.50
Rock, 2,000 cu. yds.	2.00	1.50	1.75	0.50	3.00	2.50	3.00	2.75
Extra concrete, 50 cu. yds.	7.10	10.00	7.00	12.00	10.00	8.80	6.50	8.80
Extra brick work, 50 cu. yds.	12.00	10.00	12.00	12.00	15.00	12.00	15.00	12.00
Sheeting, M. B. M., 30	25.00	25.00	35.00	0.30	40.00	20.00	25.00	20.00
Piling, 1 M. ft.	0.25	0.07	0.35	0.05	0.05	0.05	0.25	80.00
Under drain, per ft.	0.35	0.35	0.60	0.50	0.75	0.75	0.40	0.55
Totals	$51,447	$52,025	$53,088	$53,973	$58,122	$61,637	$63,531	$66,925
Totals	40,408	39,964	42,844	43,748	50,941	53,534	49,194	55,691

The two sets of figures show the difference in cost in providing a sewer for Section 6 of a capacity sufficient to permit the admission of Morristown, Morris Plains, and Madison to the Joint Trunk Sewer. This section is the last section of the Joint Trunk Sewer to be let until it is definitely determined whether or not Morristown and the other cities across the South Mountain will connect up with this Joint Sewer. The sewer throughout has been made large enough for the admission of these municipalities.

The contract for Section 4 of the Joint outlet sewer has been awarded to John P. Hall, of Jersey City, for $47,553. For bids received for Section 4 see The Engineering Record of Oct. 4.

Griffin, Ga.—Local press reports state that this city proposes to have surveys and estimates made for the construction of a sewerage system.

Logansport, Ind.—City Engr. Walter A. Osmer writes that the extension of the sewerage system asked for, involving an expenditure of $175,000, will probably be granted.

Burlington, Ia.—The following bids are the lowest received Oct. 6 for sewer construction: Ash St. sewer, Stewart & Hayden, at 80 cts. per lin. ft. complete; Central Ave. sewer, Burlington Const. Co., $2.45 per lin. ft. for sewer complete, not including appurtenances extra specials; $77.25 for catch basins, including connections, and $45 for manholes; North Oak St. sewer, Geo. Kriechbaum, at $1.75 per ft. for sewer complete. Emmet Steece, City Engr.

Des Moines, Ia.—The City Council has ordered the construction of the North Des Moines sewer, which is to be built all of 12-in. pipe.

Port Huron, Mich.—Bids are wanted Nov. 1 for the construction of a brick and tile main sewer in Beard and 20th Sts. R. D. O'Keefe, Supt. of Pub. Wks.

Milwaukee, Wis.—Sewer bonds to the amount of $100,000 have been sold by this city.

The estimated cost of changing sewers in the 18th Ward for track depressing is placed by the City Engr. at $40,000.

Bond Hill, O.—The Village Council has decided to issue $40,000 bonds for sewer construction.

Minneapolis, Minn.—The City Engr. has been authorized by the Council to purchase 200,000 brick for sewer construction.

Dayton, O.—The Co. Engr. has been directed to make surveys and estimate the cost of constructing a sewer in Harrison Township.

Kalamazoo, Mich.—The contract for constructing a concrete sewer in Vine St. has been awarded to H. P. Streicher, of Toledo, O., for $9,487.

Cass Lake, Minn.—The contract for the extension of the sewer system is stated to have been let to Pastoret & Martin, of Two Harbors, for $7,474.

Oelwein, Ia.—The City Council has passed resolutions for the construction of certain sewers.

Cincinnati, O.—The Bd. of Pub. Service has approved City Engr. Stanley's plans for the construction of a trunk sewer in the ravine east of Torrence Road. Estimated cost, $10,753.

Akron, O.—Bids are wanted Nov. 1 for constructing local sewers in portions of 6 streets and a main trunk sewer in Sewer Dist. No. 9 in Meadow Alley. Bids will also be received Nov. 15 for constructing a main trunk sewer in Sewer Dist. No. 9 in Howe St. Chas. H. Isbell, Clk.

Worthington, O.—See "Water."

Ottumwa, Ia.—City Engr. J. T. Brady, writes that no bids were received Oct. 20 for the construction of a portion of South Ottumwa trunk sewer, and new bids have been asked until Nov. 3.

The 6-ft. brick sewer across Richmond Ave. recently destroyed during heavy rain is to be soon replaced by culvert of ample size.

Ottawa, O.—See "Water."

Vicksburg, Miss.—See "Water."

Gueydan, La.—Engr. Chas. D. Pabbitt is said to be making a survey of White Lake section with a view to draining and reclaiming large tracts of marsh land.

St. Louis, Mo.—Ordinances will probably soon be passed for the reconstruction of sewers in alleys between Pine and St. Charles Sts., 9th and 12th Sts. Estimated cost, $50,000.

Smithville, Tex.—A stock company is being organized here to put in a sewerage system for the city.

So. McAlester, Ind. Ter.—See "Water."

Louisville, Ky.—The ordinance providing for a $5,500,000 bond issue for streets and sewers is stated to have been passed by the Council.

Ft. Smith, Ark.—City Engr. T. A. Bayley writes that the city will receive bids Oct. 31 for the extension of about one mile of sewers; cost about $10,000.

Enid, Okla. Ter.—See "Water."

Fresno, Cal.—In a recent report to the Bd. of City Trus., City Engr. I. Teilman recommended the construction of a 30 and 36-in. brick intercepting sewer and a septic tank 60 ft. wide, 8 ft. deep and 500 ft. long, to be built of concrete. Estimated cost, $55,000.

Grand Forks, N. D.—The Co. Drainage Comn. is stated to have awarded the contract for the Levant ditch, which will be 13 miles in length and about 20 ft. wide, to P. McDonnell for $28,000.

Montreal, Que.—Local press reports state that $8,000 has been voted for the continuation of St. James St. sewer.

BRIDGES.

Springfield, Mass.—The Special Comn., consisting of John W. Corcoran, of Clinton; John J. Flaherty, of Gloucester, and Geo. F. Swain, of Boston, appointed to act in the South End grade crossing, after a hearing at the Court House, decided that public necessity and convenience required the abolition of the grade crossing at the South End Bridge.

Hatfield, Mass.—The citizens on Oct. 15 are stated to have voted to expend $3,000 toward a fill and bridge near North Hatfield. This work is to be done in connection with the electric road. The work will cost about $5,000, and the electric road has offered the town $1,600 for its share of the work.

Bath, Me.—Theo. L. Dunn, Ch. Engr., Portland, Me., writes that preliminary examinations are being made for the bridge which the Maine Central R. R. contemplates building across the Kennebec River at Bath.

Lawrence, Mass.—It is stated that the Boston & Maine R. R. Co. (H. Bissell, Ch. Engr., Boston) will erect a $20,000 bridge over So. Union St. About half of the expense will be borne by the Boston & Maine and the remaining $10,000 will be divided between the Boston & Northern St. Ry., the county and the city.

Syracuse, N. Y.—It is stated that plans are about completed at the City Engrs. office and the contract will soon be let for the construction of a bridge over the Oswego Canal at Butternut St.

Mohawk, N. Y.—A press report states that the Utica & Mohawk Valley Ry. Co. will construct 8 bridges; one of the bridges is estimated to cost $140,000. C. H. Clark, Ch. Engr., Utica.

Pulaski, Pa.—The State Viewers appointed by the Dauphin Co. Court are reported to have recommended the construction of a $20,000 stone bridge of two arches at Pulaski (Harrisburg, C. H.).

Newtown, Pa.—Bids are wanted Nov. 1 for building a bridge on Jefferson Ave. in the Boro. of Newtown. Elmer E. Funk, Clk. of County Comrs., Doylestown.

Wilmerding, Pa.—The Pittsburgh Rys. Co. is stated to have awarded to the McClintic-Marshall Construction Co., of Pittsburg, a contract for the erection of a steel viaduct 1,500 ft. long to span the tracks of the Pennsylvania R. R., and the Turtle Creek & Westinghouse traction tracks at Wilmerding.

Scranton, Pa.—Residents of the 10th Ward have presented a petition to Recorder W. L. Connell, asking that bridges be constructed over Roaring Brook at the end of Ash and Myrtle Sts.

New Castle, Pa.—The New Castle Electric Ry. Co. is reported to have submitted to the Co. Comrs. and City Council a proposition providing for the construction of a viaduct from Moravia St. over all the R. R. tracks and the Shenango River to a point on Mahoning Ave. The cost of the viaduct, with the lands necessary for the approaches, is estimated at $200,000, and it has been suggested that this sum be borne in the following proportions: Steam railroads, $100,000; County of Lawrence, $36,000; city of New Castle, $24,000, and the New Castle Traction Co., $40,000.

Towson, Md.—Residents of the 4th District are stated to have petitioned the Baltimore Co. Comrs. to co-operate with the Carroll Co. Comrs. in building a bridge over the Patapsco at Bensons Ford.

Georgetown, D. C.—At the last session of Congress an appropriation of $65,000 was made for the repair of the Aqueduct bridge across the Potomac at Georgetown. A project submitted by Col. Allen, Corps of Engrs., has been approved by Gen. Gillespie. It provides for the reconstruction of pier No. 5 from the bottom up. A raft has been constructed for taking probings at the site of the pier, and it is expected that contracts for the work will soon be let.

St. Paul, Minn.—The Com. on Sts. of the Bd. of Aldermen is stated to have accepted the plans of City Engr. Rundlett for the steel bridge to be constructed at Arcade St., to cost about $54,000.

Mason City, Ia.—The Chicago, Milwaukee & St. Paul R. R. Co. is stated to have decided to partially change and reconstruct its viaduct at Mason City. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Washington, Ind.—Local press reports state that bids will be received Nov. 10 by the Co. Comrs. for the construction of a bridge over the White River. The plans of Engr. E. C. Faith call for a bridge 420 ft. in length, 26 ft. in width and supported by two concrete abutments, each 21 ft. in length, one on each bank, and two piers in the river; probable cost $15,000.

Racine, Wis.—Ch. Engr. Edw'd C. Carter, of the Chicago-North Western Ry. Co., Chicago, writes that the proposition to construct a double track and new bridge at Racine has been considered but has not been authorized.

Anderson, Ind.—Bids are wanted Oct. 29 by Co. Aud. Otis P. Crim, for the building of approaches to bridge over Fall Creek at Cox's Ford. J. Burr, Comr.

New Castle, Ind.—Bids are wanted Nov. 7 for the construction of 6 small steel bridges. Edwin Hall, Comr. of Henry Co.

Chillicothe, O.—Bids are wanted Nov. 10 for furnishing all material and constructing the sub-structure for a bridge to be built over Yellow Bud Creek, on Franklin Pike, at Yellow Bud; bridge to be 1-span, 75 ft. c. to c., and 18 ft. wide. Harry S. Adams, Ross Co. Aud.

Salem, Ind.—Bids will be received Nov. 3 by the Bd. of Co. Comrs. for constructing a steel bridge across Buffalo Creek in Jefferson Township. Geo. M. Seifers, Co. Aud.

Cincinnati, O.—The Brackett Bridge Co., 518 Walnut St., is reported to have submitted the lowest bid for constructing the county bridge over Great Miami River at Elizabethtown. Its bid was for the superstructure $114,200, and substructure $24,525.

Akron, O.—The Council is reported to be considering the construction of a viaduct across the R. R. tracks at Exchange and Carroll Sts.

Goodland, Ind.—It is reported that an iron bridge will be constructed east of town, on the Remington Road.

Indianapolis, Ind.—Bids are wanted Oct. 29 for the construction of a concrete arch bridge over Little Eagle Creek, on Zionsville and Pike Township Road. John McGregor, Comr. of Marion Co.

Paulding, O.—It is reported that bids will be received by the Co. Comrs. Nov. 14 for 3 bridges: One over the Maumee River, north of Antwerp, to be 3 spans, each span being 129 ft. 6 in.; another over Little Auglaize River, near Mandale, to be 1 span, low-truss, 65 ft. long, and the third to cross Flat Rock Creek and be 1 span, single-track, high-truss, 105 ft. long, pin center, with 16-ft. roadway. Oliver Morrow, Co. Surv.

Crawfordsville, Ind.—It is stated that bids will be received by the Montgomery Co. Comrs. Nov. 3 for the substructure of a bridge over the north fork of Coal Creek. Jas. A. Harding, Co. Surv.

Demotte, Ind.—It is reported that bids will be received by W. C. Babcock Co. and Rensselaer for a steel bridge over a large ditch.

Ashland, Ky.—A press report states that a bridge will be constructed across the Ohio River at Ashland. The Camden Interstate Ry. Co. is reported interested. C. Lake, Ch. Engr., Huntington, W. Va.

Shreveport, La.—Bids are wanted Nov. 13 for the construction of a steel bridge over Dooley Bayou in Caddo Parish, as advertised in The Engineering Record.

Kansas City, Mo.—A press report states that the Kansas City, Mexican & Orient Ry. Co. is preparing plans for a 1,500-ft. bridge across the Missouri at Kansas City. M. P. Paret, Ch. Engr., Kansas City.

Houston, Tex.—The lowest bid received by the Co. Comrs. Oct. 17 for a steel bridge over Bray's Bayou is stated to have been submitted by A. J. Beene for $70,300.

Lake Charles, La.—Bids are wanted for constructing a steel draw-span, with piling approaches, for heavy highway traffic. F. Shutts, Consulting Engr., Lake Charles.

Huntsville, Ala.—Local business men are reported to have taken preliminary steps for the organization of a company to build a railway and wagon bridge across the Tennessee River near Whitesburg.

Eagle Pass, Tex.—The Porfirio Diaz & Eagle Pass Bridge Co. is reported incorporated, with a capital of $100,000, to construct and operate a bridge across the Rio Grande between Eagle Pass and Porfirio Diaz, Mex.

Laredo, Tex.—A charter has been granted to the Laredo Bridge Co., with a capital of $150,000, to construct and operate a bridge over the Rio Grande between Laredo, Tex., and Nuevo Laredo, Mex. Incorporators: James B. Van Woert, N. Y. City, N. Y.; John K. Beretta, of Laredo, and Wm. Hollis, of Eagle Pass.

Ludden, N. D.—Wm. S. Hewett & Co., of Minneapolis, Minn., are stated to have secured the contract for constructing a bridge over the James River at Ludden for $7,897.

San Jose, Cal.—County Surveyor J. G. McMillan writes that bids will be opened Oct. 28 for combination wood and steel bridges over Llagas Creek at Rucker and San Martin Aves.

Yellowstone Park, Wyo.—Capt. Hiram M. Chittenden, Corps of Engrs., U. S. A., writes that the lowest bid received Oct. 15 for furnishing steel for 30 highway bridges in Yellowstone National Park was from the American Bridge Co. at 3.4 cts. per lb., 750,000 lbs.

Chehalis, Wash.—It is reported that bids are wanted Nov. 6 by the Co. Aud. at Chehalis for a steel and combination bridge over Cowlitz River at Mayfield.

Ottawa, Ont.—The Council is reported to be considering the question of expending $9,000 to repair and widen the Somerset St. Bridge.

PAVING AND ROADMAKING.

Newport, R. I.—City Clk. David Stevens writes that on Nov. 4 a vote will be taken on the proposition to pave Broadway and Spring St. with bituminous macadam, at an estimated cost of $50,000.

Boston, Mass.—The following bids were opened Oct. 21 by Supt. of Streets Donovan for the construction of Bennington Boulevard, E. Boston; Metropolitan Const. Co., $53,168; Jones & Meehan, $43,327; H. A. Hanscomb & Co., $43,991; Jas. Doherty, $35,917; John O'Brien, $36,661; McGawley & Coughlan, $41,101; Patrick McGovern, $40,829; Coleman Bros., $38,392; Thos. F. Welch, $51,503; J. J. Sullivan, $49,893; W. H. Ellis, $44,993; Bruno, Salamone & Petitti, $62,479. There will be loam spaces in the center of the boulevard; the roadways will be macadam with telford base. Bidders all of Boston.

Towson, Md.—N. W. Crosby, Baltimore Co. Roads Engr., writes that the contract for building 5 miles of road has been awarded to Thos. J. Harden, 971 Frederic Ave., Baltimore, for about $5,000.

Washington, D. C.—Local press reports state that 8th St., S. E., is to be repaved at an estimated cost of $19,400.

Pittsburg, Pa.—Local press reports state that the County Comrs. have awarded contracts for 9 county roads as follows: To Booth & Flinn, Ltd., Washington Pike, for $63,676; Dravosburg Road for $10[illegible]; Noblestown Road for $65,200, and Glenfield Road for $96,344: To Keeling & Ridge, Freeport Road, Section 1, for $77,095, and Evergreen extension for $78,380: To Foley Bros., Noble Lane Road for $19,170: To J. C. McSpadden, Natrona Branch Road for $14,328, and Bull Creek Road for $87,107.

The Bd. of Viewers on the construction of Grant Boulevard, in its final report to Jos. Woods, Supt. of the Bureau of Awards, places the cost of grading, paving and curbing said boulevard at $789,608.

New York, N. Y.—The following bids for grading, paving, etc., various streets were opened Oct. 22 by L. F. Haffen, Pres. Bronx Boro.; A, M. J. Leahy; B, F. Thilemann, Jr.; C, Cunningham & Kearns; D, John H. Devlin; E, John J. McQuade; F, Wm. H. Masterson; G, D. W. Moran; H, F. V. Smith Contracting Co.; J, Matthew Baird Contracting Co.; K, Edward Roche:

E. 181st St., from 3d Ave. to Boston Road.

Bidders.	Earth, exc., 12,300 cu. yds	Rock exc., 18,250 cu. yds.	Filling, 21,150 cu. yds.	New curb, 9,060 ft.	New flags, 36,050 sq. ft.	New bridge, stone, 4,110 sq. ft.	Dry rubble, 1,375 cu. yds.
A..	$0.75	$0.75	$0.75	$0.65	$0.22	$0.55	$1.25
B..	.30	1.50	.25	.65	.22	.50	1.50
C..	.50	1.50	.30	.70	.23	.60	1.50
D..	.77	.77	.01	.61	.20	.52	1.00
E..	.35	1.10	.25	.70	.23	.60	1.50
F..	.35	1.35	.03	.70	.23	.55	1.00

Westchester Ave., from Prospect Ave. to So. Boulevard

Bidders.	New curb, 175 ft.	New bridge, stone, 925 sq. ft.	New flags, 900 sq. ft.	Gran. blk., 20,000 sq. yds.	Concrete, yds. 3,930 cu.	Road boxes, 2.
B........	$0.75	$0.60	$0.25	$2.90	$4.50	$30.00
C........	.70	.50	.22	2.67	4.25	100.00
F........	.70	.60	..	2.66	4.85	100.00
G........	.65	.50	.20	3.05	6.00	200.00
H........	.70	.60	.24	2.83	4.90	100.00
J........	1.00	.60	.25	2.81	4.75	85.00
K........	.69	.58	..	2.58	3.98	..

Ogden Ave., from 164th St. to 169th St.

Bidders.	Old curb reset, 4,800 ft.	Gran. blk. on sand, 12,750 sq. yds.
D. W. Moran........	$0.15	$2.25
F. Thilemann, Jr......	.20	2.35
F. V. Smith Contr. Co.	.10	2.20
Jas. Quinn, Sr........	.15	2.22
M. Baird Contr. Co...	.25	2.25
John H. Devlin	.13	2.10
Cunningham & Kearns.	.10	2.21
W. H. Masterson	.10	2.28

The lowest bid for 6,225 sq. yds. of granite block pavement, with sand foundation, on E. 137th St., from Brook Ave. to the Southern Boulevard, was that of Edw. Roche, at $2.17 per sq. yd.

New York, N. Y.—The following bids for asphalt paving were opened Oct. 22 by L. F. Haffen, Pres. Bronx Boro.: A, Continental Asph. Pavg. Co.; B, Hastings Pavt. Co.; C, John L. Robertson; D, Barber Asph. Pavg. Co.; E, Sicilian Asph. Pavg. Co.; F, Century Constr. Co.; G, Asphalt Constr. Co.:

E. 145th St., from 3d to St. Ann's Ave.

Bidders.	Asph., 6,300 sq. yds.	Old stone relay, 6,310 sq. yds.	Concrete, 215 cu. yds.	New curb, 3,800 ft.
D...............	$1.00	$0.22	$4.95	$0.80
E...............	1.20	.15	5.00	.80
F...............	1.36	.33	5.00	.85
G...............	1.05	.30	5.50	.80

E. 158th St., from 3d to Park Ave.

Bidders.	Asph. blk., 4,670 sq. yds.	Concrete, 795 cu. yds.	New curb, 2,000 ft.	Old curb reset, 1,400 ft.
A...............	$1.79	$6.40	$0.95	$0.25
B...............	1.68	6.00	1.00	.25
C...............	1.89	6.00	.90	.28

Various Street Intersections and Boston Rd., from Jefferson Pl. to Prospect Ave.

Bidders.	Asph., 6,650 sq. yds.	Concrete 1,040 cu. yds.	New curb, 750 ft.	Old curb, 800 ft.
D...............	$1.25	$4.95	$0.85	$0.18
F...............	1.48	5.00	.85	.35
G...............	1.30	6.00	1.00	.35

Cauldwell Ave., from E. 161st St. to Westchester Ave.

Bidders.	Asph. blk., 7,780 sq. yds.	Concrete, 1,260 cu. yds.	Old curb reset 4,400 ft.
A.....................	$1.68	$6.40	$0.25
B.....................	1.77	6.00	.25
C.....................	1.80	6.00	.28

Morris Ave., from E. 156th St. to E. 164th St.

Bidders.	Asph. blk., 11,750 sq. yds.	Concrete, 1,830 cu. yds.
Continental Asph. Pavg. Co....	$1.68	$6.40
Hastings Pavt. Co............	1.70	6.00
John L. Robertson............	1.80	6.50

Watertown, N. Y.—The Jefferson Co. Bd. of Superv. has taken action providing for the construction of 18 miles of highway under the Higbie-Armstrong law. Total estimated cost, $134,620.

Syracuse, N. Y.—The lowest bids received for the paving of East and West Colvin St. are stated to have been as follows: For asphalt—the Empire Contracting Co., at $1.60 per sq. yd., using Alcatraz, curbing at 55 cts., total, $23,993; for brick—John W. Bustin, Syracuse, at $1.87 per sq. yd., using Syracuse brick, total, $27,487.

Troy, N. Y.—Rensselaer County Supervisors have adopted plans and specifications for the improvement of the following highways: Troy-Sand Lake Road, 1.49 miles, cost $15,200; Wynantskill-West Sand Lake Road, 4 miles, cost $39,400; East Nassau Road, 3.02 miles, cost $18,121; the old northern turnpike, from Hoosick River bridge at Eagle Bridge through Buskirk; also the road from station 118x39 to Buskirk's Bridge, a distance of 2.75 miles, in Hoosick, cost $26,250; Brick Church-Rock Hollow Road, a distance of 3.33 miles, cost $33,800; Boston and Albany turnpike, a distance of 5.41 miles, cost $50,300; the Troy-Poestenkill Road, a distance of 3.6 miles, cost $33,450. One-half of the total expense, which is $216,521, is borne by the State and one-half by the county.

Newton, N. J.—The Bd. of Chosen Freeholders of Sussex Co. has awarded contracts for building three sections of macadam roads as follows: Road from Sussex Borough to Newton, to McKernan & Bergen, of Paterson, for $6,611; road from Stanhope to Newton, to the Augustus Munson Co., of Rockaway, for $7,807; road from Sparta to Newton, to McKernan & Bergen, of Paterson, for $4,406.

La Salle, Ill.—Contracts will soon be let for the following work: 26,424 sq. yds. of brick paving on broken stone foundation; 12,158 lin. ft. of stone curbing, and 10,860 cu. yds. of excavating. Estimated cost, $44,850. E. J. Noonan, City Engr.

Burlington, Ia.—The following are the lowest bids opened Oct. 6 for brick paving: Main St.—Geo. Kriechbaum, at $1.35 per sq. yd for paving, 55 cts. per lin. ft. for curbing and 40 cts. per cu. yd. for grading; Valley St.—Geo. Kreichbaum, at $1.80 per sq. yd. for paving, 75 cts. per lin. ft. for curbing, and 45 cts. per cu. yd. for grading.

Pekin, Ill.—The City Council has passed an ordinance providing for the paving of S. 4th St.; estimated cost, $18,096.

Milwaukee, Wis.—The contract for paving Market St., 4,265 yds., has been awarded to the Western Paving & Supply Co. at $2.30 per yd. for asphalt pavement.

Ft. Dodge, Ia.—The City Council has been petitioned to pave several streets with asphalt.

St. Paul, Minn.—City Engr. Rundlett estimates the cost of paving Exchange St., from Cedar to 9th Sts., as follows: Asphalt, $12,308; sandstone, $13,602, and brick, $10,238.

Sebring, O.—The contract for about 5,800 sq. yds. of brick paving is reported to have been awarded to John Hadley, of Canton, for $8,300.

Minneapolis, Minn.—The Park Bd. has decided to expend $7,000 on the new boulevard along the west bank of the river.

Hammond, Ind.—Bids are wanted Nov. 4 for improving sundry streets. W. F. Bridge, City Engr.

Indianapolis, Ind.—Bids are wanted Oct. 29 for improving portions of Cora St. by grading and paving with brick. Harold C. Megrew, Clk. of the Bd. of Pub. Improv.

Delphi, Ind.—Bids are wanted by Co. Aud. Jas. C. Smock, Dec. 1, for grading, graveling, draining, etc., the Burlington and Cutler gravel road; total length about 32 miles. E. E. Kirkpatrick, Engr. in Charge.

Akron, O.—Bids are wanted Nov. 15 for grading, curbing with stone, guttering and paving with brick, on W. Market St. Chas. H. Isbell, City Clk.

Cincinnati, O.—Street paving and improvement bonds to the amount of $200,000 are reported to have been sold.

Topeka, Kan.—The contract for macadamizing W. 6th St. road has been awarded by the Co. Comrs. to Ramsey & Ramsey at 38¾ cts. per sq. yd.

Nashville, Tenn.—The City Council has passed a bill appropriating $28,000 for paving Broad St. and West End Ave., to be available as soon as the property owners raise an additional $6,000 to help pay for the work; bituminous macadam will be used.

Memphis, Tenn.—Local press reports state that the Memphis St. Ry. Co. has arranged for paving within its tracks and 2 ft. on each side of tracks on such streets of Memphis as the tracks are on, and which will be paved by the city, with asphalt. Estimated cost to company is given as $150,000.

Paducah, Ky.—City Clk. W. H. Patterson writes that the proposition to issue $100,000 bonds for street improvements will be voted upon at the Nov. election.

Guthrie, Okla. Ter.—The City Council is said to be receiving bids for paving. Address Mayor Ball.

Boise, Idaho.—Bids are wanted Oct. 30 for the construction of cement sidewalks in numerous streets. Dean Perkins, City Clk.

Toronto, Ont.—An additional appropriation of $20,000 has been made for the improvement of Temiskaming Dist. roads.

Montreal, Que.—The Road Com. has instructed the City Surveyor to ascertain the cost of an asphalting plant to be owned by the city.

POWER PLANTS, GAS AND ELECTRICITY.

Augusta, Me.—The Union River Light & Power Co. has been incorporated to develop the water power of the Union River and its tributaries. A. Wendal Jackson, Pres., N. Y. City, N. Y.; I. L. Halman, Treas., Boston, Mass.

Madison, Me.—A committee is reported to have been appointed to investigate the cost, etc., of installing a lighting plant.

Brooklyn, N. Y.—Plans have been filed for a 1-story brick, heat and light plant, 55x128 ft., to be erected for the city at Clarkson St. and Albany Ave., to cost $30,000. Architect, L. H. Voss, 65 De Kalb Ave.

Patchogue, L. I., N. Y.—The Village Trus. are stated to have granted Irvy Myers, of North Paterson, N. J., a franchise for a gas plant.

Saugerties, N. Y.—The Saugerties Light, Heat & Power Co., of Saugerties, has been incorporated; capital, $50,000. Directors: H. R. Hord and R. C. McCormick, New York.

Addison, N. Y.—The Village Trus. are stated to have granted Jas. R. Reynolds a franchise to pipe gas from the Potter County gas fields to Addison, for fuel and lighting purposes.

McKeesport, Pa.—The Common and Select Council have passed a resolution authorizing the City Controller to secure bids for furnishing the city with electric light after Dec. 15 for 1 year. The ordinance for the municipal electric light plant is reported to have been defeated.

Centralia, Pa.—The Schuylkill Light, Heat & Power Co., of Girardville, is stated to have secured the contract for lighting the city by electricity at $95 per light per year.

Bath, Pa.—A charter has been granted to the Bath Light, Heat & Power Co., with a capital of $1,000, to supply light, heat and power to Bath and adjacent territory. Incorporators: Chas. Shuman and Wilson H. Seem, of Bath; W. M. Bennett, of Nazareth, and others.

Philadelphia, Pa.—Press reports state that plans for the new heat and light plant of the Univ. of Pennsylvania were posted Oct. 17 in the mechanical building by Prof. Spangler. The building will cost about $500,000.

Bradford, Pa.—The Bradford Gas Co. was formed Oct. 18 at the office of L. Emery, Jr., to drill for and produce natural gas to be sold to manufacturers.

Winnsboro, S. C.—Bids are wanted Oct. 29 for erecting an electric lighting plant of 35 arc and 600 incandescent lamps. W. B. Smith Whaley & Co., Engrs., Columbia.

Akron, O.—Bids are wanted Nov. 6 for making all connections, erecting, maintaining and furnishing all material necessary for furnishing the city with good and satisfactory lights for a term of 5 years: the contract calls for 800 or more gas lamps of 50 c. p. each, to be lighted on the moonlight schedule. Chas. H. Isbell, City Clk.

Sycamore, Ill.—City Clk. J. D. Beckler writes that on Oct. 17, at a special meeting of the Council, it was voted to award the contract for city lighting to De Kalb-Sycamore Electric Co.

Bettsville, O.—W. L. Day is stated to have petitioned the Council for a franchise for an electric light plant.

Milwaukee, Wis.—A plan to extend and enlarge the steam-heating service of the Milwaukee Electric Ry. & Light Co. is reported to be under consideration by Pres. John I. Beggs; the plans include the boring of large tunnels through the downtown streets within a few blocks of the plant on Broadway.

Baraboo, Wis.—Local press reports state that the Baraboo Gas & Electric Light Co.'s plant has been sold to Brown & Mayer, of Chicago, Ill. New mains will be laid and the entire system, both for fuel purposes and street lighting, will be put in new. B. H. Strong will be retained as mgr.

Forest, O.—See "Water."

Superior, Wis.—Bids will be received by the Common Council Nov. 18 for a franchise for the construction, maintenance and operation of a plant for the distribution of electric currents throughout the city, supplying said city with electricity for power, heat and lighting purposes. John A. Hobe, City Clk.

Youngstown, O.—A press report states that Chas. Hauk, of Toledo, is about to organize a company to furnish manufactured fuel gas to Youngstown, Warren, Niles, Girard, Struthers and Lowellville.

Worthington, O.—See "Water."

Berwyn, Ill.—The Village Trus. are reported to be investigating the advisability of installing a lighting plant in connection with the water works.

Effingham, Kan.—John W. Wilson, Pres. of the company recently granted a 20-year light franchise, writes that bids are wanted until Nov. 1 for the construction of an electric light plant, to cost about $6,000.

Scranton, Miss.—See "Water."

Talladega, Ala.—Engrs. Collier and Brown, of Atlanta, Ga., are reported to have a representative in Talladega who is preparing plans for the Talladega Co. which proposes developing the water power on a stream 10 miles from the city to generate electric light and power. They have secured all rights and franchises, and will commence active construction at an early date.

Huntsville, Ala.—Mr. Jackson, of Nashville, Tenn., is reported to have been selected to prepare plans for municipal electric light for Huntsville.

Schulenburg, Tex.—Negotiations are reported to be pending for the re-establishment of the electric light plant destroyed by fire last Nov. Alderman L. E. Miller, of Houston, owns the franchise.

Corona, Cal.—F. A. Worthley, Supt. of the Riverside Electric Light Plant, is reported to have been employed by the City Council to furnish an estimate of the cost of an electric light plant for Corona.

San Francisco, Cal.—The Golden State Power Co. is reported incorporated, with a capital of $10,000,000, to develop the water power in Feather River. Directors: C. L. Morrill, Theo. Getty and others.

Ellendale, N. D.—J. A. Johnson, of Fargo, is reported to have petitioned for a franchise for an electric light plant.

Douglas, Wyo.—John Morton and T. J. Williams are stated to have petitioned the Council for a franchise for an electric light plant.

Ballard, Wash.—An ordinance is stated to have been introduced in Council granting Oren C. Wilson and his associates a franchise to install and operate a plant for general electric light and power.

Denver, Colo.—Hendrie & Bolthoff are stated to have secured the contract for installing the electric light plant in the court house, for $3,675.

San Pedro, Cal.—City Clk. O. C. Abbott writes that a 50-year gas plant franchise has been sold to H. C. Rogers, of Pasadena, Cal.

Toronto Junction, Ont.—The Canadian General Electric Co. is stated to have secured the contract for furnishing 85 arc lights with two 50-light transformers, switchboard, etc., for $3,580.

ELECTRIC RAILWAYS.

Bourne, Mass.—The Selectmen are stated to have granted the Middleboro, Wareham & Buzzards Bay St. Ry. Co. a franchise to extend its line to Sandwich. Chas. H. Cox, Ch. Engr., Middleboro.

Waltham, Mass.—The Boston Suburban Ry. Co. is stated to have purchased a site in Waltham and will erect there a central power house to be used as a feeder for its railway system. A general repair shop will also be erected on the site. N. C. Smith, Supt., Newtonville.

Norton, Mass.—The Norton & Taunton Ry. Co. is stated to have petitioned the Selectmen for a franchise for a location from Norton Center to the Easton line. C. E. Short, Ch. Engr., Norton.

College Point, L. I., N. Y.—The Cross Country R. R. Co., of Brooklyn, has been incorporated, with a capital of $250,000, to operate a 15-mile electric surface railroad with termini at College Point and Willets Point. Directors: J. F. McClean, A. A. Halsey and Theo. Bernard, all of Brooklyn.

Dunkirk, N. Y.—It is stated that the Dunkirk & Point Gratiot St. Ry. (D. F. Toomey, Mgr., Dunkirk) is to be extended to Buffalo. A reorganization of the company is now under way and the new road will be known as the Buffalo, Dunkirk & Western Ry. Co.

Huntington, L. I., N. Y.—J. H. Smith, of Brooklyn, with a residence at Farmingdale, is reported interested in the construction of an electric railway between Huntington and Amityville.

Dillsburg, Pa.—A charter has been filed for the extension of the Dillsburg, Wellsville & Dover St. Ry. from Rossville to Lewisberry. Newberry, Goldsboro, York Haven, Dillsburg and Bowmansdale.

Le Roy, N. Y.—The Highway Comrs. are stated to have granted a franchise to the Buffalo & Depew Electric Ry. Co. E. Melvin, Ch. Engr., Depew.

New Castle, Pa.—The New Castle Electric Ry. Co. is stated to have petitioned the Council for franchises for a new extension to be built at a cost of about $50,000. The West Washington St. branch will be extended to the city line, as will also the Pittsburg St. branch.

New Kensington, Pa.—The Council is stated to have granted a franchise to the Tarentum & New Kensington St. Ry. Co.

Philadelphia, Pa.—The Bureau of Surveys has approved plans of the Rapid Transit Co. for the extension of its 19th and 20th Sts. line from Tasker St. to Passyunk Ave., through Lebanon Cemetery. W. S. Twining, Ch. Engr., Philadelphia.

Oswego, N. Y.—It is stated that the Syracuse Rapid Transit Co. has under consideration the extension of its line from Liverpool to Oswego. E. G. Connette, Gen. Mgr., Syracuse.

Bradford, Pa.—C. E. Hudson, Supt. Bradford St. Ry. Co. is reported interested in the construction of an electric railway from Bradford to Jamestown, a distance of about 38 miles.

Brockport, N. Y.—The Brockport, Niagara & Rochester Ry. Co. has been incorporated, with a capital of $500,000, to construct an electric road from Rochester to Medina, a distance of 44 miles. Directors: Fred. Beck, Brockport; W. S. Shields, Waterville, and S. J. Spencer, Buffalo.

Springfield, O.—The Co. Comrs. are stated to have granted the Dayton & Kenton Interurban Ry. Co. a franchise to cross the pikes in Clark County for its line from New Carlisle to this city. R. E. Kline, Ch. Engr., Dayton.

Norwood, O.—The Norwood, Oakley, Madisonville & Red Bank Traction Co. is stated to have secured a right of way over the Red Bank and Brotherton Roads. David Davis, of Norwood, and Peter Eichels, of Red Bank, are among the incorporators of this railway.

Davenport, Ia.—The Scott County Bd. of Superv. are stated to have granted a franchise to the Iowa-Illinois Interurban Ry. Co. to build a line from the city limits of Davenport to a mile beyond Bettendorf on the River Road.

Toledo, O.—W. F. Brown, 864 Oakwood Ave., is stated to have been employed to conduct the final survey for the construction of an electric railway for the People's Rapid Transit Electric Ry. Co. to connect Toledo, Napoleon, Defiance, Greenville, Dayton and other small towns.

Belleville, Ill.—The Belleville Interurban Electric R. R. Co. has been incorporated, with a capital of $5,000, by Henry A. Kirchner, Chas. Becker and others, to construct an electric line in Belleville with branch roads to neighboring towns.

La Salle, Ill.—The Ill. Valley Traction Co. (L. W. Johnson, of La Salle, Supt.) is surveying for an electric line between La Salle and Ottawa; distance, 15 miles.

Kenosha, Wis.—Volney W. Foster, of Chicago, Ill., is reported interested in the construction of an electric railway from Kenosha to Waukegan.

Ashland, Ky.—John Graham, of Huntington, W. Va., Pres. Camden Interstate Ry. Co., is reported interested in the construction of an electric railway to Oakview, Pollard and Russell.

Chattanooga, Tenn.—The Chattanooga Electric Ry. Co. is stated to have decided to extend its line to Chickamauga Park. J. W. McFarland, Supt. and Ch. Electrician, Chattanooga.

Knoxville, Tenn.—The Knoxville Traction Co. has been granted right of way by the County Court to extend a line along the Clinton pike about 1½ miles and on Sharps Gap pike about 1 mile; work will begin within 60 days. C. H. Harvey, Knoxville, Gen. Mgr.

Columbia, Tenn.—The Council is stated to have granted a franchise to the Nashville & Columbia Electric Ry. Co.

Nashville, Tenn.—Percy Warner and E. C. Lewis, of Nashville, Receivers, and R. Lancaster Williams, of Richmond, representing the owners of the Nashville Ry., are reported to be outlining improvements on the Nashville Ry. which contemplates the extension of nearly all of the old lines, the building of new ones and the elimination of unnecessary curves.

Biloxi, Miss.—A charter is reported to have been granted to the Gulf Shore Electric R. R. Co. to construct an electric line from a point at or near Henderson's Point, on the southeastern shore of the Bay of St. Louis, to Point Cadet, being the eastern shore point in the city of Biloxi; total length of proposed line is 20 miles. Incorporators: W. W. Hungerford, Geo. P. Hewes and others.

McKinney, Tex.—Jesse Shain and I. E. Reeves are reported to be on the committee appointed to secure right of way for the McKinney & Blue Ridge Rapid Transit Ry.

Waco, Tex.—The Union Traction Co., of Cleveland, O., is reported to have made a proposition to a number of towns between Waco and Dallas for an electric road between these two cities, to do both a passenger and freight business.

Paris, Tex.—J. S. Williams, Sterling Price and S. B. M. Long, of Paris, are reported to have met with C. C. Dorchester and Cecil Lyon, of Sherman, here on Oct. 16 for the purpose of discussing the proposed electric railway between Paris and Sherman.

Atoka, Ind. Ter.—The Lehigh Traction Co. is reported incorporated to construct an electric railway from Atoka to Coalgate, a distance of 15 miles. Principal office to be at Atoka.

Marshall, Tex.—Y. D. Harrison, of Marshall, representing a company, is stated to have petitioned the Council for a franchise.

Phoenix, Ariz.—It is reported that the Co. Superv. have granted Weirich & Latham a franchise for the construction of an electric railway from Phoenix to Glendale and to Mesa City, a distance of about 30 miles.

Missoula, Mont.—D. A. Barlow, of Missoula, is stated to have petitioned the City Council for a franchise.

Hillsboro, Ore.—The City Council is stated to have granted a 25-year franchise to the West Side & Suburban Ry. Co. for the construction of an electric motor line through the city. The line is to be built from Portland and will probably extend to Forest Grove.

Oakland, Cal.—The San Francisco, Oakland & San Jose R. R. Co. has petitioned the Council for a franchise for an electric railway, commencing on Yerba Buena at its intersection with the southern line of Emeryville, thence westerly to the western limits of Oakland.

The Oakland Transit Consolidated Ry. Co. has also petitioned the Council for a franchise for the construction of additional lines. F. W. Nelson, Ch. Engr., Oakland.

RAILROADS.

Schenectady, N. Y.—The State R. R. Comn. on Oct. 16 granted the petition of the city of Schenectady for the abolition of R. R. grade crossings; the contemplated improvement will cost about $2,000,000.

Newton, Ia.—The Newton & Northwestern R. R. Co. is reported incorporated, with a capital of $2,500,000, to construct a railroad from Newton to Fraser, Gourie, Rockwell City and Sioux City. Principal office to be at Boone. Hamilton Browne, Pres.; W. A. Kelly, Secy.

Salina, Kan.—A press report states that the Union Pacific Ry. Co. will expend about $100,000 in improvements at Salina, including the erection of roundhouse. J. B. Berry, Ch. Engr., Omaha, Neb.

Bloomfield, Mo.—The St. Louis & Gulf Ry. Co., of St. Louis, is reported to have filed with the Secretary of State resolutions to extend a branch railroad from a point north of Bloomfield to a point on the line of its road in Dunkin County, between Calagoa and Campbell, a distance of 35 miles. G. W. Carlisle, Div. Supt., Bloomfield.

Louisa, Ky.—A press report states that the work of surveying for the Seaboard Air Line is about completed. The line above Louisa extends along the west side of Tug River to Naugatuck, and to the Breaks, by way of Peter's Creek, and across to the waters of John's Creek, following that stream to the most favorable point for getting through to the Levisa fork of the Big Sandy. Three tunnels will be constructed on this line. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

Wetmore, Tenn.—A charter has been granted to the Ocoee Valley Ry. Co., with a capital of $10,000, to construct a railroad from Wetmore to Copper Hill. Principal office to be at Knoxville. Incorporators: J. L. Boyd, J. E. Lutz, Al. A. Yeager and others.

Ducktown, Tenn.—A press report states that the Louisville & Nashville R. R. Co. (R. Montford, Ch. Engr., Louisville, Ky.) may completely change the route of the Atlanta, Knoxville & Northern through the mountain near Ducktown. The contemplated change will cost about $2,000,000 and will reduce the length of the road 22 miles, as well as avoid heavy grades and difficult passages. The proposed route is through the Ocoee River cavern.

Natchez, Miss.—The Natchez & Gulf R. R. Co. has been incorporated to construct a railroad from Natchez to Gulfport. Incorporators: J. W. Lambert, W. H. Shields and others.

Blytheville, Ark.—The Chickasawba R. R. Co. has been incorporated, with a capital of $75,000, to construct a railroad from Blytheville east to the river.

Austin, Tex.—The charter of the Trinity & Brazos Valley Ry. Co. has been filed, providing for the construction of a line of railway from a point on the Brazos River in Hood Co., southeast, via Cleburne, Hillsboro, Hubbard and Mexia, to a point on the Sabine River in Orange Co., in all about 300 miles. S. R. Wrightington and S. E. Young, of Boston, Mass.; E. M. House and R. H. Baker, of Austin, are among the incorporators.

Galena, Mo.—The Galena, Frontenac & Northern R. R. Co. is reported incorporated, with a capital of $100,000, to construct a railroad from Frontenac to Galena. R. B. Billerly and John L. Christopher, of Topeka, are reported to be among the incorporators.

Florence, Ala.—J. L. Bell and associates, of New York, are reported to have secured a right of way through Florence and terminal facilities for the Alabama & Tennessee R. R. The road will run between Florence and Clifton, Tenn., a distance of 65 miles, and will have a branch road 15 miles in length.

Denver, Colo.—The Colorado-Utah Construction Co. is reported to have contracted with the Denver, Northwestern & Pacific Ry. Co. to build and equip about 500 miles of its railroad, between Denver and Salt Lake City, Utah. This contract provides for a substantial roadbed, 80-lb. steel rails and modern passenger and freight equipment.

PUBLIC BUILDINGS.

Boston, Mass.—Lamont G. Burnham is reported to have bequeathed to the Boston City Hospital $150,000 to be used in the erection of a building to be known as the Lamont G. Burnham Ward.

Plans have been filed for a 2-story brick and iron gate house at the Charles St. Jail for Suffolk County. Estimated cost, $34,000. Builders, McNeil Bros., 166 Devonshire St. H. H. Atwood, Archt.

Boston, Mass.—Bids will be received Oct. 30 by the Bath Trus. for erecting a bathhouse on Cabot St. Herbert D. Hale, Archt., 15 Exchange St.

Pittsburg, Pa.—Bids are wanted Oct. 31 for erecting an engine house in the 23d Ward. Harry S. Estep, Archt., Publication Bldg. J. O. Brown, City Recorder.

Philadelphia, Pa.—Estimates aggregating over $1,000,000 in appropriations for the Philadelphia Hospital and Almshouse for next year have been passed upon by Councils' Com. on Charities and Correction. Several items for new buildings are as follows: $80,000 for a pavilion for consumptives, $150,000 for a new operating room, $50,000 for a pavilion for nervous diseases, $80,000 for bacteriological and pathological laboratories, and $150,000 for a laboratory for clinical medicine.

G. R. Curry is stated to have secured the contract for erecting an addition to the Union Mission Hospital. Cost of building, exclusive of equipment, will be $50,000. Architects, Stearns & Castor, Stephen Girard Bldg.

New York, N. Y.—Bids are wanted Nov. 1 for labor and material necessary to complete a disinfecting and ambulance station on the County Poor House Farm, Boro. of Richmond. Ernst J. Lederle, Ph.D., Pres.

Bids are wanted Oct. 29 for a new system of radiation and new steam and return lines to be installed in building known as Wards 25 to 28, also new system of return for building known as Wards 21 to 24, Randall's Island; for installing steam heating apparatus at Tuberculosis Hospital, Blackwell's Island, and for steam heating apparatus at Almshouse, Blackwell's Island. Homer Folks, Comr. of Pub. Charities.

Bids were opened Oct. 21 by J. A. Cantor, Pres. Manhattan Boro., for erecting a public bath at 317-9 W. 41st St., as follows: Murphy Bros., 489 5th Ave., $100,873; Thos. Cockerill & Son, $103,500; Louis Wechsler, $109,750.

Bids were opened Oct. 21 by J. A. Cantor, Pres. Manhattan Boro., for the completion of the heating and ventilating, etc., of the Criminal Court Bldg., at Centre, Franklin, Elm and White Sts., as follows: Howe & Bassett, $88,500; United Heating Co., $87,442; Walker & Chambers, $109,000; Blake & Williams, $115,989; E. Rutzler, $115,555; Frank Dobson, $114,715; John F. Sayward & Co., 21 W. 24th St., $86,853. It is stated that the lowest bid exceeds the appropriation.

Brooklyn, N. Y.—Plans have been filed for a brick extension to St. Cecilia's Church, 84 Herbert St., to cost $40,000. Architect, T. H. Poole, 13 W. 130th St., N. Y. City.

Elmira, N. Y.—Bids are wanted Nov. 14 for installing smoke breeching and furnishing one return tank at the N. Y. State Reformatory, as advertised in The Engineering Record.

Farnhurst, Del.—Bids are wanted by the Bd. of Trus. Nov. 6 for the construction (except heating, plumbing and electric lighting) of a building for consumptives on the grounds of the Del. State Hospital at Farnhurst. Totten & Rogers, 931 Chestnut St., Philadelphia, Pa., are the architects.

Bronson, Fla.—Bids are wanted Nov. 3 for erecting a fireproof brick building for the protection and safe keeping of the public records of Levy Co. A. P. Hardee, Co. Clerk.

Richmond, Va.—Bids are wanted Nov. 6 by the Capitol Bldg. Comn., A. J. Montague, Chmn., for fireproofing, restoring and repairing the Va. State Capitol, in accordance with drawings and specifications which may be seen at the office of Noland & Baskervill, of Richmond. Probable cost, $125,000.

Troy, O.—The Christian Society is reported to have decided to erect a $20,000 church. Geo. W. Humphreys, Treas.

Albert Lea, Minn.—Competitive designs will be received by the Library Bd. until Dec. 1 for the proposed $12,000 Carnegie Library.

Racine, Wis.—Bids are wanted Nov. 1 by the Library Bd. for the erection of the $50,000 Carnegie Library.

Fond du Lac, Wis.—Bids will be received Nov. 11 by the Library Bd. for erecting a library. Van Ryn & De Gelleke, Archts., 211 Grand Ave., Milwaukee. Address J. W. Watson, Secy.

Tipton, Ia.—Bids are wanted Nov. 8 for erecting a library. Address W. N. Treichler, Pres. Library Bd.

Cleveland, O.—Adams B. Howard, M. D., Supt. Cleveland State Hospital, writes that the contract for erecting an Acute Hospital at site of State Hospital, has been awarded to Geo. M. Schneider, of Columbus, O., for $31,168.

Tuscaloosa, Ala.—A press report states that plans will be received by the Co. Comrs. until Nov. 7 for a court house for Tuscaloosa County, to cost not over $70,000.

Hamburg, Ark.—The Ashley Co. Comrs. are stated to have decided to erect a $50,000 court house. Ed. McCammon, Comr., is stated to have been appointed to secure plans, etc., for the proposed building.

Hickman, Ky.—P. Frank Milburn, of Columbia, S. C., is reported to be preparing plans for a $25,000 court house for Fulton Co.

New Orleans, La.—The Courthouse Comn., created under an act passed during the recent session of the Legislature, which authorized the construction of a new court house in New Orleans, has organized with Bernard McCloskey as Pres. and Wm. P. Ball as Secy. The court house will be erected on the partnership plan, the State to appropriate $200,000 and the city $375,000.

Texarkana, Tex.—J. D. Fitzgibbons is stated to have secured the contract to erect a hospital here for the Cotton Belt R. R. for about $100,000. W. E. Green, Gen. Supt. of R. R., Tyler, Tex.

St. Louis, Mo.—Local press reports state that bids will be received by the Bd. of Pub. Improv. until Oct. 31 for erecting a poorhouse hospital.

Beatrice, Neb.—Rutherford & Lee, of Beatrice, are stated to have secured the contract for erecting the Carnegie Library for $17,000, and C. G. Pyle, for plumbing same, at $1,615.

Boise, Idaho.—The M. E. Society is reported to be preparing to erect a $39,000 church.

Walla Walla, Wash.—The Co. Comrs. are reported to be considering the erection of a $25,000 infirmary.

Riverside, Cal.—Bids are wanted Nov. 14 for the construction and completion before Dec. 30, 1903, of the Riverside Co. Court House. Burnham & Bleisner, of Los Angeles, are the architects. W. W. Phelps, Clk. of the Bd. of Co. Surv. Cost, $150,000.

Omaha, Neb.—Wm. Coburn, Secy. Bd. of Pub. Wks., writes that the contract for the erection of a public market house on Capitol Ave. has been awarded to C. W. Partridge, of Omaha, for $11,987, not including heating and plumbing.

London, Ont.—Bids are wanted Nov. 7 for erecting a drill hall. Moore & Henry, Archts., London. Address Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa.

BUSINESS BUILDINGS.

Boston, Mass.—A. H. Vinal, 19 Milk St., is stated to have prepared plans for a theater for Weber & Fields, to be erected on Washington and Beach Sts., to cost about $200,000.

It is stated that Shubert Bros., of New York, N. Y., have purchased a site on Tremont St. for the erection of a theater, to cost about $750,000.

Plans have been prepared by Shepley, Rutan & Coolidge, Ames Bldg., for a 10-story office building to be put up at State and Devonshire Sts. for the Fred. L. Ames Estate; steel frame, fireproof, stone outside. Estimated cost, $500,000.

Worcester, Mass.—The contract for erecting the buildings to be occupied by the Standard Plunger Elevator Co. at Jamesville are stated to have been awarded to Geo. H. Cutting & Co. for $41,000. Contract for equipment is also reported awarded.

Buffalo, N. Y.—F. W. Humble, 217 Franklin St., is the architect for a 3-story brick store to be built at 5 to 11 Chippewa St. Owner, W. H. Peabody Estate. Cost, $18,000.

Newark, N. J.—H. L. Jenkinson is stated to have secured the contract for the interior marble and tile work on the United Banks Bldg. now being erected on Market and Union Sts. for $24,000; total cost of building, $300,000. Architect, Geo. B. Post, 33 E. 17th St., New York, N. Y.

Allegheny, Pa.—It is stated that the Pennsylvania R. R. Co. is to erect a depot on Federal St. to cost about $250,000. W. H. Brown, Ch. Engr., Philadelphia.

Pittsburg, Pa.—The Wabash R. R. Co. is to erect a depot and train shed on Liberty Ave. and Ferry St. to cost about $1,000,000. Architect, Theo. C. Link, 308 N. 6th St., St. Louis, Mo. Jos. Ramsey, Jr., Pres., St. Louis, Mo.

D. H. Burnham & Co., Rookery Bldg., Chicago, Ill., are stated to be preparing plans for an 18-story hotel to be erected on 5th Ave. and Grant St. for Henry Clay Frick, to cost about $3,000,000.

McKee's Rocks, Pa.—Seymour Davis and Paul A. Davis, 3d, 907 Walnut St., Philadelphia, are reported to have been commissioned to prepare plans for a $30,000 Y. M. C. A. building to be erected at McKee's Rocks, Pa., for the Erie R. R. Co.

A press report states that the Pressed Steel Car Co. is to erect an office building here, to cost about $50,000. Architect, U. T. L. Peoples, Times Bldg., Pittsburg.

Philadelphia, Pa.—Geo. F. Payne & Co., 401 S. Juniper St., is stated to have taken out a permit to erect an 8-story store and office building for Perry & Co. at 16th and Chestnut Sts. to cost $280,000. Wilson Bros. & Co., Drexel Bldg., are the architects.

Richmond, Va.—Baldwin & Brown will erect a store at a cost of $10,000.

Savannah, Ga.—The Natl. Bank of Savannah and the Oglethorpe Savings & Trust Co. will erect a 10-story office building on Bull and Broughton Sts. early in the coming year. Herman Myers is Chmn. of Bldg. Com.

Toledo, O.—E. O. Fallis, "The Nasby," is stated to be preparing plans for a 7-story mercantile building to be erected by the Huron Bldg. Co. on Jefferson St. to cost about $75,000.

Ludington, Mich.—W. T. Cooper, of Saginaw, is stated to have prepared plans for a 100-room hotel to be erected here for the Stearns Hotel Co.

Cleveland, O.—Local press reports state that plans are under consideration by the Lake Shore R. R. Co. for the erection of a building about 14 stories high on the site of its present general offices on Seneca and St. Clair Sts.

Montgomery, Ala.—Bids are wanted Nov. 7 for the erection of a club building. Alex. Rice, Pres. Frank Lockwood, of Montgomery, Archt.

Birmingham, Ala.—Theo. Paull is stated to have secured the contract for erecting a building for the Birmingham Athletic Assoc. on 20th St. and 5th Ave. for $30,500.

Los Angeles, Cal.—The Los Angeles Ice & Cold Storage Co. is about to erect a $65,000 building at 4th St. and Central Ave., to be let to A. McNally and Geo. Booth. Architects, Eisen & Wyman, of Los Angeles.

San Francisco, Cal.—D. H. Burnham, Rookery Bldg., Chicago, Ill., is reported to be the architect for the new 13-story building to be erected for the Merchants' Exchange, on California and Montgomery Sts.

E. J. Vogel, Claus Spreckels Bldg., is stated to have prepared plans for a 6-story business building to be erected for J. S. Morgan & Sons on Mission and 2d Sts., to cost about $100,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

32 Broome St, 7-story br factory and stores; c, $25,000; o, Lippman & Gold; a, Horenburger & Straub.

W Washington Pl and Barrow St, 8-story br factory and warehouse; c, $75,000; o, Consolidated Dental Co; a, Mulliken & Moeller.

Wooster & Bleecker Sts, 7-story br loft and store bldg; c, $70,000; o, Kruse & Mulford; a, C F Kruse.

Broadway and Trinity Pl, 6-story br and stone office building; c, $100,000; o, Catharine B and Maria L Campbell; a, Benj W Morris.

37 and 39 E 21st St, 10-story and basement stone front warehouse; c, $250,000; o, J W Stevens Bldg Co; a, John W Stevens.

42d St and 7th Ave, 3-story br and stone theater; c, $250,000; o, Klaw & Erlanger; a, Herts & Tallant.

7th Ave and 36th St, 12-story stone front hotel; c, $600,000; o, Central Realty Co; a, Harry B. Mulliken.

12th Ave and 48th St, 2-story br factory; c, $20,000; o, Bradish Johnson Estate; a, R. E. Dusinbene.

Southern Boule and Brown Pl, 5-story brick factory; c, $25,000; o, Anton Doll; a, B Finkensieper.

BROOKLYN.

Ryerson St and Willoughby Ave, 2-story gymnasium; c, $25,000; o, C M Pratt; a, Boring & Tilton.

DWELLINGS.

Boston, Mass.—Plans have been filed by Archt. F. A. Norcross, 110 Tremont St., for a block of 9 3-story houses to be located on Magnolia St.; estimated cost, $55,000. Owner and builder, J. J. Driscoll, 10 Sewall St.

Bradford, Pa.—Louis Kamper, Miner Bldg., Detroit, Mich., is stated to have been selected to prepare plans for a $50,000 residence to be erected at Bradford for C. A. Unruh.

Pittsburg, Pa.—Alden & Harlow, 314 4th St., are stated to be preparing plans for a residence for F. T. F. Lovejoy to be erected on Braddock Ave., to cost about $300,000.

Atlanta, Ga.—Walter Downing, Equitable Bldg., is the architect for a $20,000 brick residence to be built at once for J. Hunt.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

302 to 356 W 46th St, 6-story br flat; c, $75,000; o, Gottlieb W Karpas; a, G F Pelham.

51st St and Park Ave, 5½-story stone front dwell; c, $40,000; o, Eliz E W Adams; a, Chas Brendon.

5 E 78th St, 5-story stone front dwell; c, $50,000; o, Reginald G Barclay; a, C P H Gilbert.

SCHOOLS.

New York, N. Y.—Bids are wanted Oct. 31 for excavations and foundations for school 132. C. B. J. Snyder, Supt. of School Bldgs.

Cliffside Park, N. J.—Bids are wanted Oct. 27 for the erection and completion of a school. Jos. Turk, West New York, N. J., is the architect. Robt. H. Nutt, Pres. Bd. of Educ. of the Boro.

Allegheny, Pa.—Bids are wanted Oct. 27 for the purchase of Allegheny School Dist. bonds amounting to $125,000. G. W. Gerwig, Secy. High School Com.

York, Pa.—The Bd. of School Control is stated to have decided to erect two schools, one in the 9th Ward, the other in the 10th Ward, at a total cost of about $80,000.

Donora, Pa.—The Donora Lumber Co., of Donora, is stated to have secured the contract for erecting a school at Donora for $60,000.

Washington, D. C.—Gleeson & Humphrey are stated to have secured the contract for erecting an 8-room school on Pierce St. for $36,460.

Paterson, N. J.—The plans of Cook & Bunce are stated to have been accepted for School No. 15, to be erected on Market and Vine Sts., to cost $40,000.

Philadelphia, Pa.—Contracts for school work are stated to have been awarded Oct. 21 by the Property Com. of the Bd. of Educ. as follows: For a 6 division addition to the Manayunk Grammar School, to Chas. O'Neill, 1218 S. Broad St., $25,979; for a 15 division school at 63d St. and Elmwood Ave., to H. A. Miller, 1609 Allegheny Ave., for $74,400; for a 15 division school to replace the Hancock School, 12th St. and Fairmount Ave., to John H. Jordan, 2118 Oxford St., for $73,217, and for an elevator in the Girls' High School, to Stokes & Parrish, Bullitt Bldg., for $9,750.

Hawthorne, N. J.—Bids will be received Oct. 30 by the Bldg. Com. of Bd. of Educ. for erecting a brick and stone school, including ventilating, heating, etc., according to plans prepared by Wm. C. Vermeulen, 228 Market St., Paterson. John G. Whittaker, Chmn.

Georgetown, D. C.—Thos. C. Kennedy, 113 N. Charles St., Baltimore, Md., is stated to be preparing plans for a 3-story brick and stone hall and school building, 63x125 ft., for the Holy Trinity R. C. Church, to cost about $50,000.

Marietta, O.—Bids are wanted Nov. 3 for constructing three schools. L. P. Hill, Clk. Bd. of Educ.

Marion Township, Franklin Co., O.—Bids are wanted until Nov. 7 for $12,000 bonds issued by the Bd. of Educ. Lucien Livingston, Township Clk.

Bangor, Mich.—Sidney J. Osgood, of Grand Rapids, is reported to be preparing plans for a brick school, to cost $20,000.

New Prague, Minn.—It is stated that bids are wanted Nov. 26 for erecting a high school. H. C. Gerlach, Archt., Mankato. Address Jos. T. Topka, Secy. Bd. of Educ.

Des Moines, Ia.—Proudfoot & Bird, Crocker Bldg., are reported to be preparing plans for two buildings Des Moines College will erect next year on its campus on W. 9th and Washington Sts. One will be the main building, to cost $65,000, and the other a gymnasium, to cost $25,000.

Lexington, Ky.—Bids are wanted Nov. 10 for the erection of the Girls' Dormitory. H. S. Barker, Chmn. Bldg. Com., Bd. of Trus. H. L. Rowe, of Lexington, Archt.

Butte, Mont.—Bids will be received Oct. 28 by the Trus. of School Dist. No. 1 of Silver Bow Co. for erecting a 2-story and basement and sub-basement brick and stone school. Henry Mueller, Pres. School Bd.

STREET CLEANING AND GARBAGE DISPOSAL.

Meadville, Pa.—City Engr. W. A. Donne writes that the following bids have been received for the construction of a garbage crematory: International Engineering Co., Bridgeport, Conn., 25-ton furnace, steel stack, $5,750; if brick stack, $5,250; if wooden building, $2,400; if brick building, $4,500, in addition to furnace. Dixon Garbage Furnace Co., Toledo, O., 25-ton furnace, steel stack, $5,250; if wooden building, $2,812.50; brick building and platform, $3,750 in addition. Davis Garbage Furnace Co., Lancaster, Pa., 25-ton furnace, steel stack, $4,650; if brick stack, $5,100; if brick building, 30x40 ft., $4,200 additional; if 2 12½-ton furnaces instead of 1 25-ton, with brick stack, $7,400; steel stack, $6,900; brick building, $4,200 additional as before.

Utica, N. Y.—The contract for the removal of ashes and street dirt has been awarded to Wm. Pritchard, the present contractor, his bid being $37,685 for 5 years.

Cincinnati, O.—The Bd. of Pub. Service has approved an ordinance providing for the issue of $37,000 bonds to pay for the collection and disposal of garbage under the contract with the Cincinnati Reduction Co.

Milwaukee, Wis.—The American Underwriting Co. of Boston has, according to local press reports, made a proposition to buy the garbage crematory of the city and operate same without cost to city, the city to pay for collection and transportation of garbage.

Oakland, Cal.—An ordinance before the Council provides for the purchase by the city of a garbage crematory plant from the Pacific Odorless Incinerator Co. for the sum of $35,000.

The City Council has authorized the expenditure of $45,000 for sprinkling streets, and an expenditure of $12,000 for cleaning gutters and portions of streets.

GOVERNMENT WORK.

Boston, Mass.—The following bids were opened Oct. 18 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging at the Navy Yard, Boston, about 90,000 cu. yds.; estimated cost, $22,500: Bay State Dredging Co., Boston, 34½ and 45c. per cu. yd; C. H. Southern, Boston, 34¼ and 45c. per cu. yd.; Eastern Dredging Co., Portland, Me., 29 7/10 and 44 7/10c. per cu. yd.

Newport, R. I.—Bids are wanted Nov. 26 for a water supply and storage system at the U. S. Naval Coal Depot, Narragansett Bay. R. B. Bradford, Ch. of Bureau of Equipment, Navy Dept., Washington, D. C.

Washington, D. C.—Bids are wanted Nov. 15 for freight elevator door frames for the new building for Government Printing Office, as advertised in The Engineering Record.

Ft. Wadsworth, N. Y.—Bids are wanted Nov. 7 for building one set of quarters here. Lieut. Geo. L. Hicks, Jr., Q. M.

Pittsburg, Pa.—Bids are wanted at the U. S. Engineer Office until Nov. 22 for building a lock, 2 guide walls, a guard crib and abutment for dam at Six-mile Island, Allegheny River, as advertised in The Engineering Record.

New York, N. Y.—The following bids were opened Oct. 20 by Col. S. M. Mansfield, Corps of Engrs., U. S. A., for the removal of rock and stone at certain harbors:

Bidders and Addresses.	Larchmont Harbor. 336 c. y. rock.	Larchmont Harbor. 2,300 tons stone.	Echo Bay, 1,100 c. y. rock.	Total.
P. Sanford Ross, Inc., Jersey City	$11.00	$2.00	$10.00	*$19,296
J. J. McSpirit, Jersey City	16.00	.65	13.75	21,996
R. G. Packard Co., N. Y. City	17.00	1.50	17.00	27,862
Dunbar & Sullivan, Buffalo	12.00	2.00	12.00	21,832
J. J. Fitzpatrick, Plattsburg, N. Y.	11.87	1.59	11.87	20,702
H. H. Sturgis, S. Standish, Me.	9.37	2.10	10.37	19,385

*Contract awarded. The contract for removing 1,500 cu. yds. of rock at Saugerties Harbor (bids opened Oct. 20) has been awarded to R. G. Packard Co., New York City, at $5.30 per cu. yd.

Philadelphia, Pa.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., Nov. 4, to furnish the Navy Yard, League Island, Pa., with a quantity of cement; also for erecting a storehouse at Naval Magazine, Ft. Mifflin, Pa. A. S. Kenny, Paymaster Gen., U. S. Navy.

Washington, D. C.—Bids will be received Nov. 18 at the Bureau of Supplies and Accounts for furnishing at the Navy Yard, Puget Sound, Wash., a quantity of railroad material, electrical supplies, etc., and for the erection and installation of electric generating and distributing plant. A. S. Kenny, Paymaster Gen., U. S. Navy.

Charleston, S. C.—The Navy Department, Washington, has awarded a contract for building the first granite and concrete dry dock at Charleston Navy Yard to the New York Continental Jewell Filtration Co., at about $916,000.

Savannah, Ga.—The lowest bid received Sept. 27 by Capt. Cassius E. Gillette, Corps of Engrs., U. S. A., for repairing and adding to Mackay's Point training wall, Savannah Harbor, was from D. Power & Co., Savannah, as follows: Piling (common), 5,400 lin. ft., at 5 cts.; piling (cluster), 330 lin. ft., at 7 cts.; pile-driving, 2,700 lin. ft., at 9 cts.; mercht. timber, 12,000 ft. B. M., at $30; brush in bundles, 2,000 cu. yds., 51 cts.; stone, 1,800 cu. yds., $2.25; iron, 2,000 lbs., 4 cts.; total, $6,046. Other bids were from Egan Smith & Co., of Jacksonville, at $9,795, and Sam. W. Skinner, Wilmington, N. C., at $9,889.

Muskegon, Mich.—The lowest bid opened Oct. 15 at the U. S. Engineer Office, Grand Rapids, for constructing revetment and repair of pier at Muskegon was from Robert Love, of Muskegon, at $52,317.

Jeffersonville, Ind.—Bids are wanted Oct. 30 at the Depot Q. M. Dept. for supplies, including circulating boilers, sheet zinc, etc. J. M. Marshall, Asst. Q. M. Gen.

Fergus Falls, Minn.—The contract for the constructing of the U. S. Government Bldg. in this city is stated to have been awarded to Lauritzen Bros., of Fergus Falls, for $80,073.

Ft. Morgan, Ala.—Bids are wanted at the U. S. Engineer Office, Mobile, until Nov. 22 for raising and strengthening sea wall at Ft. Morgan, as advertised in The Engineering Record.

St. Louis, Mo.—The contract for the structural steel work for the Government Bldg. at the Louisiana Purchase Expo. is stated to have been awarded to the Penn Bridge Co., of Beaver Falls, for $102,570.

Nashville, Tenn.—Bids are wanted Nov. 24 for building dredge. Lieut. Col. M. B. Adams, Corps Engrs., U. S. A.

Boise, Idaho.—Bids are wanted at the Treasury Dept., Washington, D. C., until Nov. 25 for the installation of a conduit and electric wiring system for the U. S. Public Bldg. at Boise; bids are also wanted Nov. 29 for steam heating and ventilating apparatus for said building, as advertised in The Engineering Record.

Aberdeen, S. D.—The contract for constructing the U. S. Post Office Bldg. is stated to have been awarded to E. Miller & Co., Aberdeen, for $136,400.

MISCELLANEOUS.

Hartford, Conn.—The Bd. of St. Comrs. will receive bids Oct. 29 for 600 ft. of concrete culvert, 10 ft. in diameter, with necessary excavation, partly in rock.

New York, N. Y.—The following bids were opened Oct. 17 at the Dept. of Docks and Ferries for (*a*) rebuilding and extending W. 58th St. pier and (*b*) dredging thereat: Degnon-McLean Const. Co.: *a*, $83,426; *b*, 22 cts. Bernard Rolf, 39 Cortlandt St. (awarded): *a*, $73,333; *b*, 16 cts. H. L. Spearon: *a*, $75,608; *b*, 14 cts. Augustin Walsh: *a*, $83,000; *b*, 20 cts. Wm. H. Jenks: *a*, $78,442; *b*, 14 cts.

Bids opened at the same time for dredging on the North River, between the Battery and 159th St., were as follows: Henry DuBois Sons' Co., 17 State St. (awarded), 14 9/10 c. per cu. yd.; Wm. H. Beard, 18c.; W. H. Taylor, 15¾c.

Watervliet, N. Y.—Bids are wanted Oct. 29 for cleaning out culverts in Dry River, and repairing wing wall at 18th St. culvert. Luhr Eggles, City Clk.

New York, N. Y.—Bids will be received Nov. 3 by McDougall Hawkes, Comr. of Docks, for dredging in the North River between W. 21st and 23d Sts.

Brooklyn, N. Y.—J. M. Briggs was the lowest bidder Oct. 23 for building shore protection at the end of Ocean Parkway at Coney Isl. Concourse, his bid being $15,590.

Syracuse, N. Y.—Bids are wanted Nov. 1 for $50,000 Onondaga Creek improvement bonds; also on same date for $10,000 Harbor Brook improvement bonds. E. J. Mack, Compt.

Baltimore, Md.—Local press reports state that the Baltimore & Ohio R. R. Co. has invited bids for the steamship pier to be erected at Locust Point, at this port. This improvement will represent an outlay of about $500,000; length of pier to be over 500 ft., with two decks.

Milwaukee, Wis.—Local press reports state that the dry docks of the Milwaukee Dry Dock Co. (J. C. Wallace, Gen. Mgr.), at the foot of Mineral St. and on Vogel's Island, are soon to be enlarged at an estimated cost of $100,000.

New Orleans, La.—T. J. Duggan, Secy. Orleans Levee Dist., writes that the contract for reconstructing the levee from Clouet to Pauline Sts., 3d Dist. of this city, has been awarded to W. T. Carey & Bro., of New Orleans, for $23,496.

NEW INDUSTRIAL PLANTS.

The Compensating Pipe Organ Co., Ltd., Battle Creek, Mich., is being organized, and will erect a 300x60-ft. main building, with smaller buildings for engine, boilers, packing and dry kilns. A 150-H.-P. engine, two 100-H.-P. boilers and wood-working machinery will be installed.

The Mitchell Wheel Co., Miamisburg, O., will erect a 300x70-ft. main building, with dry-houses, warehouses, etc. Engine and boilers of 200 H.-P. will be installed.

The Graham Foundry & Machine Co., Monongahela, Pa., will be reorganized and incorporated, and a new plant will be erected. The company will require considerable new equipment, and desires catalogues and price lists from manufacturers.

The Kalispell (Mont.) Malting & Brewing Co. is planning to double the capacity of its plant and install an ice machine.

R. S. Fram, Vandalia, Ill., is interested in the erection of a paper mill, which will include buildings of the following sizes: 25x100, 40x50, 20x35, 35 ft. square, and 30 ft. square. Four 16-ft. boilers of 60-in. diameter, having a capacity of 320 H.-P., a 200-H.-P. Corliss engine and a 25-H.-P. slide valve engine will be installed.

The Miller-Lewis Co., Columbus, O., manufacturing stationers, are erecting a 2-story brick factory, to be equipped with elevator, electric lighting and individual direct-current motors at 220 volts for the machines.

The Geneva (N. Y.) Woven Label Works is erecting 56x90 and 24x30-ft. buildings. Electric power of about 30 H.-P., purchased from a local company, will be required.

The White Enamel Refrigerator Co., St. Paul, Minn., has purchased a brick building about 191x267 ft. in size at Midway, which it is remodeling, and the company is also erecting a 64x200-ft. warehouse. The factory will be supplied with electric power and light and steam heat.

The Camden (S. C.) Water, Light & Ice Co. will rebuild its ice plant, and is in the market for a 15-ton plant.

The Pacific Coast Pipe Co., Spokane, Wash., will erect a 100x200-ft. building to replace plant recently burned. The new plant will have a daily capacity of 3,000 to 5,000 ft. of pipe, and will be enlarged by a brick addition in the spring.

The Southern Steel & Smelting Co., 2 N. Paca St., Baltimore Md., contemplates erecting a smelting plant in the near future.

The Barnard & Leas Mfg. Co., Moline, Ill., maker of mill and elevator machinery, expects to erect a new foundry soon, but details are undecided.

The Seaboard Steel Casting Co., Chester, Pa., will increase the capacity of its plant about one-third, adding a steel building, connected to the main foundry, for storing flasks, and equipped with a traveling crane; a large drying oven; 25-ton furnace; about 50 ft. to the machine shop, and install additional tools to increase the finishing department. Another traveling crane will be installed in the machine shop.

M. Gould's Son & Co., 61-63 Hamilton St., Newark, N. J., makers of trunk hardware and brass goods, are erecting a 4-story, 50x120-ft. building and expect to install a 25-H.-P. gas engine, a 200-light dynamo, three or four drop presses, three or four cutting power presses and exhaust tumbling barrels.

BUSINESS NOTES.

The York (Pa.) Mfg. Co. reports receiving the following orders: Frank Banard, Castries, W. I., 5-ton ice plant; People's Pure Ice Co., Chicago, 65-ton refrigerating plant; Marlin (Tex.) Ice & Cold Storage Co., 30-ton ice plant; Pelican Ice Co., New Orleans, La., 75-ton ice plant; Miller Brewing Co., Rochester, N. Y., 100-ton refrigerating machine; Retail Grocers' Ice Co., Little Rock, Ark., 50-ton ice plant; Gardeners' & Shippers' Ice Co., New Orleans, 25-ton ice plant; Mt. Vernon (Ohio) Ice, Coal & Milling Co., 25-ton ice plant; Border City Ice & Coal Co., 50-ton ice plant; Liberty Brewing Co., Springfield, Mass., two 65-ton refrigerating machines; J. T. Jones, Gulfport, Miss., 15-ton ice plant; Butler (Pa.) Ice Co.; S. Castleman, Belzona, Miss., 15-ton ice plant; People's Ice & Fuel Co., Charlotte, N. C., 30-ton freezing and distilling plant; J. Frederick Weissner, 10-ton freezing system; Belle Springs Creamery Co., Abilene, Kan., 40-ton refrigerating machine and 12-ton freezing and distilling system; Durban (South Africa) Breweries & Distilleries Co., 12-ton freezing outfit.

The Ball Engine Co., Erie, Pa., reports the recent receipt of the following orders: Engines for the electric plant of the Temple Court Bldg., Denver, Colo.; two engines for the John Deere Plow Co., Kansas City, Mo.; an engine for an electric plant at Wilburton, Ind. T.

N. A. Christensen, Herman Bldg., Milwaukee, Wis., has now control of the manufacture of his air compressors, except those connected with air brakes exclusively, which will be manufactured by the Christensen Engineering Co., of which he was formerly superintendent and is still consulting engineer.

The Columbian Cordage Co., Auburn, N. Y., has recently contracted with Westinghouse, Church, Kerr & Co. for a generating equipment, comprising water-tube boilers, Roney stokers, economizers, mechanical draft, coal-handling apparatus and high-pressure steam piping. The present boiler plant contains five water-tube boilers, hand fired, operating at 100 lbs. pressure. The new plant will contain 1,575-H.-P. boiler capacity, and the transformation will take place without disturbing the operation of the plant. The present brick chimney will be retained and used in connection with the mechanical draft apparatus, as it is necessary to provide means to elevate to a suitable height the waste acid gases resulting from the various chemical processes of rope manufacture.

The Electrical Equipment Co., 939 Monadnock Bldg., Chicago, has been awarded a contract for the installation of a lighting plant for the City of Washington, Ia. The equipment includes a Westinghouse three-phase 60-cycle generator, direct-connected to an Ideal engine. Work is now under way, and the plant will be in operation about Jan. 1. The same company has also been awarded a contract for the installation of a water-power electric transmission plant for the Rouge River Light & Power Co. at Rockford, Mich. The equipment includes two General Electric generators and various motors ranging in size from 10 to 50 H.-P. The plant will be in operation Dec. 1, 1902.

The Keystone Coal & Coke Co., Greensburg, Pa., has contracted with Wm. B. Scaife & Sons Co., Pittsburg, for a large filtering plant for their waterworks at Madison, Pa. Among other recent contracts taken for the Scaife and We-Fu-Go water-filtering systems are the following: W. D. Boyce Paper Co., Marseilles, Ill., 1,000,000 gals.; Thomas Phillips Co., Akron, O., 750,000 gals.; Carroll Hotel, Vicksburg, Miss., complete filtering system.

The Philadelphia Pneumatic Tool Co. states that the sales for September have amounted to 20 per cent. more than any previous month. During the current month the monthly record for foreign shipments has already been broken, large orders having been received from Great Britain, Germany, France, Italy and Denmark.

The Stanley Electric Mfg. Co. has recently opened a sales office in the Empire Bldg., Atlanta, Ga., to take care of the increasing demand for apparatus in the South. The office is in charge of George P. Hardy.

The Dixon Garbage Crematory Co., Toledo, O., has just completed the construction of a new garbage crematory plant for the Quartermaster's Department of the U. S. Army at the San Juan Post.

The New England Structural Co., Boston, is building foot-bridges for the Pemberton Mills, Lawrence; Forbes Lithograph Mfg. Co., Revere; and the Ipswich Mills Co.

The F. D. Cummer & Son Co., Cleveland, has just closed a contract with the Midland Portland Cement Co., Indianapolis, Ind., for three dryers; one for coal, one for stone, and one for clay.

The Goodall Worsted Co., Sanford, Me., is building a large addition to its present works, and has purchased from the Westinghouse Electric & Mfg. Co., a 400-Kw., two-phase, alternating-current generator which will be belted to an 800-H.-P. Brown engine. The generator will furnish power to all departments of the plant by means of Westinghouse induction motors, and will also provide current through transformers for lighting at 104 volts.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Oct. 27.	Bradford, Pa.	Oct. 25
Oct. 28.	Columbus, O.	Oct. 25
Oct. 28.	Tank and tower, Truman, Minn.	Oct. 18
Oct. 28.	Ft. McRee, Fla.	Oct. 11
Oct. 29.	Moline, Ill. Adv., Eng. Record, Sept. 27 to Oct. 25.	Sept. 27
Oct. 30.	Kiester, Minn.	Oct. 18
Oct. 30.	Westbrook, Minn.	Oct. 18
Oct. 31.	Hamilton, Ont.	Oct. 11
Nov. 1.	Irrigation plant, Vinton, La.	Oct. 18
Nov. 1.	Miami, Ind. Ter.	Oct. 11
Nov. 3.	Sullivan, Ill.	Oct. 25
Nov. 4.	La Junta, Colo.	Oct. 25
Nov. 4.	Gueydan, La.	Oct. 4
Nov. 5.	Lawton, Okla. Ter.	Oct. 11
Nov. 7.	Fremont, O.	Oct. 25
Nov. 8.	Pipe, etc., Bremerton, Wash.	Oct. 11
Nov. 8.	**Pumping plant, Brockton, Mass.** Adv., Eng. Record, Sept. 27, Oct. 4.	**Sept. 27**
Nov. 26.	Newport, R. I.	Oct. 25
Dec. 1.	**Pumpa, Seguin, Tex.**	**July 26**
Dec. 20.	Pumping engines, Louisville, Ky. Adv., Eng. Record, Oct. 25.	Oct. 25
	SEWERAGE AND SEWAGE DISPOSAL.	
Oct. 28.	Columbus, Neb.	Oct. 18
Oct. 28.	Ft. McRee, Fla.	Oct. 11
Oct. 28.	Binghamton, N. Y.	Oct. 11
Oct. 28.	Cincinnati, O.	Oct. 4
Oct. 29.	Niles, O.	Oct. 18
Oct. 29.	Brooklyn, N. Y.	Oct. 11
Oct. 30.	Columbus, O. Adv., Eng. Record, Oct. 18, 25.	Oct. 18
Oct. 30.	Cleveland, O.	Oct. 11
Oct. 31.	Buffalo, N. Y.	Oct. 25
Oct. 31.	Ft. Smith, Ark.	Oct. 25
Nov. 1.	Port Huron, Mich.	Oct. 25
Nov. 1.	Akron, O.	Oct. 25
Nov. 3.	Toledo, O.	Oct. 25
Nov. 3.	Ottumwa, Ia.	Oct. 25
Nov. 4.	Bessemer, Ala.	Oct. 18
Nov. 5.	Jamesburg, N. J.	Oct. 25
Nov. 5.	Westfield, Mass. Adv., Eng. Record, Oct. 18.	Oct. 18
Nov. 6.	Nashville, Tenn.	Oct. 11
Nov. 8.	Roselle Park N. J.	Oct. 18
Nov. 11.	Oneida, N. Y.	Oct. 25
Nov. 15.	Washington, D. C. Adv., Eng. Record, Oct. 25.	Oct. 25
Nov. 15.	Akron, O.	Oct. 25
Dec. 15.	**Montevideo, Uruguay**	**Sept. 13**
	BRIDGES.	
Oct. 28.	San Jose, Cal.	Oct. 25
Oct. 29.	Anderson, Ind.	Oct. 25
Oct. 29.	Indianapolis, Ind.	Oct. 25
Oct. 31.	Hilo, Hawaii	Oct. 18
Nov. 1.	Newtown, Pa.	Oct. 25
Nov. 3.	Salem, Ind.	Oct. 25
Nov. 3.	Crawfordsville, Ind.	Oct. 25
Nov. 3.	Demotte, Ind.	Oct. 25
Nov. 5.	Cordova, Ala.	Oct. 11
Nov. 5.	Chicago, Ill.	Sept. 6
Nov. 6.	Chehalis, Wash.	Oct. 25
Nov. 6.	Indianapolis, Ind.	Oct. 18
Nov. 7.	New Castle, Ind.	Oct. 25
Nov. 10.	Chillicothe, O.	Oct. 25
Nov. 10.	Washington, Ind.	Oct. 25
Nov. 10.	Topeka, Kan.	Oct. 18
Nov. 13.	Shreveport, La. Adv., Eng. Record, Oct. 25.	Oct. 25
Nov. 14.	Paulding, O.	Oct. 25
Dec. 1.	**Bigtimber, Mont.**	**Sept. 27**
———	Lake Charles, La.	Oct. 25
	PAVING AND ROADMAKING.	
Oct. 28.	Cincinnati, O.	Oct. 4
Oct. 29.	Indianapolis, Ind.	Oct. 25
Oct. 29.	Elkhart, Ind.	Oct. 18
Oct. 29.	Cincinnati, O.	Oct. 18
Oct. 29.	Brooklyn, N. Y.	Oct. 18
Oct. 30.	Boise, Idaho	Oct. 25
Nov. 3.	Toledo, O.	Oct. 4
Nov. 3.	Vincennes, Ind.	Oct. 11
Nov. 4.	Hammond, Ind.	Oct. 25
Nov. 12.	Cincinnati, O.	Oct. 18
Nov. 15.	Akron, O.	Oct. 25
Dec. 1.	Delphi, Ind.	Oct. 25
Dec. 22.	Portsmouth, Va. Adv., Eng. Record, Oct. 18, 25.	Oct. 18
	POWER, GAS AND ELECTRICITY.	
Oct. 28.	Chattanooga, Tenn. Adv., Eng. Record, Sept. 13 to Oct. 11.	Sept. 13
Oct. 29.	Winnsboro, S. C.	Oct. 25
Nov. 1.	Effingham, Kan.	Oct. 25
Nov. 1.	Miami, Ind. Ter.	Oct. 11
Nov. 1.	**Macon, Ga.**	**Aug. 30**
Nov. 6.	Akron, O.	Oct. 25
Nov. 15.	Baton Rouge, La. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 15	Norfolk, Va.	Sept. 13
Nov. 18.	Superior, Wis.	Oct. 25
Nov. 18.	Washington, D. C.	Oct. 25
Jan. 15.	Rome, Ga.	Oct. 11
	GOVERNMENT WORK.	
Oct. 28.	Ft. McRee, Fla.	Oct. 11
Oct. 29.	Ft. Yates, N. D.	Oct. 11
Oct. 29.	(Ft. Greble) Newport, R. I. Adv., Eng. Record, Oct. 11, 25.	Oct. 11
Oct. 29.	Chicago, Ill. Adv., Eng. Record, Oct. 4 to 25.	Oct. 4
Oct. 29.	**Pier, Manistee, Mich.** Adv., Eng. Record, Sept. 27 to Oct. 25.	**Sept. 27**
Oct. 30.	Jeffersonville, Ind.	Oct. 25
Oct. 30.	Wheeling, W. Va. Adv., Eng. Record, Oct. 4 to 25.	Oct. 4
Oct. 30.	Dredging, Boston, Mass. Adv., Eng. Record, Sept. 20 to Oct. 25.	Sept. 20
Oct. 31.	Dredging, Norfolk, Va. Adv., Eng. Record, Oct. 11, 25.	Oct. 4
Nov. 1.	Shreveport, La.	Oct. 18
Nov. 1.	Bldg. at Navy Yard, Philadelphia, Pa.	Oct. 11
Nov. 1.	Quay Wall, San Francisco, Cal.	Oct. 11
Nov. 1.	West Point, N. Y. Adv., Eng. Record, Sept. 20 to Oct. 25.	Sept. 20
Nov. 1.	Light-house, Philadelphia, Pa. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Nov. 4.	Philadelphia, Pa.	Oct. 25
Nov. 4.	Htg Hosp., Flandreau, S. D.	Oct. 11
Nov. 4.	Cheyenne, Wyo. Adv., Eng. Record, Oct. 4, 11.	Oct. 4
Nov. 5.	Floor in Post Office, New York, N. Y. Adv., Eng. Record, Oct. 11, 18.	Oct. 11
Nov. 6.	Breakwater, Cleveland, O. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 6.	Entrance to harbor, Cleveland, O. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 6.	Chicago, Ill.	Oct. 11
Nov. 7.	Ft. Wadsworth, N. Y.	Oct. 25
Nov. 7.	Ft. Monroe, Va.	Oct. 18
Nov. 8.	(Ft. Greble) Newport, R. I. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 8.	Completing Post Office, Chicago, Ill.	Oct. 11
Nov. 8.	Water mains, Bremerton, Wash.	Oct. 11
Nov. 10.	Ft. Banks, Winthrop, Mass.	Oct. 18
Nov. 10.	Ft. Ethan Allen, Vt. Adv., Eng. Record, Oct. 18, 25.	Oct. 18
Nov. 10.	La Purchase Expo. Bldgs., St. Louis, Mo. Adv., Eng. Record, Oct. 11, 18.	Oct. 11
Nov. 10.	(Lemon Creek) New York, N. Y. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 10.	Newport, R. I. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 10.	(Raritan Bay) New York, N. Y. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 10.	(Woodbridge Creek) New York, N. Y. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
Nov. 10.	Removal of ledge, New York, N. Y. Adv., Eng. Record, Oct. 11 to 25.	Oct. 11
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Nov. 12.	**Charleston, S. C.** Adv., Eng. Record, Oct. 4 to 18.	**Oct. 4**
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THE ENGINEERING RECORD.

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Some Peculiarities of Industries.

In the investigations of the census bureau a good many curious facts are brought to light which would otherwise be buried in local histories. Some of these facts relating to the localization of industries have been compiled by Dr. Frederick S. Hall, and some of his statements are full of interest as showing how other causes than the presence of cheap raw materials or good shipping facilities have caused certain trades to become localized in small cities or country districts. These two factors have been potent in many cases, of course, and even Chicago enterprise could not take from Baltimore its precedence in oyster canning nor could Yankee thrift compete in coke making with the Connellsville district. But in some lines of manufacture, the history is simply a record of the result of a mere chance.

A good instance of the result of chance is afforded by Lynn's position in the shoe trade. It is the result of one Adams Dagyr's choice of that place as a home in 1750. He was a skilled Welsh shoemaker who trained his apprentices so well than in 1764 he was termed "the celebrated shoemaker of Essex." His influence was all-important in causing the manufacturing spirit of his town to lean toward his specialty, and it is not surprising, therefore, that in a calling where skilled labor was the most important element of manufacture until a comparatively few years ago, Lynn occupies a prominent place. Over 40 per cent. of the products of the city, on the basis of value, are boots and shoes, the proportion being exceeded only in Brockton, with 75 per cent., and Haverhill, with 61 per cent.

The inventive genius of a woman is responsible for the most localized industry in the country, and the fact that this woman was the wife of a blacksmith of Troy has given that town the distinction of being the first city of the country in the collar and cuff industry. We can imagine the value of detachable collars and cuffs would appeal strongly to the wife of the village smith. but it is a little surprising to learn that the great business behind such an idea was first scented by a Methodist minister, who established the first collar and cuff shop in the town about three-quarters of a century ago. Manual skill is necessary in this industry, and the large supply of specially skilled labor in Troy has localized the manufacture in that city, which now produces 85.3 per cent. of the total product of the country.

The glove manufacturing of the country was localized by the barter of a country glove maker. About the middle of the eighteenth century, Sir William Johnson brought many Scotch families to his great estate in New York, and among them were some members of the glove guild of Scotland. They brought the simple implements of their trade with them and taught their children the trade. It never amounted to anything, however, until about 1809, when a quantity of gloves were sent on horseback to Albany. They sold readily and a demand for them soon arose which fixed Gloversville and Johnstown as the centers of the industry. Skilled labor thus became abundant there, and, as this is the decisive element of the industry, English, French and German glove makers establishing branches in this country have settled in those two towns, which now produce over 54 per cent. of all the leather gloves made in the country.

One of the most interesting examples of localization is afforded by the knit-goods industry, in which Philadelphia, Cohoes and Amsterdam are the leading centers. In Philadelphia the first start was made in 1698 when a large number of skilled hand knitters from the German Palatine settled in Germantown. The industry was fixed at Cohoes in 1832 when Egbert Egberts of that place invented the first power knitting machine; the abundant water-power at the town made the use of the machine very profitable. The neighboring town of Amsterdam likewise possessed a valuable water-power, and it was not long before the knitting industry was firmly established there as well. There is a further localization to be mentioned in this connection, moreover, for Philadelphia knitters manufacture hosiery almost exclusively, while underwear and other knit goods are the chief products of Cohoes. An analogous condition is found in the boot-and-shoe industry; Brockton makes men's shoes, Lynn ladies' shoes and Haverhill shoes for young people and children.

The pottery trade centers at Trenton and East Liverpool, a fact that illustrates the prevalence of the law of heredity in manufacturing as well as in natural history. Skilled labor from abroad settled at both these points, where coarse pottery was already made from local deposits of clay. The industry is one in which skilled handwork prevails to an unusual degree, and the advantage of possessing this labor was increased in the case of the two cities mentioned by facilities for water transportation and proximity to coal supplies. The manufacture of porcelain and other fine-grade pottery was undertaken, and the industry so firmly established that these two places remain its centers, although the clay used in Trenton for the purpose is brought more than 50 miles and none of that used for the fine product of East Liverpool is found within hundreds of miles of the city. The demand for sanitary porcelain in New York and Philadelphia has stimulated its manufacture at Trenton, while many of the East Liverpool makers specialize in fine chinaware.

Localization of this nature is peculiar neither to the present time nor this country. An English book of the thirteenth century tells of the localization of scarlet cloth in Lincoln, burnet at Beverly, russet at Colchester, needles at Wilton and razors at Leicester. In Russia there are now over 500 villages devoted to various branches of woodworking, in one village practically nothing being made except spokes for the wheels of vehicles, in another nothing but the bodies, and so on.

These few instances of specialization and localization of industries from other causes than proximity to raw material, good shipping facilities or abundant water power are particularly interesting because of the probability that another ten years will see changes in the census figures far greater than any yet recorded. Combinations of one sort or another are taking place in so many industries that the managers will soon be in possession of statistics showing definitely where certain classes of goods can be made best. At these places, consequently, there will probably be a specialization or localization beyond anything yet witnessed, while other places will lose industries for which they have long been noted. This will work hardship to many operatives and mechanics who must change their homes or go into other trades, but the result will eventually be beneficial. The manufacture of agricultural machinery, largely in the hands of a few great firms, has become localized on these grounds in places where freight rates and proximity to hardwood timber have shown that the products are turned out and shipped with the least expense. The same thing is taking place quietly but extensively in the iron and steel trade, while its occurrence in the furniture business is so recent and marked as to require no comment. It is full time to recognize that native shrewdness and manufacturing skill have to face now a new competition in the enormously valuable statistics which uniform systems of accounting place at the disposal of the managers of combinations of manufacturing plants of a similar nature.

Construction on the Louisiana Purchase Exposition grounds is making good progress, according to a recent report of Director of Works Taylor. Of the nine buildings which are to form the main group of the fair, seven are in course of erection. The Manufactures Building has recently been contracted for, and the Transportation Building, it is anticipated, will be put under contract very shortly. There are now about 8½ miles of railway and spur tracks on the grounds. In connection with the landscape work 127 large trees, from 9 to 16 inches in diameter, were transplanted, and, with the exception of 8 or 10, all have grown remarkably well.

The Atlanta Water & Electric Power Company has begun the construction of works for the development of nearly 20,000 horse-power at a point on the Chattahoochee River about 16 miles from Atlanta. It is estimated that the plant will cost $1,500,000 and will require about eighteen months for construction. The principal features of the work will be a concrete dam across the river 50 feet high and about 1,100 feet long and a power house of concrete steel construction 200 feet long. The equipment will consist of seven 1,500-kilowatt generators, each direct-connected to a pair of turbines with a maximum capacity of 2,500 horsepower under a head of 50 feet. The electrical machinery is being supplied by the Westinghouse Company. The hydraulic machinery will be furnished and the dam and power house built by the S. Morgan Smith Company, of York, Pa. At the present time about 250 men are employed upon the construction of cofferdams and erection of cableways. There are to be three cableways across the stream to be used in depositing the 60,000 cubic yards of concrete masonry. Mr. S. Morgan Smith, of York, Pa., is president of the company, and Mr. Forest Addair, of Atlanta, is vice-president.

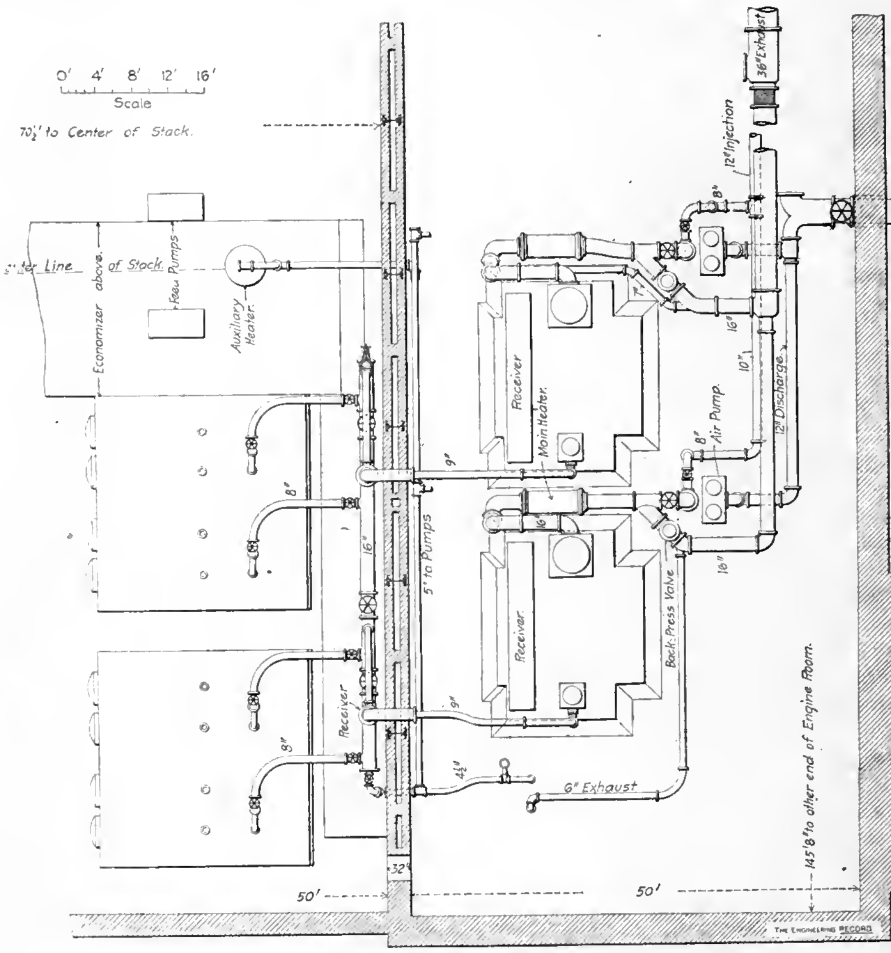
Power Plant of the Cambridge Electric Light Company, Cambridge, Mass.

The Cambridge Electric Light Company has recently completed a distinctly modern electric lighting and power plant, on Western Avenue near the Charles River, in Cambridge, Mass. The new plant is an alternating-current one with a three-phase 60-cycle supply furnished from direct-connected vertical compound condensing generating units, of which the steam engines are to receive superheated steam. In addition to both main and auxiliary feed-water heating, economizers have been provided, to utilize the heat of the flue gases. Among other notable features of the plant may be mentioned the lofty character of the building, which has resulted in well lighted and ventilated boiler and engine rooms, an unusually light basement under the engine room, due to numerous outside windows in that story and to several openings in the engine room floor, the use of a traveling crane in the boiler room as well as in the engine room, and an extensive provision of special pipe hangers to allow for expansion changes in practically all classes of piping. The old plant, near which the new one has been built, had been outgrown by a rapidly increasing business and is to be entirely dismantled.

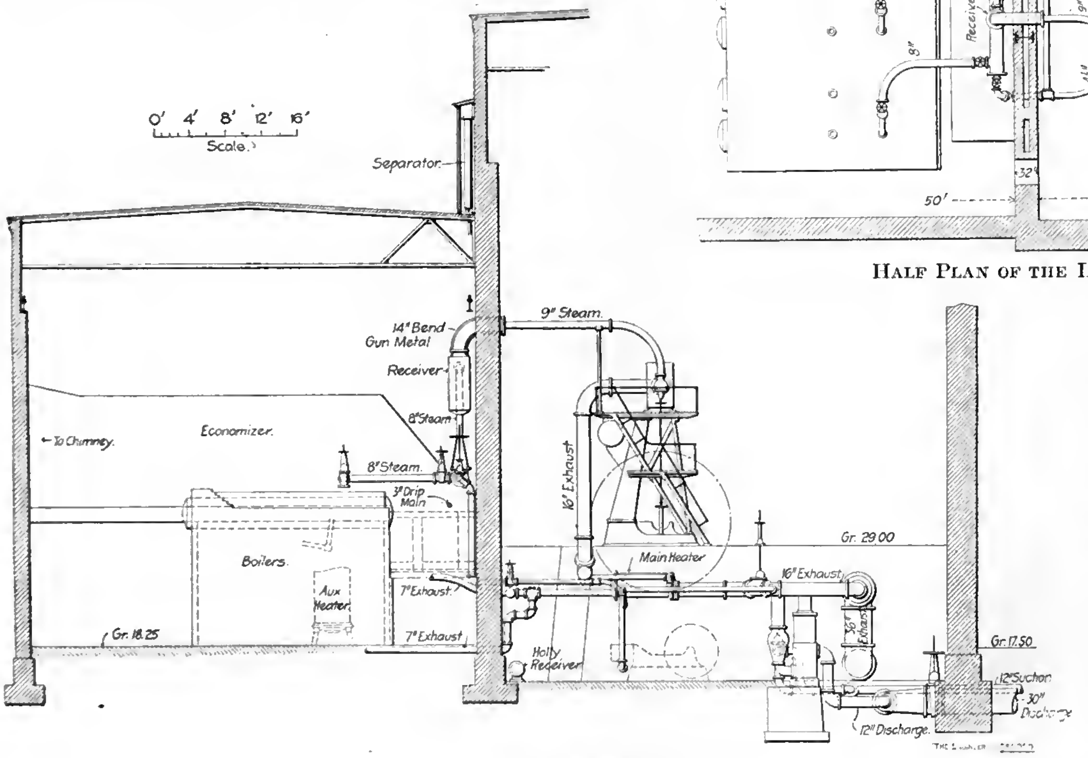
The power house is a steel frame building with brick walls and a timber roof supported by steel trusses. The street walls of the building are built with an enclosed air space of 8 inches, and are faced on the outside with a cut-stone base course and surmounted at the roof by a heavy balustrade. In main dimensions the building is 106 feet x 151 feet 4 inches and is of the class in which the engine and boiler rooms are side by side, the longitudinal partition being composed, similarly to the street walls, of two 12-inch walls with 8 inches air space between. The boiler and engine rooms are of the same width, 50 feet, and are 145 feet 8 inches long, but if desired, one end wall may be torn down and indefinite extension made. The floor of the engine room is 10 feet 9 inches above the level of the boiler room floor, and the basement floor 4 feet 3 inches below it, leaving a clear height in that story of 13 feet 8 inches. In the boiler room, the lower chord of the roof trusses is 41 feet 9 inches above the boiler room floor; in the engine room, the distance is about 52½ feet. In the case of each room, the roof has a large monitor, and in the engine room, in addition, there is a row of windows in the upper part of the main walls above the main windows. The interior walls of the boiler room are of red glazed brick for perhaps the first ten feet, and are painted white above; the under side of the roof is white, while the roof trusses are painted green. The floors are all of cement. The cranes are 25-ton hand-power Maris traveling cranes.

The boiler room contains two batteries of Babcock & Wilcox water-tube boilers, two boilers in each battery. There is space for a future installation of two similar batteries in the present building. Located in the center of the present boiler room are two boiler feed pumps, the auxiliary feed-water heater and the economizer, the latter supported overhead, so that the floor space underneath could be utilized for the pumps and heater. Incidentally the flue gases do not have to be carried downward in their passage from the boilers to the stack, which rises outside of the building as an entirely independent structure.

Each boiler contains 192 4-inch tubes 18 feet long, arranged in 16 sections 12 pipes high, and two 42-inch steam drums 23 feet 3⅝ inches long. They were built to carry 200 pounds pressure, and the steam connections are made so that before entering the steam header all the steam from each boiler must pass through a superheating coil which contains 125 square feet of heating surface. Grates have been provided for burning soft coal, and the grate surface in each boiler is 67.6 square feet, bearing a ratio to the total heating surface of each boiler, which is 3,964.5 square feet, of 1 to 58.7. No provision has yet been made for mechanically handling coal, as it is conveniently brought to the boiler house by water.



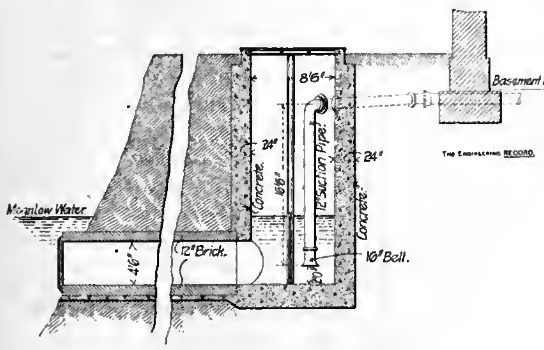
HALF PLAN OF THE LIGHTING STATION.



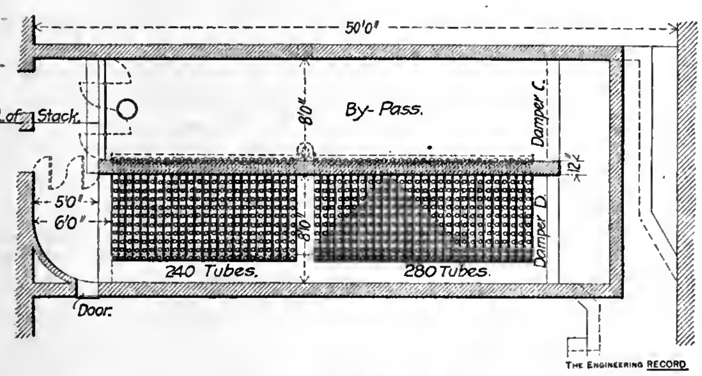
CROSS-SECTION OF THE STATION.

The smoke passage is located immediately behind the boilers and is of brick, its floor and ceiling consisting of arches sprung between light I-beams that extend from the partition wall to the boiler setting. The wall of the passage back of the boilers is 12 inches thick. The floor and the roof above the ceiling arches are both covered level with Portland cement mortar, composed of equal parts of sand and cement, with the mortar 4 inches thick above the I-beams in the floor construction. The inside area of the smoke duct is constant its entire length, 36 square feet, which is not quite 54 per cent. of the aggregate area of the four openings into the smoke passage from the four boilers.

At the center of the boiler room the breeching is carried upward into the economizer setting, which is a brick structure of 12-inch walls, carried on steel columns from the boiler room floor and having brick arch floors and roof finished with Portland cement plaster. The setting is constructed to have a central direct smoke passage to the chimney with two sets of economizer tubes on each side. Half of the full boiler plant only having been installed, the second set of tubes has not been put in place and as now built, the economizer setting comprises one set and the by-pass. The by-pass passage has an area of 60 square feet, which is 1 2/3 times the area of the present smoke passage. The economizer was built by the Green Fuel Economizer Company and consists of the usual 4-inch tubes 9 feet high, arranged in two groups, one of 280 tubes and the other of 240 tubes. An accompanying drawing indicates the method of operating the dampers controlling the entrance to the setting. Each of the two dampers is



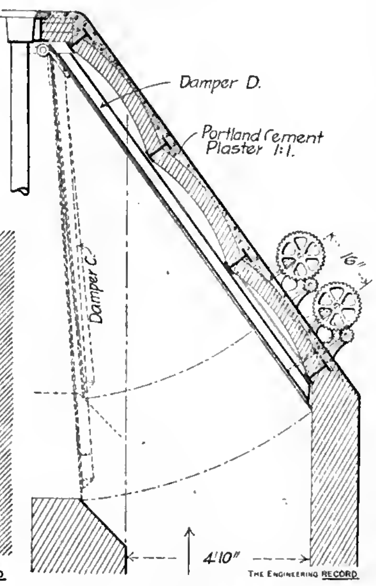
Condensing Water Intake.



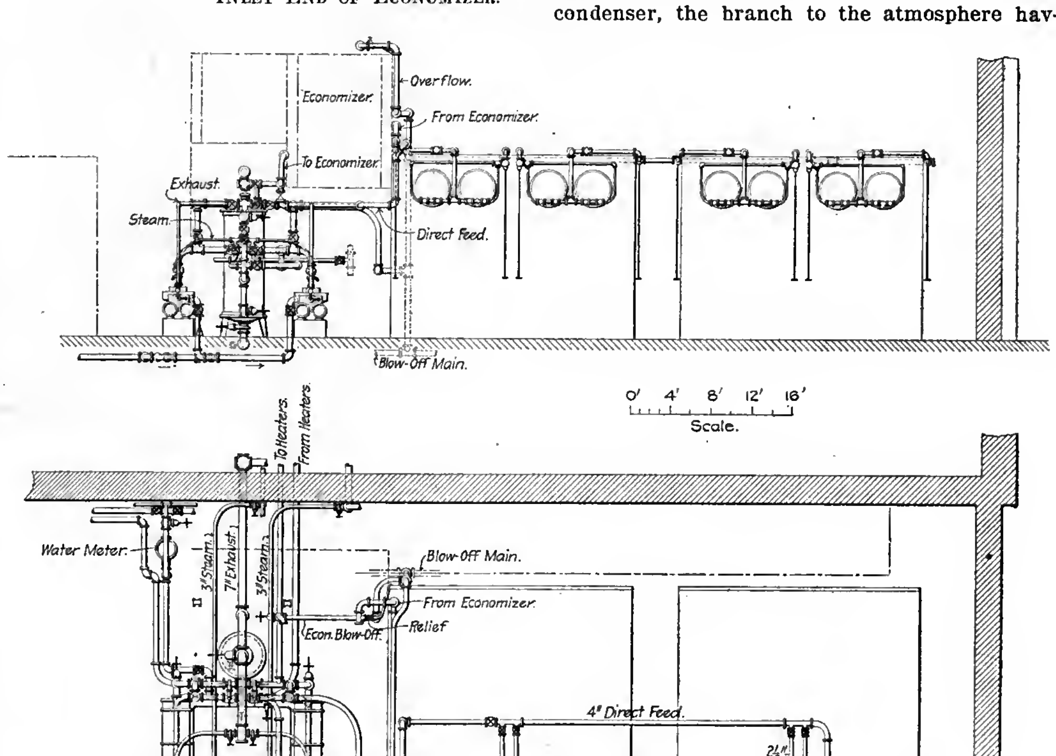
Plan of Economizer.

hinged at the top and is lifted or lowered by means of a chain at the bottom, the winding drum operated in each case by a hand crank through spur gearing. The dampers at the exit of the passages are suspended by chains at their axes, the chains passing through the top of the setting and being twisted to turn the dampers. The economizer extends below the by-pass passage and the clean-out doors are located on the inner side of the economizer wall and under the by-pass passage. The chimney, which is located a short distance outside the boiler room, is of brick of the double-shell type, with a constant inside diameter of 9 feet and a height above the grate bars of 252½ feet.

The steam from each boiler is carried from the cross-connection joining the outlets of the two superheating coils in each boiler to a 16-inch header by means of a horizontal 8-inch wrought-iron pipe bent horizontally. This pipe is connected into the side of the header, with a valve at the cross-connection and at the header. The header, which is of steel and supported by cast-iron roller bearing chairs fastened by extension pedestals to the top of the smoke duct, is divided into four sections, corresponding to the four boilers, by gate valves. These are readily accessible from the roof of the smoke passage. The supply pipes to the engines already completed rise 8 inches in size in a long upward bend to a steam receiver, which is suspended in position by means of a special bend of gun metal passing through and anchored in the partition wall. From the top of the receiver, the engine supply continues 9 inches in diameter, with resultant reduction in velocity, roughly 6,000 feet per minute, and passes through the gun metal bend into the engine room where it reaches the high-pressure engine cylinder by means of long downward bend. The receivers are 30 inches in diameter and 6 feet high and, besides being a reservoir of steam, used to lessen the chance of pipe vibrations by the periodic cut off of steam and to supply a sudden demand of steam, act as separators. These receivers and each section of the header are drained into a 3-inch drip main suspended below and run parallel with the header; from this the water is conducted into a Holly receiver and returned, together with other clean high-pressure drips, into the boilers by means of the Holly system. For the supply of the various pumps, a 5-inch main is carried along the partition wall in the basement of the engine room, this main supplied by a 5-inch pipe from each end of the main header. The high-pressure piping throughout is provided with the Vanstone joints with copper gaskets.



Inlet End of Economizer.



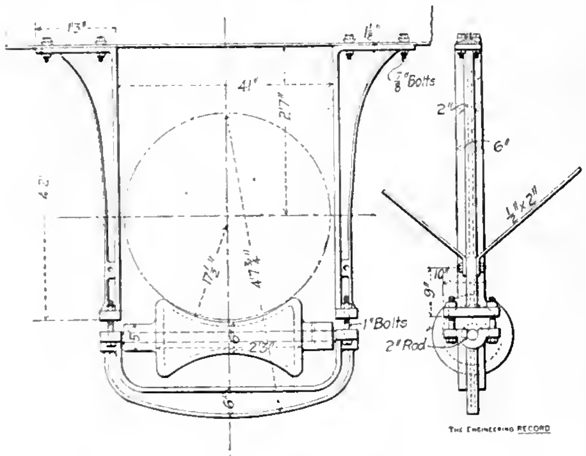
Plan and Elevation of the Feed Piping.

There is at present in the engine room two 500 kilowatt electric generating units, a 1,500-kilowatt unit approaching completion and space for another 1,500-kilowatt unit, making the capacity of the initial plant when entirely installed, 4,000 kilowatts, with a continuous overload capacity of 1,000 additional kilowatts. The units consist of McIntosh & Seymour vertical cross-compound engines and General Electric three-phase 60-cycle alternators, the alternator and a fly-wheel being located between the two cranks. The governing mechanism is of the interia fly-wheel type, under control of a ⅛-horse-power motor, mounted on the wheel and controlled from the switchboard, for moving the weights to the desired position and thus securing facility in synchronizing. The smaller engines have 18 and 38-inch cylinders and a common stroke of 42 inches, and the large engine 31 and 64-inch cylinders and 48-inch stroke. The rotative speed of the smaller units is 120 revolutions per minute and that of the large combination, 120 revolutions; the alternators generate a voltage of 2,300 volts. Current is transmitted, at this pressure, throughout Cambridge, being stepped down by transformers at the points of use. The switchboard, which was built by the General Electric Company, is located against the outside wall of the engine room, and the conductors pass out of the building through a wiring tower, which is a small shaft built against a rear corner of the boiler room.

Each engine is provided with a receiver for the passage of the steam from the high-pressure to the low-pressure cylinder, and the high-pressure cylinder is jacketed for high-pressure steam and there is a high-pressure steam coil in the receiver. The condensation from each source is returned to the boilers by means of the Holly system. The exhaust steam from the low-pressure cylinder passes first through the main heater and then may be conducted to the atmosphere or to the condenser, the branch to the atmosphere having the usual back-pressure or relief valve for use when the condenser is in operation. The heaters were made by the Whitcock Coil Pipe Company, of Hartford; for the smaller engines, they contain 165 square feet of heating surface, and for the larger, 334 square feet.

The condensers are of the Blake vertical twin type of jet condenser, with 12-inch steam cylinders, 25-inch air pump and 18-inch common stroke. The reciprocating members rise into the engine room, and a light well has been built around them, giving considerable light to the basement in that way, in addition to that obtained from the basement windows. The condensers are located on the far side of the engine foundations from the boiler room and the main exhaust line is carried to the outside of the building independently of the exhaust from the pumps and auxiliary machinery. The exhaust piping throughout is of cast iron.

The condensing water is drawn from the Charles River through a tunnel to a well near the power house and from there through a 12-inch injection pipe. The tunnel is circular in section, 4 feet 6 inches in diameter, of 12-inch brick walls and about 85 feet long. Its inlet is protected with a grill of 1-inch iron bars, set vertically. The well is 8 feet 6 inches in diameter, built with concrete walls 24 inches thick, and capped with a cast-iron cover; it is about 23½ feet deep. It is fitted with a partition of wood with a copper-wire screen in the bottom, the partition dividing the well into two compartments, one in which the screened water is taken through the enlarged mouth of the injection pipe and the other in which debris collecting outside the screen can be removed. The screen consists of ⅛-inch copper wire, with ¾-inch mesh and has a free area of about 14 square feet. The discharge pipe from the condensers, which is 30 inches in diameter, ends 75 feet beyond the condensing water intake.



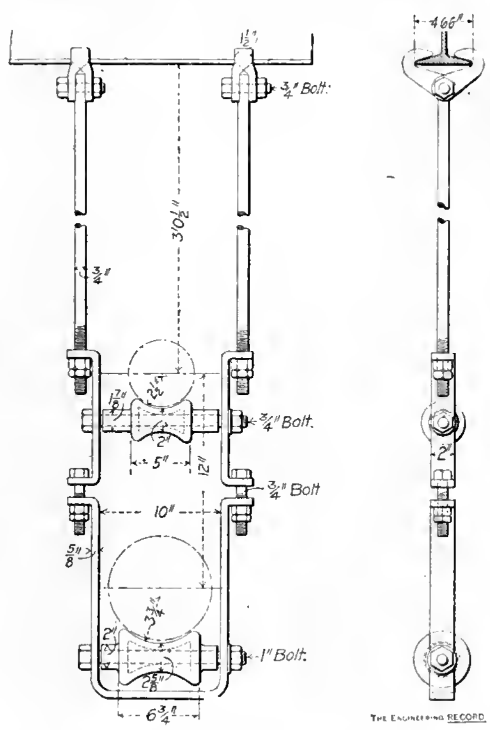
Hanger for 36-Inch Exhaust Pipe.

The condensing water piping throughout is of cast iron, and in the power house is carried in a cement lined trench below the basement floor.

Besides the condensers and the boiler-feed pumps, which are supplied from the auxiliary steam main, there is a steam-driven exciter unit in the basement, supplied from the same source. This consists of a 10x12-inch Armington & Sims horizontal engine, running at 275 revolutions per minute, and a 120-volt Westinghouse direct-current dynamo of 25 kilowatts capacity. This is intended to supply the field current for starting the alternators, but under normal running conditions the field excitation will be obtained from a 35-kilowatt motor driven set in the engine room. This comprises an induction motor directly connected to a direct-current dynamo. Space has also been reserved for a larger set to care for the entire plant upon the addition of the fourth unit. The three make a very flexible and practically a duplicate combination for excitation.

Feed-water ordinarily is taken from a rain water tank of 40,000 gallons capacity, and when necessary, from the city water mains through a water-meter. No purification or water softening has been found necessary. There are two feed-pumps situated, as stated, underneath the economizer, one the reserve of the other. These are of the Blake outside packed plunger type, designed for high-pressure work, with 6½-inch plungers and duplex compound steam cylinders, 8 and 12 inches in diameter and 12 inches stroke. They deliver the water usually through the main heaters in the main engine exhaust pipes, then through the auxiliary heater, for the utilization of the exhaust from the pumps and auxiliary apparatus, then through the economizer and into the boilers. Any one of the heaters may be by-passed, as may also the economizer. The feed-pumps are governed automatically by means of a Locke governor. The by-pass around the economizer is extended into an independent boiler feed main, while that from the economizer makes a second feed main. The method of taking connections from both mains, which, it may be pointed out, can be connected together, is shown in an accompanying drawing of the feed piping systems. The auxiliary heater is of the closed type, of the same make as the main heaters, and contains 500 square feet of heating surface.

An extensive oiling system has been installed



Hanger for a Pair of Pipes.

for the generating machinery. It includes a duplicate installation of filters and oil tanks under a compressed air system of circulation. The equipment is located in the basement against the engine foundations and facing the basement windows. The oil tanks rest on brick piers on the basement floor and are 4 feet in diameter and 3 feet high with dished heads, the heads turned in the same direction. The filters, which are of the Cross make, are 35 inches in diameter, 4 feet 4 inches high, supported immediately above the level of the top of the oil tanks. The compressed air is furnished by a 5-horse-power motor-driven Ingersoll-Sergeant Drill Company air compressor, and a compressed air tank 3 feet in diameter and 6 feet 9 inches long is provided, suspended from the basement ceiling. A 1-inch pipe leads from the air tank to the tops of the two oil tanks, with valves so that either tank can be put into use, and there is a branch to this pipe for filling with fresh oil. The oil is forced from the bottom of each tank through 1-inch piping to the lubricating system. On its return it is delivered by 2-inch piping into the filters and thence by a ¾-inch pipe into either oil tank to be recirculated. The air is maintained at 50 pounds pressure.

The power plant was designed by Messrs. Sheaff & Jaastad, of Boston. The general contractor for the structure, including the chimney, was Mr. F. B. Gilbreth, of that city, and the contractor for the piping was the Walworth Manufacturing Company. It will be interesting to note that in the construction of the foundations for the building and machinery, the portable gravity concrete mixer made by the Contractors' Plant Company was used, combined with the concrete set-up invented by Mr. Gilbreth, which is moved away from the mixed concrete instead of removing the concrete from the concrete mixer. Mr. D. E. Badger, chief engineer of the plant, supervised the construction, while the electrical end was looked after by the chief electrician, Mr. W. R. Eaton.

The Hydraulic Power Plant of the Riverside Power Company.

The city of Riverside, Riverside County, Cal., owns an electric generating system driven by steam, using crude oil as a fuel. In addition to the steam plant the city buys electricity from several different sources and sells electricity for lighting and power. The conditions of irrigation around and in Riverside are such that the plants pumping water for irrigation, either from wells or from the various canals, are considerable consumers of power, and the majority of these pumping plants may be so operated as to utilize the surplus electric power without materially interfering with the lighting load. Some of the choicest orchard land is above all existing or projected canals, and the city has been making a determined effort to increase its sales of electric power to the irrigators of such land, and, in fact has somewhat oversold the supply.

The Riverside Power Company is one of several companies that were gotten up to sell electricity to the city at wholesale. The Riverside Power Company utilizes the water supply of the Santa Ana River by passing it through a canal which heads three miles below the city and extends six miles along the bank to a power station, where two 300-kilowatt General Electric generators are to be driven by turbines. The design of the system, as worked out in a report of Samuel Storrow, consulting civil engineer, of Los Angeles, Cal., included a concrete-lined canal having a capacity of 120 cubic feet per second and leading to a reservoir capable of storing 12 hours' flow. The original scheme provided for a power plant so designed that the day load on the electric equipment could be taken care of by one generating unit, and the night load by two units, the intention being to allow the reservoir to fill up during the day by the excess of the capacity of the canal over the demands of the wheels, and then to allow the reservoir to empty through the power house during the peak of the lighting, thus giving a fluctuating delivery to correspond with the fluctuating demand upon the system.

The intake of the canal is placed at the "Narrows" of the Santa Ana River, where its channel is crossed by a granite dike and the wide valley contracted as the river enters the canyon. This is a particularly strong and satisfactory site for a diversion weir, and has but one objection—that the river carries an extraordinarily large amount of sand, which is constantly moving down stream at all stages of the river and more especially at times of flood. This difficulty was obviated by building sand-boxes, or "blow-offs," in the bottom of the canal at a point about 1,000 feet below the entry, where the canal enters the flume and passes along the side of a vertical cliff and directly over the left bank of the river.

The great fluctuation in the discharge of the river, varying from 5,000 cubic feet per second or more in the winter floods to 30 cubic feet per second in the short season of low water in July, renders it necessary to have two points of diversion, one at the above-mentioned granite dike for use during low water, and one at a point about 600 feet down stream for use during floods, when the works at the dike will be entirely submerged and the upper part of the canal entirely filled by the drifting sand. An excess of grade is given to this upper part, and the gates are so arranged that as the floods subside the upper 600 feet of the canal will be cleared of the sand by sluicing it out in such a way as will restore the upper intake to use without interfering with the operation of the system.

Contracts have been let for the grading, for the water wheels, and for the electric plant at a price within 3 per cent. of the estimates of the engineer. Active grading has begun under the charge of Mr. H. Clay Kellog, who has contracted to do the necessary civil engineering. The estimate for the grading and concrete is $42,000. The company has a contract with the city of Riverside by which the city will purchase all the electricity that the company can generate and pay therefor at the rate of $6 per horse power per month, for deliveries at the distributing station in the city of Riverside, during a term of thirty years. The exact design of the consulting engineer has been carried out, excepting that the canal is being built with a capacity of 140 cubic feet per second, and the reservoir, which was suggested to enable the system to give a larger output during the peak of the load, is to be omitted.

The electric plant is to be furnished by the General Electric Company, and includes the following: Two alternating, 3-phase, revolving-field, 12-pole, 300-kilowatt, 11,500-volt, 50-cycle generators, with base, and two bearings and shaft arranged for water-wheel connections, to operate at 500 revolutions per minute; two 4-pole, 17-kilowatt, 125-volt exciters, arranged to operate in connection with a water-wheel or by an induction motor, at 750 revolutions per minute; and three 200-kilowatt, 50-cycle, air-blast transformers, primary circuit 10,000, secondary 2,300 volts. The switchboard arrangement will consist of two 300-kilowatt, 11,500-volt generator-panels, one induction motor panel, two exciter panels, one 600-kilowatt, high-tension transformer panel, one 600-kilowatt, low-tension feeder panel, and General Electric lightning arresters. Form K automatic oil switches will be used throughout.

The officers of the Riverside Power Company are: President, Hon. E. W. McGraw, of San Francisco; vice-president, Charles H. Toll, of Los Angeles, and secretary, W. E. Pedley, of Riverside. The other directors, in addition to the officers, are G. D. Cadwallader and Myron Alguire.

The Wachusett Dam, at Clinton, Massachusetts, for the Boston Metropolitan Water-Works, is progressing steadily. According to the recent monthly bulletin of the excursion committee of the Boston Society of Civil Engineers, rubble masonry in the main part of the dam is being laid by ten derricks with a combined capacity of about 500 cubic yards of masonry per day. These derricks are of the stiff-leg type, are fitted with large bull wheels and operated by compressed air. Each derrick is self-contained and can be lifted bodily by the Lidgerwood cableways and set in a new position from time to time, as required by the progress of the masonry.

Electrical Apparatus in English Coal Mines.

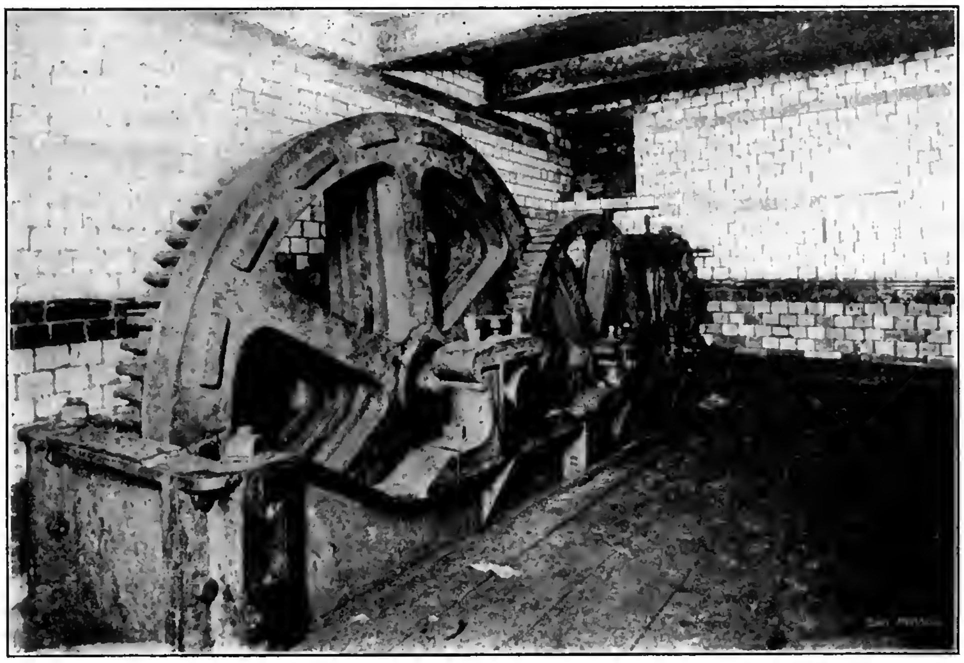
The price of coal in England is steadily rising, shafts are being carried deeper and deeper, and, the richer veins having been exhausted, the thinner veins, containing often poorer grades of coal, must now be developed. These things have put the British operator upon his mettle, and he has taken up the latest and most improved methods of coal mining very rapidly. He has adopted for power transmission alternating currents and induction motors, which, for mining work and especially coal mining, are stated to have many great advantages over direct-current machinery. The foregoing facts are well illustrated in the following brief description of the electrical plants recently installed at a number of English coal mines.

The Sneyd Colliery, at Burlem, Staffordshire, has recently put in a complete alternating current equipment. Current is generated by a Westinghouse three-phase alternator, direct coupled to a Westinghouse steam engine. Westinghouse induction motors aggregating about 1,000 horse-power are used for driving "main-and-tail" and "endless" rope hauling engines, for pumps and for several other auxiliary purposes. The hauling gears with their electric motor equipment are shown in the accompanying photographs. These mines are gaseous, and the use in them of direct current machinery would have been dangerous. The induction motor, however, on account of the fact that it has no moving contacts to spark or flash is well adapted for use in such locations.

The Clapwell Colliery, of Chesterfield, has recently installed two three-phase Westinghouse alternators, one of 225 kilowatts capacity and the other of 20 kilowatts, together with a 6-kilowatt, direct current exciter. The British Westinghouse Company also furnished ten induction motors, aggregating 280 horse-power. The Oxcroft Colliery, of Chesterfield, has installed two three-phase Westinghouse alternators, each of 200 kilowatts capacity and operating at 440 volts, 30 cycles per second and 100 revolutions per minute. The equipment includes two exciters, each of 11¼ kilowatts capacity, and a small generator of 1½ kilowatts capacity; also 13 Westinghouse induction motors with an aggregate capacity of 300 horse-power and a complete switchboard outfit for the entire plant.

About 4,000 horse-power of Westinghouse electrical apparatus is about to be installed in the several collieries owned by the Stavely Coal & Iron Company, of Chesterfield. The Sherwood Colliery, of Mansfield, have purchased two three-phase Westinghouse alternators, each of 50 kilowatts capacity, operating at 440 volts, 60 cycles per second and 900 revolutions per minute, and three direct-current, multipolar generators of about 12 kilowatts aggregate capacity. At the Tredegar Iron & Coal Co.'s collieries, in Monmouth, a complete power equipment is being installed, comprising two 150-kilowatt, three-phase Westinghouse alternators, two exciters, each of 7½ kilowatts capacity, and ten induction motors ranging in size from 50 to 5 horse-power and aggregating 220 horse-power.

The Bolsover Colliery Company, of Chesterfield, has decided to adopt electric driving to a considerable extent, and has placed a large order with the British Westinghouse Co., including a 180-kilowatt, three-phase alternator, together with exciter, a 200-horse-power induction motor, complete switchboards, etc. The Stanton Iron Works Company, of Pleasley, will equip its collieries with electrical apparatus, including about 150 kilowatts in generating capacity and 100 horse-power in motors, all purchased from the British Westinghouse Company. The Tyrdail Collieries, of Carmarthen, have contracted for an electric power installation consisting of a 60-kilowatt, three-phase, Westinghouse alternator, exciter, switchboard, and about 50 horse-power of induction motors. The New Cross Hands Colliery, of Lanelly, has purchased an electrical power equipment consisting of a 125-kilowatt, direct-current Westinghouse generator, with switchboards, etc., complete, and several Westinghouse direct-current motors.



Induction Motor Operating "Endless Haulage," Sneyd Colliery, Staffordshire.

From the above examples it will be apparent that the British manufacturers are by no means slow to see the economies of electric driving.

The Panama Canal Company can transfer to the United States "a good, valid and unencumbered title," according to the opinion of Attorney General Knox, officially rendered October 25, after an exhaustive research. The recent French premier, M. Waldeck-Rousseau, confirms this by the statement: "The United States will acquire the finest and most impregnable title of ownership to the property transferred, and will assume no other obligations than those stipulated in the contract of transfer itself."

Cooper's Bridge Foundation Specifications.

General specifications for foundations and substructures of highway and electric railway bridges have been prepared by Mr. Theodore Cooper, consulting engineer, New York, and will soon be published for the use of builders and engineers. Through Mr. Cooper's courtesy we present in advance selected illustrations and abstracts from the text which give some valuable data and indicate the character of the specifications. Mr. Cooper briefly analyzes the general cases, points out important conditions and requirements and describes typical structures, calling attention to essentials of their design and details of their construction. These features add materially to the value of a simple specification. The author has thus provided a general standard which will be very useful in designing and specifying work of this class, for which there is little formulated data generally available. There are 24 pages of text classified under numerous headings, two appendices and twelve full-page engravings of general designs and details of typical substructures. The text describes and specifies simply and clearly good and suitable structures and methods which are not complicated by elaborate calculations or requirements difficult for an ordinary builder to follow. The drawings are exceptionally clear and well arranged.

In the preface the author notes that while standard specifications are available for highway bridge superstructures there are none for their substructures and that he has therefore endeavored to illustrate the more common forms of substructures and foundations suitable for highway bridges and give the required proportions for all ordinary cases, with instructions and specifications for their construction.

Standard proportions and specifications for the substructures of highway bridges will not only broaden the competition for their construction, but will result in obtaining a better class of substructures than has been generally the case heretofore. They will also enable in many cases the local artisans to proportion and build the same.

The author excludes from consideration difficult foundations in deep water or those requiring pneumatic or other special appliances or works of such expense as would demand special study of the conditions to determine the best or most economical solution; also city bridges and long-span bridges, where a higher and more elaborate class of substructure may be demanded and justified.

Attention is called to the necessity for a careful determination of the regimen of the river, the conditions of flood, character of bottom scour, traffic, and the requirements of navigation to aid a careful judgment in the selection of the type of substructure, and it is recommended that where the local knowledge of the river and its banks and bottom is not complete and certain, a special examination should be made by an experienced engineer. In many cases the location of the piers is determined by natural conditions: where it is a matter of choice the most economical arrangement of spans can be found by appendix A.

The character of the bottom on which piers and abutments must be founded is considered under three classes, first, rock; second, hard ground, as hard-pan, gravel, compact sand or hard dry clay; third, soft ground, as soft or wet clay, silt or mud, whose sustaining power must largely depend upon the frictional resistance of long piles or piles driven through the soft material to an underlying material of a harder character.

Several paragraphs are devoted to instructions for the preparation of the site to receive the foundations. Where the footings are carried down to rock the excavation should be made to sound hard surface and filled up to a level or stepped surface with concrete.

In hard ground the material should be excavated to a depth below the action of frost or scour by surface currents, with a minimum depth of 3 feet, if above the water. And for foundations in the water, to a depth sufficient to be below any possible scour by the river currents (usually increased by the placing of piers in the stream) and to give the piers sufficient foothold to resist displacement by the shoving action of floods, ice or floating material.

Where the foundations are on or near the banks of streams or on sloping strata they should be carried deep enough to insure them from slipping by the sliding of this underlying material.

Where the material is liable to be softened, scoured or undermined by water action or where under water the foundations cannot be carried deep enough to be beyond any possibility of being affected by scour the bottom should be piled.

In soft ground the material should be excavated to a stratum of harder material or else it must be excavated to a depth where the soil is permanently wet, if on land, and below ordinary scour, if in the water. Piles spaced not over 2½ feet centers should then be driven over the whole area to a "good refusal." The piles should be cut off or driven to one level and then covered with a timber platform or a layer of well-rammed concrete 2 feet thick, upon which to start the masonry. In all cases as the masonry is built up, the remaining openings of the excavation should be refilled with good material well rammed in place.

The general requirements provide that wood shall be used only where it will be permanently wet. Metal is not allowed in contact with the soil except for the shells of deep water piers and for piles. Concrete must be laid in the open when possible. The tops of viaduct piers must be at least 18 inches above the surface of the ground, and all bridge seats must be single stones or concrete blocks with an area double that of the metal base supported. The size and refusal of piles is specified, and 8 to 12 feet in wet gravel, sand or stiff clay, and 20 to 40 feet in soft clay or silt given as the minimum penetration. The instructions for framing and connecting timber work give particulars about spiking, notching and dovetailing. Particular care is taken to make the requirements for cement so simple and the tests so easy, that good results can be obtained under ordinary local conditions, without expert services. The character of the sand and gravel is described and directions are given for making and using the concrete and mortar. Mortar shall be made with 300 pounds natural cement and 12 cubic feet of sand, or 375 pounds Portland cement and 16 cubic feet of sand. Concrete shall be made with 375 pounds Portland cement to 8 feet of sand and 16 feet of ¾-inch broken stone or gravel, or with 300 pounds of natural cement, 12 feet of sand and 24 feet of broken stone or gravel, the latter formula being allowable when the foundations below the surface of the ground are not exposed to weather or running water.

The detailed specifications for rock faced broken-range masonry, for rock faced, coursed masonry and for monolithic concrete masonry are simple and comprehensive and conform to the standard requirements for good work. Steel shells for concrete piers are required to conform to the requirements of Cooper's highway bridge specifications for 1901, and the thicknesses, riveting and bracing are specified.

The second part of the specifications includes descriptions of the design and construction of different types of foundations and is intended to be mandatory as well as explanatory. Plans and elevations are given for the different classes of ordinary bridge substructures, with the leading dimensions indicated by letters corresponding to tabulated values giving the proportions for varying sizes and assumptions.

Methods of constructing foundations on submerged soft soil are illustrated by Plate 2. One figure shows a sheet pile and puddle cofferdam enclosing an excavation in which piles are driven and capped with concrete or a timber platform to receive the masonry. Another figure shows piles driven in an open dredged excavation, cut off level, and filled around with broken stone to receive the solid timber bottom of a caisson, which is floated into position and sunk on the pile tops by building the masonry inside, after which the detachable sides of the caisson are removed, leaving the bottom permanently engaged between the masonry and the pile tops.

Plate 2 shows a plain masonry abutment, on hard bottom and without wing walls, which is proportioned for spans of from 75 to 200 feet. Plate 3 shows a masonry abutment and wing wall on hard bottom. Plate 4 shows a long and narrow masonry river pier with cutwater, on hard bottom, and gives tables of dimensions for spans of 50 to 300 feet.

To spread the loads and weight of the masonry over soft or unequal soil or to facilitate the founding of piers under water, it is often expedient to use timber platforms, grillages, caissons or cribs.

Timber platforms consist of two or more layers of closely-laid timber alternately crossing each other and thoroughly spiked together to act as a solid platform. The thickness and size of each platform must be such as to distribute in a proper manner the full load over the piles, where used, or over the underlying material, without exceeding the carrying capacity of such material.

Timber grillages are similar layers of alternately crossing timbers laid with open spaces about the width of the timbers, so they can be weighted with gravel, stone or concrete, to facilitate the sinking and placing into position. They are generally floored top and bottom with plank.

Open caissons, the only kind of caissons here considered, are timber platforms or grillages with water-tight wooden sides attached thereto (usually so as to be removable after the work is completed), so as to form a water-tight box in which the masonry can be built in the dry; and which can be floated into place and sunk in proper position, either upon the pile heads or on the prepared bottom.

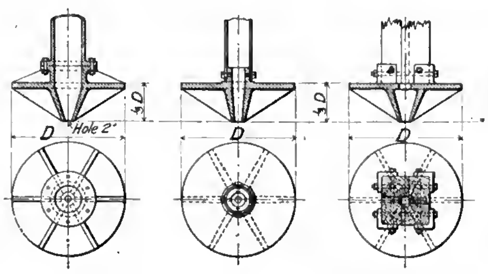
Timber cribs are formed of alternate longitudinal and transverse timbers, notched, dovetailed and spiked together at their crossings, so as to form a rigid structure divided into a series of pockets several feet square. The open spaces of the ends and sides may be filled in with timber, so as to make them close and solid. A portion of the pockets are floored over so they can be filled and loaded with broken stone or concrete to sink the cribs into position upon the bottom or into the mud to a depth sufficient to get the desired stability. After the crib is in proper position the floored pockets should be loaded and the open pockets dredged until the desired depth is obtained. For hard bottom, where it is not possible to obtain a level surface by dredging, the bottom should be carefully cross-sectioned and the bottom of the crib built to the correct shape to get a proper bearing.

The author considers that the use of cribs for foundations may be justified where there is no possibility of their settlement or displacement, and that cribs may be sometimes used to protect and hold the footings of cylindrical piers on hard bottom, as shown by Plate 7, or to give lateral stiffness to pile foundations in soft mud or deep water, as shown by Plate 9, which is not here reproduced. This plate gives a plan and elevation of a group of piles driven through a pocket in one end of a crib which is sunk into the soft bottom with rock ballast in pockets both sides of the piles. The top of the crib is a little below low water and the tops of the piles at a little higher level are capped with a platform of crossed timbers, also below low water, which receive the masonry pier for one truss of the bridge. There is a similar separate pier for the other truss at the opposite end of the crib. The crib is made with notched and dovetailed joints and with square timber except that the floors of the ballast pockets are made with round timber. The well through which the piles are driven is lined on the sides with vertical planks, and is filled with small broken stone or gravel packed around and between the piles.

Attention is called to the necessity for providing for river piers foundations which are below the possibility of scour. Abutments should be designed as retaining walls for the earth banks behind them, with weep holes or other provision for drainage, and the earth deposited back of such walls should be carefully rammed in layers as the masonry is built up. Plate 5 shows a square tower pier which is one of two separate piers supporting the superstructure instead of a long pier where there is quiet water and no danger from ice or other floating material. It has an extended footing on an offset timber grillage with a close laid plank floor top and bottom, and is sunk, with its diagonal parallel to the current, in a dredged excavation and filled around with broken stone.

Plates 6 and 8 show piers on soft bottom with piles having their tops enclosed in steel shells which reach down into the ground and are filled with concrete. One of them has a single oblong shell with rounded ends, and the other has two separate cylindrical shells connected by riveted transverse bracing above low water. With each there is a table of dimensions and numbers of piles required for different classes of bridges and for spans of 50 to 250 feet. The bottoms of the shells should be sunk below danger of scour, by loading and interior excavation, and they should be filled with piles driven to good refusal and cut off at low water level. The piles should be kept 4 to 6 inches clear of the shells and the spaces between the piles must be less than the size of the smallest pile used. For the oblong shells this close spacing need only apply to the end portions, symmetrical with the center of the bearings of the trusses. The spaces between and about the piles must then be well filled and rammed with Portland cement concrete. The shells above low water shall then be pumped dry and filled with Portland cement concrete in well-rammed layers to the top, where it must be finished off in proper shape for the bridge seats and drainage.

For material which can be excavated from the inside of shells to a sufficient depth below possible scour, but which does not need piling; the shells should be sunk to the proper depth, the bottom sealed against the admission of water by depositing concrete through pipes or in bags, then pumped dry and the interior properly filled with Portland cement concrete. Or, the bottom may be dredged beforehand to a proper level and the shells bolted rigidly to a timber platform or grillage and then sunk as an open caisson.



Part of Plate 11.—Disk Piles.

For rock bottom, where it is possible to fit the platform to the rock surface, this form may be used, but where the weight of the piers is not sufficient to give abundant security against the shoving action of floods, ice or floating material the platform should be anchored securely to the rock by anchor bolts.

For rock or hard bottom cylinder piers may be steadied and also protected from scour by a surrounding crib, as shown on Plate 7. After the crib is placed and sunk by filling the floored pockets with broken stone or concrete, the cylinders should be lowered into place through the open pockets provided for them; then the open spaces outside of the cylinders should be well filled and rammed with Portland cement concrete to the full depth of the cylinders. Then the interior of the cylinders should be pumped dry and filled in the usual way with concrete. Where the crib cannot be sunk to the rock, owing to the overlying mud, sheet piles or sheeting can be driven around the periphery of the open pockets to the rock and the mud removed, before placing the cylinders or depositing the concrete.

The permanency of the wooden crib in fresh water and the protection of both sides of the metal shell by cement concrete gives this style a superiority over those where the outside of the shell is in direct contact with the water and hence subject to continuous oxidation.

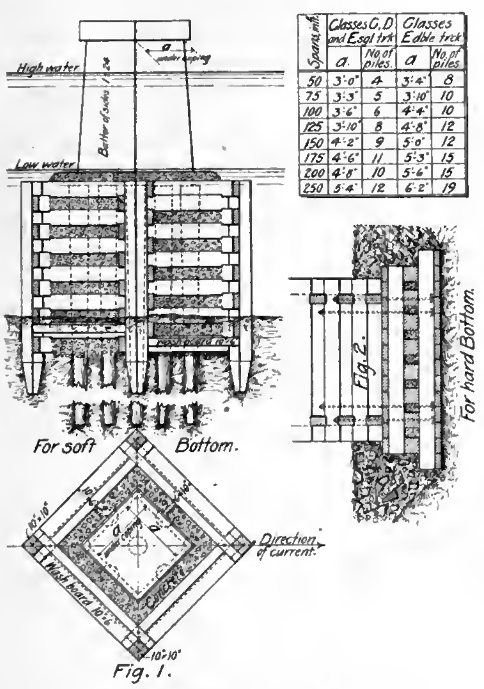
Little or no faith should be put in the claim that when the metal shells do finally rust away, the concrete core will be able to serve the full purpose of a pier, even for the best concrete work; and when the concrete is deposited through the water as has been the usual custom heretofore it will probably be found to be no better than loose stone.

In many localities instead of using metal shells, wooden boxes, as shown on Plate 10, can be advantageously substituted, and should be placed diagonally to the current. The timbers being entirely under water, will be permanent in fresh water, or where the waters are free from the teredo or limnoria.

Low viaduct piers should be built of masonry with a minimum base 3½ feet square for hard bottom for even the shortest spans. The bearing area should be increased 50 per cent. for moderately good ground and should of course be increased according to the length of span and doubled for double track electric railways.

Submerged foundations may be built on disc or screw piles, which, below the mud line should have timber or cast-iron shafts. Disc piles are sunk by the aid of a water jet, to a level sufficiently below any possible scour, so as to have at all times a depth in the sand of 6 to 10 feet. For silt or soft material, the disks should penetrate to a good stiff bottom or else to a depth such as would be required for good piling in the same material.

The discs shall be of cast-iron and of the sizes given in the tables for the particular



Spans, ft.	Classes C, D and E sgl trk a.	Classes C, D and E sgl trk No of piles.	Classes E dble trck a	Classes E dble trck No of piles
50	3'-0"	4	3'-4"	8
75	3'-3"	5	3'-10"	10
100	3'-6"	6	4'-4"	10
125	3'-10"	8	4'-8"	12
150	4'-2"	9	5'-0"	12
175	4'-6"	11	5'-3"	15
200	4'-8"	10	5'-6"	15
250	5'-4"	12	6'-2"	19

Plate 10.—Wooden Box Foundation.

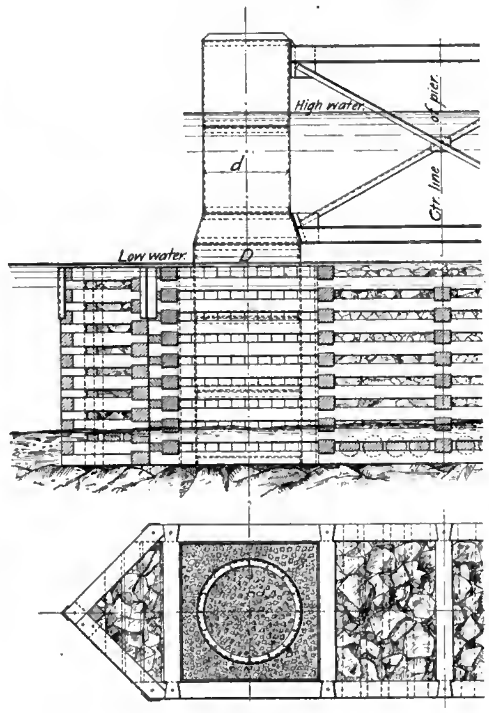


Plate 7.—Cylinder Pier on Rock, with Crib Protection.

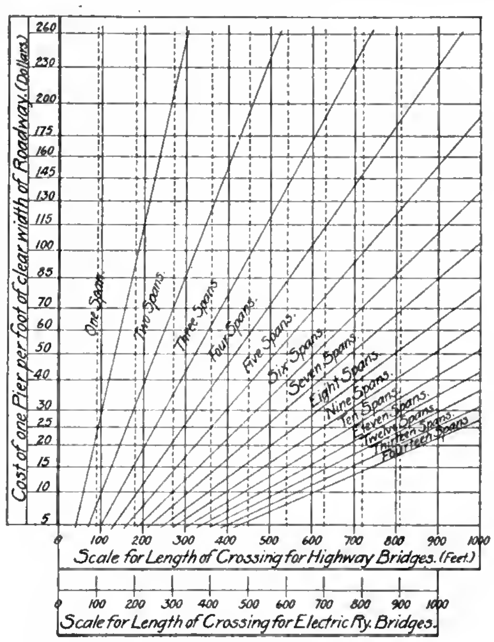


Plate 13.—Diagram for Determination of Economical Spans.

span as proposed. The thickness of the metal in the top plate and thicker parts of the cone and connecting ribs should not be less than 1¼ inches for discs 24 inches in diameter, or 1½ inch for larger sizes. The point should be pierced with a vertical conical hole at least large enough for a 1½-inch jet pipe.

Although screw piles are expensive to make and drive, their use is sometimes justified. They should be designed throughout to resist very heavy torsional stresses.

The best pitch for different materials is a matter of experience and judgment. In general it should be from 1/3 to 1/6 of the diameter of the screw, the larger pitch being for soft material and decreased as the material increases in toughness of penetration.

The points of the screws may be made of various forms to suit the material, which is to be penetrated, viz., gimlet pointed for gravel, serrated for soft rock or coral, blunt for sand or fitted for the assistance of the water-jet in sand or gravel.

Plate 12 shows three screw piles with five different types of points, all of which are hollow castings, bolted to the pile shafts, which in two cases are steel or cast iron pipes and in the third a solid square timber. An accompanying table gives the value of the diameter of the shaft and screw for different types of bridge and lengths of span.

Appendix B gives tables of the amount of masonry in piers and abutments for spans of from 100 to 300 feet, calculated for heights of 10 to 30 feet between top of coping and bottom of footing, and for roadways 12 feet wide, 20 feet wide, for single and for double electric car tracks. The arrangement of piers to give the minimum total cost for the bridge is discussed in Appendix A, accompanied by Plate 13, in which, to provide for bridge of different widths, the cost of one pier per foot of clear width is used; the clear width for highway bridges being the width of roadway and sidewalks, and for electric railway bridges, 14 and 26 feet for single and double track bridges.

The vertical column at the left hand of the diagram (scale of square roots) gives varying costs per foot of clear width for one pier, including towers, if there be any.

The horizontal line at the bottom gives the length of the crossings between centers of abutments (one scale for highway and one for electric railway bridges.)

Having made an estimate of the cost of one pier (see Appendix B) of the required dimensions as per the specifications, divide it by the clear width of the proposed bridge. Then follow the horizontal line through this value to the vertical line through the length of the crossing and the number of spans given for that point will be the required number for economy.

Example: Crossing, 500 feet; width of roadway, 20 feet and two sidewalks, each 5 feet.

Should one pier cost $900 or $30 per foot of width, use 7 spans.

Should one pier cost $1,800 or $60 per foot of width, use 5 spans.

Should one pier cost $4,000 or $133 per foot of width use 3 spans.

Of course, many features of interest in Mr. Cooper's specifications have not been given in this abstract.

In the Chicago Drainage Canal Litigation a motion was recently filed in the Supreme Court of the United States to discharge the case because of lack of action by the prosecutor, the State of Missouri, an entire term of the court having elapsed without an effort by the complainant to further the prosecution.

The Use of Slag in Cement Making.

Extracts from advance sheets of a report by Edwin C. Eckel on the Utilization of Iron and Steel Slags, in "Mineral Resources, 1901."

Slag cement, properly so called, is the product obtained by pulverizing, without calcination, a mixture of granulated basic blast-furnace slag and slaked lime. This product, though in reality a member of the class of pozzuolanic cements, is usually marketed as "Portland cement," in spite of the fact that it differs from a true Portland cement in method of manufacture, ultimate and rational composition, and properties. Six or eight plants are at present engaged in the manufacture of this material in the United States, the production for 1901 being 272,689 barrels. The writer has discussed the manufacture of slag cement in detail in a recent publication. A brief résumé of the technology of the material in question is here given.

As to composition, the material used in the manufacture of slag cement must be basic blast-furnace slag. Tetmajer stated that the ratio CaO/SiO_2 should never be less than unity, and that the best results were obtained when the ratio Al_2O_3/SiO_2 gave a value of 0.45 to 0.50. Prost and Mahon later obtained good results from slags in which the alumina was much higher than indicated by Tetmajer's ratio, and analyses of slags used in practice are shown in the following table, with the ratios CaO/SiO_2 and Al_2O_3/SiO_2 calculated for each slag:

Analyses of slags in actual use.

Constituent.	Middlesboro, England.	Bilboa, Spain.	Choindez, Switzerland.	Saulnes, France.	Chicago, Ill.
SiO_2	31.50	32.90	26.24	31.50	32.20
Al_2O_3	18.56	13.25	24.74	16.62	15.50
FeO	.....	0.46	0.49	0.62	.....
CaO	42.22	47.30	46.83	46.10	48.14
MgO	3.18	1.37	0.88	.....	2.27
CaS	.....	3.42	0.59	.....	.....
$CaSO_4$	.....	.....	0.32	.....	.....
S	2.21	.....	.....	.....	.....
SO_3	0.45	.....	.....	.....	.....
CaO/SiO_2	1.34	1.44	1.78	1.46	1.49
Al_2O_3/SiO_2	0.59	0.41	0.93	0.52	0.48

Slags allowed to cool slowly are only feebly hydraulic, even if of proper chemical composition. When used in the manufacture of slag cement, therefore, the slag must be cooled as suddenly as possible. This is effected by bringing the slag, as it issues from the furnace, in contact with a jet or stream of cold water. This sudden cooling "granulates" the slag, i. e., breaks it up into porous particles, and has also two important chemical effects. One is that the slag, if of suitable chemical composition, is rendered strongly hydraulic; the other, that most of the sulphur is removed in the form of hydrogen disulphide. After granulation the slag is dried, usually in rotary driers.

The lime used for mixture with the slag should be low in magnesia, well burned, and carefully slaked. At Chicago, where the Whiting process is used, a small percentage of caustic soda is added to the water used for slaking, the effect being to accelerate the set of the cement. After slaking and drying, the lime is ready for mixture with the granulated and dried slag, which usually has received a preliminary reduction in a crusher, ball mill, Kent mill, or other comparatively coarse reducer. The proportions used will vary from 20 to 40 parts of lime for 100 parts of slag. The mixture and final reduction is usually accomplished, in the American plants, in tube mills. The composition of a number of American and European slag cements is shown in the following table of analyses collected from various sources.

The composition of good slag cements may vary within the following limits: Silica, 22 to 30 per cent.; alumina and iron, 11 to 16 per cent.; lime, 49 to 52 per cent.; magnesia, less than 4 per cent.; sulphur, less than 1½ per cent. It will be noted that the lime content is

Analyses Showing Composition of Slag Cements.

Constituent.	Choindez, Switzerland.	Donjeux France.	Saulnes, France.	Chic., Ill.	Ensley, Ala.
SiO_2	19.5	24.85	22.45	28.95	27.78
Al_2O_3	17.5	12.10	13.95	11.40	11.70 (Al₂O₃ and FeO)
FeO	.....	3.85	3.30	0.54	
CaO	54.0	49.20	51.10	50.29	51.71
MgO	....	1.75	1.35	2.96	1.39
S	....	1.30	....	1.37	1.31
SO_3	....	1.35	0.35	....	....
Loss on ignition	....	5.65	7.50	3.39	....

lower and the alumina-iron content higher than in a cement of the Portland type. Slag cements also differ from Portland cement in being lower in specific gravity and lighter in color. Normally, they are slower setting than Portland cement, though this defect can be overcome by treatment during manufacture. They are deficient in resistance to mechanical wear, and do not set satisfactorily in dry situations. For use under water or in permanently damp ground, however, they would seem to be of service.

True Portland cements, which must be sharply distinguished from the slag (pozzuolanic) cements discussed in the preceding section of this paper, can be made from mixtures of which one element is blast-furnace slag. In this case the slag is ground, intimately mixed with powdered limestone, and the mixture calcined and reground. Two plants are engaged in the manufacture of Portland cement from slag and limestone in the United States. An analysis of the "Universal" brand of the Illinois Steel Company, a Portland cement made from these materials, is as follows: SiO_2, 23.62 per cent.; Al_2O_3, 8.21 per cent.; Fe_2O_3, 2.71 per cent.; CaO, 61.92 per cent.; MgO, 1.78 per cent.; SO_3, 1.32 per cent.; S, none; loss on ignition, 0.52 per cent.

Cecil von Schwarz, in a paper read before the Iron and Steel Institute of Great Britain, has described in detail German and Belgian practice in the manufacture of Portland cement from blast-furnace slag. (See The Engineering Record of June 2, 1900.) The slag is granulated in order to remove sulphur and to reduce the cost of crushing. The granulated slag is dried and mixed with about an equal amount of limestone. To the mixture is added about 3½ per cent. of powdered slaked lime, and their intimate mixing and reduction are accomplished in ball mills and tube mills. About 8 per cent. of water is added, and the slurry is then made into bricks, which are dried before charging into the kiln. A ring kiln is used, with coke as fuel. The clinker is moistened, stored for six weeks, and reduced in ball and tube mills. Analyses of the limestone, slag, and finished cement follow:

Constituent.	Limestone.	Slag.	Cement.
SiO_2	1.6	30 -35	23.70
Al_2O_3	1.0	10 -14	6.14
Fe_2O_3	...	.....	1.80
FeO	...	0.2- 1.2	.....
MnO	...	3 - 4	.....
$CaCO_3$	97.0	....	.....
CaO	...	46 -49	59.08
MgO	0.5	0.5- 3.5	1.40
SO_3	0.06	0.2- 0.6	1.30
Loss on ignition	...	....	5.70

In England blast-furnace slag has been somewhat largely employed as an adulterant of Portland cement, its color aiding this practice. As commonly carried on, the practice has nothing to recommend it. It should be noted, however, that the addition to a Portland cement of a certain amount of finely ground slag of proper composition should, theoretically, increase the structural value of the product. A "sand cement" made by using slag instead of sand might be made a technical and commercial success, the office of the siliceous slag being to combine with the lime set free during the setting of a Portland cement.

Sleeping cars are to be put on the 173-mile Cleveland-Detroit electric railway.

A Protracted Job of Underpinning.

The five story and basement brick building at No. 51 Exchange Place, New York is adjacent to the west side of the lot on which a tall steel cage building for the Bank of the State of New York is being constructed, as described in The Engineering Record of September 13. The new foundation piers have rectangular pneumatic caissons sunk close to the lot lines, and, as the soil is a very fine sand which will flow through extremely small openings, the excavations endangered the foundations of the old buildings on both sides of the bank lot. Those on the east side were underpinned as described in an article entitled Complicated Underpinning in The Engineering Record of September 27.

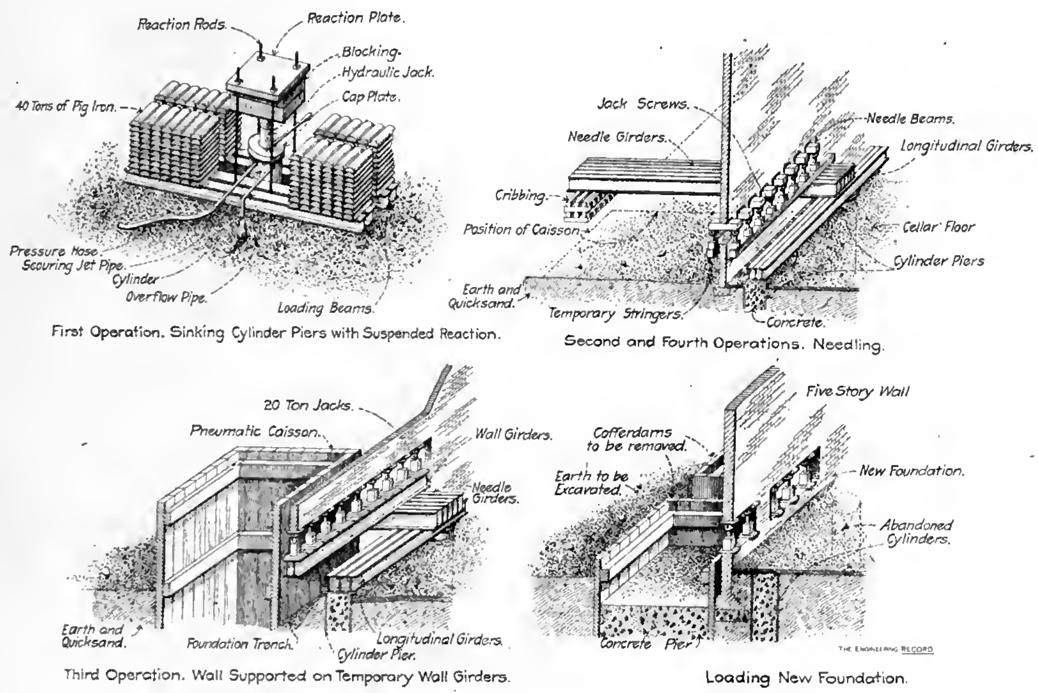
The east wall of the building at No. 51 is about 70 feet high and 100 feet long and has an estimated weight, with its floor load, of about 16,000 pounds per linear foot on the 2x4-foot concrete footing, which was built in a trench excavated only about 6 feet below the curb. This wall required support under its whole length, which might have been positively and permanently afforded by carrying its foundations down to the solid rock in the first place, an operation which could have been advantageously done by sinking cylindrical piers to bed rock, under its center line. This was first done at the Stokes building, New York, as described in The Engineering Record of August 8, 1896, and has since been done in many similar cases in New York, where old foundations were extended to a considerable depth. It was, however, decided to extend the foundations only to about the bottom of the excavation for the bank building, and to seat the footings on the sand and earth at that level.

As the sinking of the caissons so close to the lot line was considered sure to cause some disturbance in the fine wet sand, it was determined in advance not to build the new footings until after the caissons were sunk; and therefore provisions were made to support the wall so as to prevent its settlement from flow of sand while the excavation was in progress and to build the new footings after the caisson work was completed. This system corresponded with the one used for the building on the east side of the bank, but the conditions were somewhat different and caused the details of the work to be modified. Subsequent changes in the plan occasioned further complications in the process, resulting in a very long and elaborate series of operations which have been conducted with great skill and care and have surmounted difficulties of an unusual and serious character.

Both faces of the wall were accessible, but only a very narrow working space was available on the inside, and on the outside most of the ground had to be left unobstructed for the sinking of the 8x15-foot caissons about 6 feet apart and only 2 or 3 inches from the face of the wall. Supports had to be provided on both sides of the wall and as these had to come between the caissons they were about 20 feet apart in the direction of the wall, and as they had to extend beyond the row of caissons they reached at least 10 feet from the outer face of the wall. This necessitated the use of groups of long steel needle girders about 20 feet apart on centers, each group supporting a load of about 320,000 pounds.

Inside building No. 51 operations were restricted to the basement hallway so that the girders could not project more than 5 to 7 feet through the wall, while on the outside they were obliged to extend through the row of caissons and be supported beyond them. This arrangement gave very long span girders with the loads concentrated close to one end. The moments being inversely proportioned to the lever arms gave reactions of about 80,000 pounds at the end of the girder in the bank lot and 240,000 pounds at the end in the cellar. The long ends of the girders were supported in the usual way on timber cribbing which sufficiently distributed their loads on the bottom of the partly excavated pit. The short ends could not be safely supported on the cellar floor so close to the edge of the excavation and it was considered necessary to carry them on piers sunk to rock. The needle girders carried longitudinal girders from which the wall was jacked up to allow the old footings to be removed, compensation to be made for the settlement of the soil, and the new footings to be built and loaded. The weight of the whole wall was transferred from the old foundations to the temporary needle girders in successive sections of about 30 feet, as indicated in the plan of the first and second sections at the street corner of the building.

The first work was to provide for the support of the ends of the needle girders in the cellar of No. 51. This was done, as shown in the sketch of the first operation, by sinking 16-inch steel pipes through the cellar floor to hard pan, a distance of about 40 feet. The pipes were received in short sections and forced down by jacking them against a heavy cast-iron reaction plate from which was suspended a loading platform. As the pipes descended additional sections were screwed on top and the core inside was removed by scouring out the earth and sand with an hydraulic jet through a nozzle on the lower end of a small steel pipe inserted through the upper end of the 16-inch pipe and worked around by hand in the interior. The loosened material was brought up and carried away by the overflow water or was removed finally if necessary by a sand pump, and then the cylinder was filled with concrete and capped with a thick horizontal cast-iron plate at cellar floor level.



First Operation. Sinking Cylinder Piers with Suspended Reaction.

Second and Fourth Operations. Needling.

Third Operation. Wall Supported on Temporary Wall Girders.

Loading New Foundation.

Some Stages of the Work Preliminary to Underpinning.

The loading platform consisted of two pairs of long 15-inch I-beams supported at both ends on timber cross pieces on the cellar floor. The beams were close together in each pair and the pairs were about 2 feet apart. Forty tons of pig iron was piled across each end of the platform and between the piles the pipe sections were set vertically through the middle of the platform. On each side of the pipe cylinder a horizontal transverse pin was arranged to take bearing on the under sides of the beam flanges and engage the loop eye of a 1½-inch vertical suspension rod about 9 feet long with a threaded upper end which projected through a hole in one corner of a cast-iron cap plate about 28 inches square and 3 inches thick. On each rod there was a nut screwed up tight against the plate on both the upper and under side, thus holding it in position against a vertical force in either direction. When a jack was inserted and operated between the top of the cylinder and the cap it developed reaction in the vertical rods, by which, at the limit, the whole load was lifted from the floor and suspended from the top of the cylinder, sufficing with the scouring from the 60-pound jet and ¾-inch nozzle to gradually sink it until another section could be added, and so on. In each cylinder the first section of pipe was 10 feet long and was started in a hole cut through the concrete floor and dug as deep as possible in the open; the remaining sections had uniform lengths of 5½ feet and all were ⅜-inch thick.

At the commencement of the work the pipe sections were coupled together with outside screwed sleeves 6 inches long. These were found to offer a great resistance to sinking and in one case where they were used it took eight men 12 days to sink the cylinder 12 feet. To diminish the resistance the edges of the sleeve were beveled, as shown in the sectional view, and thin wooden lagging of exactly the same thickness as the sleeve was carefully fitted under its edges and around the pipe and secured with thin sheet metal bands. This reduced the friction but it cost $5 a length and caused considerable delay in fitting it on after the pipe sections were coupled up. Finally inside sleeves were substituted for the outside ones, and, the ends of the pipe sections being fitted to make accurate butt joints, a smooth continuous exterior surface was secured which offered much less resistance to sinking. At first the cylinder was driven by a screw jack; but when this was replaced by an eighty-ton hydraulic jack, two men were able to sink it twice as fast as eight had done with the screw. A line of eight cylinders was sunk about 16 feet apart and 3 feet from the wall which was to be underpinned. They were filled with concrete and capped with thick iron plates on which were seated three longitudinal lines of 15-inch I-beams to receive the inner ends of the transverse needle girders, which were inserted through the wall in holes made just above the footing.

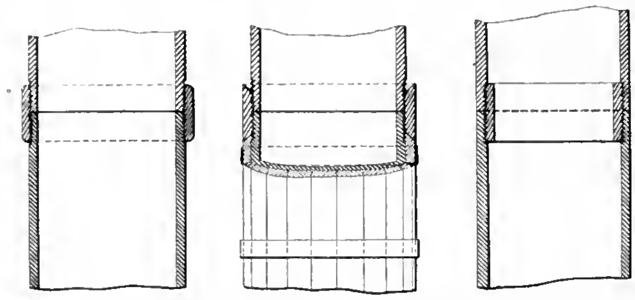
A horizontal row of holes about 14 inches square and 3 feet apart was made 4 feet above the tops of the needle girders and short 12x12-inch needle beams were inserted in them and supported at both ends on jack screws on longitudinal temporary stringers close to the faces of the wall which were carried by the needle girders and on temporary intermediate blocking as shown at the left of the plan and in the sketch of the second operation. The jacks were operated to lift the wall about 1/8 inch as noted by a level set up in the street and reading on marks made on the face of the wall and on a permanent bench mark established across the street. All the old masonry below the needle beams was removed and a pair of 24-inch 100-pound I-beams resting on the needle girders were inserted in the plane of the wall between the jackscrews. Single 20-ton jackscrews were placed in engagement between the top of the I-beams and the bottom of the brickwork, between the needle beams, as shown in this sketch of the third operation and were turned up to release the needle beams. As the latter were removed their places were filled by pairs of 5-ton jackscrews between the 20-ton screws and the whole weight of the wall was thus transferred to the pair of 24-inch girders in its plane which acted as like a lintel and transferred an estimated load of nearly 500,000 pounds to the needle girders, which in turn carried it to their four points of support close inside the wall and a considerable distance outside of it.

Another set of holes for needle girders and needle beams was pierced in the adjacent section of the wall and it was supported in the same manner and the process was repeated until the whole of the wall was carried on jackscrews in its plane or under the ends of short needle beams. The 24-inch girders were set alongside the wall before the needle beams were put in service, and when 24-inch I-beams were not available, two 12-inch I-beams, one on top of the other, were substituted. The first group of needle girders had to be placed about 10 feet from the front of the building so as to come between the adjacent caissons, and this left a portion of the wall near the corner which was supported on the cantilever ends of the 24-inch longitudinal girders projecting 8 feet beyond the center of support on the needle girders.

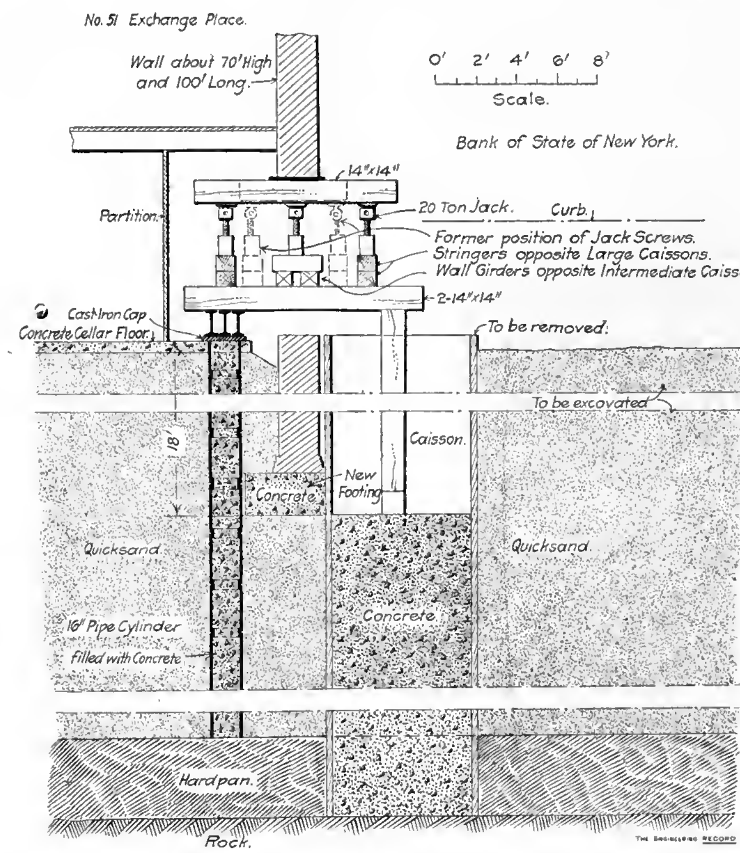
The first floor and basement doors in the street front extend to the side wall and very much weaken its bond with the front wall. Cast iron columns are built into the brickwork on both sides of the doors, and these were reinforced by cover plates bolted on over their lower splices and by a transverse horizontal brace across the feet of the columns, which held them rigidly when they were lifted from their bases and the latter were temporarily removed so that the lower parts of the columns were suspended. The front wall at the corner was supported on a vertical shore engaging the lintel over the first story door and bearing on two jackscrews seated in about the middle of a pair of long 15-inch I-beams which were carried at one end on the needle girders and at the other end on blocking on the sidewalk. The front of the wall was braced by inclined shores, reaching up to the second story and having their feet set on jackscrews chained to the needle girders.

Greased vertical planks were fastened to the face of the wall and served as guide strips, in contact with which the caissons were sunk between the needle girders, as shown in the sketch of the third operation. After the caissons were sunk the needle beams and temporary stringers were replaced as in the second operation, and the load of the wall was transferred to them and the 24-inch wall girders were released and removed to allow the new footing to be built up close to the under side of the old wall at the level of the needle beams. It was found when excavation was commenced in the bank lot, inside the row of wall caissons, that the fine sand flowed in rapidly from the site of the adjacent building through the spaces between the caissons. It was therefore determined to close the spaces by intermediate caissons, which, with the original caissons, form a continuous wall enclosing the side of the bank lot.

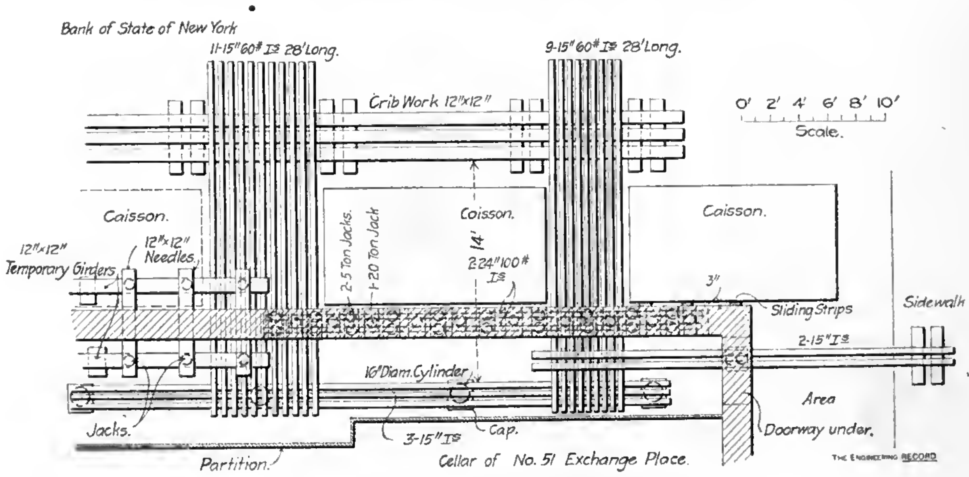
As these caissons occupy the space in which the needle girders were originally set the latter had to be removed after each of the temporary longitudinal stringers which they carried had been replaced by a pair of 14x14-inch timbers, one on top of the other, set close to them outside, and supported on pairs of 14x14-inch horizontal transverse needle girders close together side by side. These are 12 or 14 feet long, from 8 to 12 feet apart on centers, and are supported inside the building on the pipe cylinders, and outside on pairs of vertical 14x14-inch posts set on the concrete in the



Cylinder Pier Joints.



Support of Wall on Second Set of Needle-Beams.



First Section of Underpinning Beams, Girders and Cylinders.

caissons. The temporary stringers are about 7 feet apart on centers and carry lines of 20-ton jackscrews from 2½ to 3½ feet apart which support the ends of 14x14-inch 10-foot needle beams.

Between the rows of jackscrews pairs of longitudinal 14x14-inch timbers about 10 feet long were set side by side in the plane of the wall, so as to span the spaces originally left between the caissons where the steel needle girders had been and the jackscrews were set on them to receive the weight of the wall directly. The adjacent needle beams were thus released and removed and the temporary stringers were cut out between the caissons, leaving clear spaces to sink the intermediate small caissons. After these are completed the center lines of jackscrews and timbers opposite them will be replaced by the needle beams and outside stringers, the new foundations will be built with their footings carried down to a total depth of 24 feet below the curb, equal to the greatest depth of the bank excavation, the wall will be built up close to the lower part of the old wall and the weight of the latter will be transferred to it by a center line of jackscrews engaging old and new brickwork, the needle beams will be withdrawn and the jackscrews operated to lift the building as fast as the pressure causes the new footings to settle. When the settlement entirely ceases the brickwork will be completed and wedges driven and grouted between the old and new parts and the jackscrews gradually removed as the spaces are bricked up.

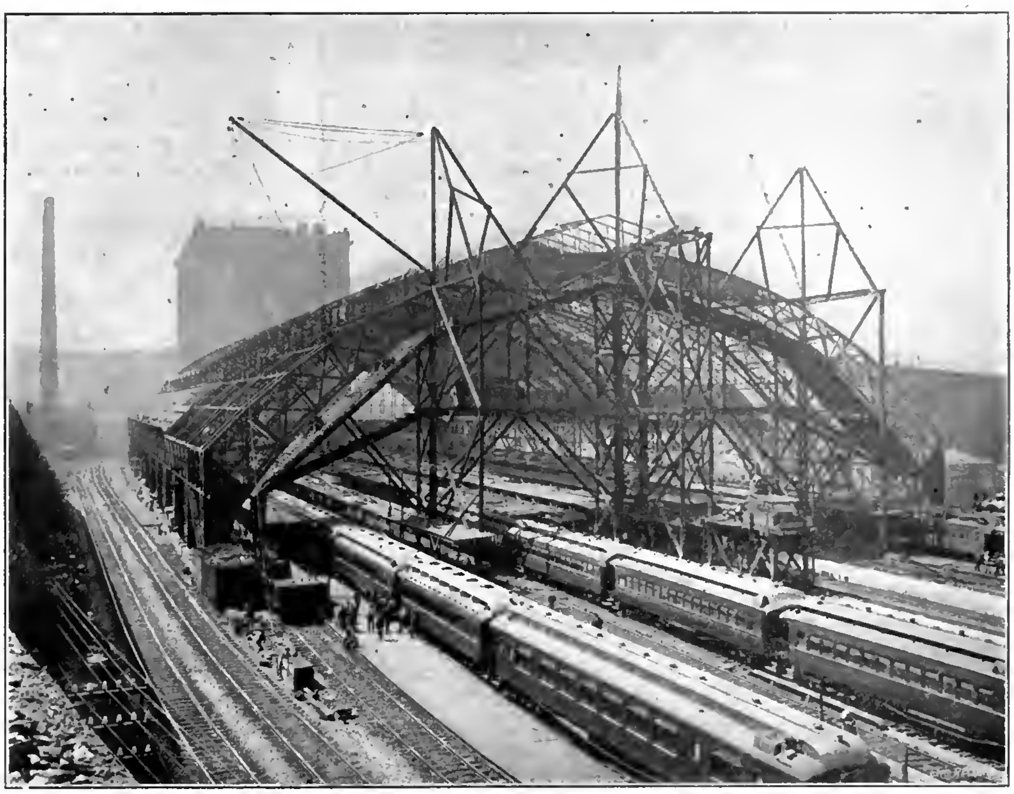
When completed the work will have been accomplished in eight operations: First, sinking the pipe cylinders; second, carrying the wall on needle beams; third, shifting the wall to center line of jacks and 24-inch girders; fourth, transferring the wall to longer, new needle beams; fifth, transferring portions of the wall to center lines of jackscrews and longitudinal girders opposite the intermediate caissons; sixth, building new footings; seventh, transferring the weight of the wall to the new footings and releasing and removing the needle beams; eighth, closing the joint between old and new brickwork and removing the jackscrews. This complex and protracted series of operations involved lifting six times a wall about 100 feet long and 70 feet high, weighing 1,600,000 pounds, which had to be supported at the extremities of long beams while every inch of the face was left free and clear for deep excavations alongside, and had to be preserved from distortion, cracking and other injury. The interior of the building had to be unobstructed and any interruption of tenants or business avoided, and finally the wall had to be constantly watched and adjusted to compensate for the continual undermining of the fine sand under its foundation. This involved vigilance for many weeks, and a system of periodical measurements and records, together with frequent lifting of portions of the wall to maintain its position. For some time the jackscrews had to be turned up daily and their total extension amounted to about 2½ inches, thus indicating the amount which the wall really settled and was lifted. The successful accomplishment of this complicated and prolonged series of delicate and dangerous operations, which were of an unusual nature and involved such critical conditions and heavy loads, reflects great credit on the courage, skill and ability with which they were conducted. The work was executed by the George A. Fuller Company, general contractors for the Bank of the State of New York, and was in charge of Mr. A. E. Riendau, who planned and supervised the method and details.

The pipe cylinders in the cellar of No. 51 Exchange Place were sunk under the direction of Mr. C. C. Lovejoy, who accomplished the work in the very narrow space available without obstructing any other part of the building or interfering with the tenants. If the same cylinders had been sunk under the center line of the wall so as to serve for the underpinning and carry the weight directly to bed rock once for all, as has been illustrated in The Engineering Record in descriptions of the Empire, Gillender, Corn Exchange, Stock Exchange, Queen's buildings and others of similar character which have been built in New York under conditions similar to those at the Bank of the State of New York, the work would have been greatly simplified and shortened and its cost diminished. Instead of the eight operations described only two would have been required—sinking the cylinders and transferring the weight of the wall to permanent bearing on them. The cylinders would have been sunk much more rapidly and less expensively by jacking them down from the under side of the wall itself, and thus avoiding the labor and delay of the less efficient artificial reaction which was secured by the suspended reaction platform. No transfers of loading would have been required, and no settlement would have occurred. The support of the wall would never have been diminished nor the loads on the soil increased. There would have been no obstructions necessary on either side of the wall, and no restrictions to the excavation or caisson sinking. The foundations would have been permanently established on solid rock without unnecessary work, and the cylinders would be in permanent service instead of being abandoned in the cellar. The cost of labor and materials for the entire work would probably have been less than for the first operation described above.

Losses by Forest Fires in the United States are very great, according to a bulletin issued by the Bureau of Forestry at Washington. In an average year 60 persons perish, \$25,000,000 of real property is destroyed, 10,724,000 acres of timber land burned over, and young growth estimated at \$75,000,000 killed.

The Erection of the Pennsylvania R. R. Train Shed, Pittsburg.

The new Pennsylvania Railroad train shed at Pittsburg is a 260x555-foot building 110 feet in extreme height, which was described in The Engineering Record of August 23. The walls and roof have a steel framework with twelve pairs of three-hinge arch trusses of 255-foot span on centers of end pins. The pairs of trusses are 49½ feet apart on centers and the trusses are 9 feet apart in the pairs, the two trusses of each pair being transversely braced together to form a single rib with considerable independent lateral stiffness, and the ribs being braced together with longitudinal struts and diagonals. The trusses have vertical end posts about 37 feet high from the top of the pier to the hip; between the hips the top chord is uniformly curved and the bottom chord is correspondingly curved, but to a smaller radius so as to increase the depth from about 7 feet at the crown to about 16½ feet at the hips. The trusses are built in symmetrical halves connected by a 5-inch pin at the crown and bearing on 5¾-inch end pins through pedestals like bridge shoes which rest at one end on expansion rollers, and at the other end on fixed bed plates.



Erecting Arch Trusses of Pittsburg Train Shed with Traveling Falsework.

The train shed occupies nearly the same position as the old train shed and the difficulties of erection were considerably increased by the necessity of maintaining uninterrupted service for 261 regular passenger trains and transporting 100,000 passengers daily at the same time that the shed site was raised several feet to the new grade and the old depot building was removed and a temporary one constructed. The construction of the new 137x225-foot head house, fourteen stories high, was not exactly a part of the train shed erection, but was so nearly associated with it that it may be considered as influencing that problem.

The west end of the old train shed was first removed and an 89x200-foot temporary wooden house was built on its site and equipped with offices, waiting rooms, restaurant, kitchen, etc., to accommodate the passengers while the new structures were being built. The pipes in the building were connected to the city water main and sewer by double swinging folding arms connected with four elbows so that they opened and closed without springing and allowed the building to be raised as the ground underneath was filled in to the higher new grades. The walls of the old depot were braced by 6x4-inch longitudinal and transverse horizontal timbers at the second story level and a track being laid through the center of the building the materials were carried off on it as fast as torn down. After it was completely removed the foundation excavations were made in sheeted pits and circular concrete piers with conical, extended footings were built in them. The piers rested with a pressure of 4 tons per square foot on a gravel bed 50 feet thick, and were capped with cast iron pedestals which transmitted a pressure of 20 tons per square foot to the concrete.

Under and around the train shed the grade was raised as much as 13 feet in places over an area of about 10 acres by filling in about 100,000 cubic yards of slate, clay and rock excavated from a cut in the hillside which later accommodated several new tracks. The grading was done while about 350 regular trains a day passed over the twenty tracks, and no obstruction or delay to traffic was occasioned by it. The tracks were quickly jacked up about a foot at once, singly, at times when the trains were least frequent. They were temporarily supported on stones while a dirt car was run alongside and ballast tamped under to the required height.

The head house was designed and erected very much like a steel cage office building and after its erection and the completion of the grading the erection of the train shed was accomplished without interrupting the numerous trains constantly passing over the tracks below which were parallel to its axis and covered its site. The tracks were mostly as close as possible together, in pairs with spaces for narrow passenger platforms between the pairs. The platforms were covered with temporary low wooden roofs and very little space was left for the falsework or for handling materials at ground level.

The erection of the train shed was substantially the erection of twelve double bents of roof trusses of about 255 feet span and 87 feet clear height, and was accomplished from a movable falsework with derricks fixed on it, which traveled the entire length of the building. The falsework was about 230 feet long, extending across all but the two outside tracks in the shed (on which two it was supported) and was about 14 feet wide, in the direction of the longitudinal axis of the shed, and about 82 feet high above the rail base in the center. It consisted of a working platform having four inclined planes supported just below the lower chords of the arch trusses by six vertical bents transverse to its length and parallel to the longitudinal axis of the train shed. Each bent was made with two 12x12-inch vertical posts braced together with caps, sills, intermediate horizontal struts and 6x12-inch X-braces in the panels between the horizontal members. The bents were braced together by the working platform and by horizontal and inclined timbers parallel to the planes of the roof trusses.

Each bent was set on double flanged wheels arranged tandem and with the exception of the outside bents ran on rails spiked to 8x14-inch stringers laid on line of platforms so as not to interfere with the use of the tracks. The falsework thus formed a single stable structure which spanned nearly the full width of the train shed and moved under the completed roof trusses from one end of it to the other. The middle two trestle bents, about 10 feet apart, were connected at the top by a horizontal section of the working platform, and were braced together with four panels of longitudinal horizontal struts and vertical X-braces to form a tower. The sills were extended about 40 feet beyond the face of this tower, on the advancing side, to engage with four more 12x12-inch vertical posts in the planes of the trestle bents. These posts were also transversely and longitudinally braced by horizontal struts and X-braces and formed an independent tower with its top extending above the top of the other tower to the level of the upper chord of the arch truss and supporting, at the outer face, the foot of one stiff-leg of a derrick with a 45-foot mast and a 10-ton, 75-foot boom. This tower was thoroughly braced to the main falsework and formed a buttress greatly increasing its moment of stability and adding to its resistance to any forces which might tend to overturn it when being advanced on its narrow base.

The lowest transverse struts, parallel to the planes of the arch roof trusses, were about 12 feet above the tracks so as to clear the passenger platforms and shelters and allow passengers to pass freely through the bases of the towers to arriving and departing trains. The falsework trestle bents next to the center tower on each side were about 60 feet away from it and were connected to it by 12x15-inch horizontal struts attached to their vertical posts at about the middle points. These struts were supported near their centers by long 10x10-inch kneebraces reaching nearly to the feet of the vertical posts but clearing all trains on the intermediate tracks. Similar kneebraces from the ends of these struts supported the centers of the inclined girder-struts which connected the tops of the trestle bents and carried the working platforms.

Two more 12x12-inch vertical posts about 85 feet high and 40 feet apart were braced together in the plane of each of these two trestle bents and fastened and braced securely to the falsework. The top of the outside post in each case was at the level of the adjacent top chord of the roof truss and supported, at the outer end, the foot of one stiff leg of a boom derrick. These derricks were similar to the one in the center of the falsework, and like it had one leg in the plane of the front face of the falsework and secured to it. The remaining two trestle bents, at the ends of the falsework, were about 12 feet high and were not braced in the planes of the arch trusses. Their tops were braced by struts running to the middles of the adjacent bents and carrying a foot walk to the platform which was built there and supported a house used for office and tools. The engine which operated the south derrick was on a platform moved along the south track immediately west of the traveler. The engine for the center and north derricks was located on a traveling platform in advance of the center tower-buttress.

The inclined girder-struts connecting the tops of the trestle bents were chords of four approximately equal segments of the bottom chord of the arch truss. They were pairs of 12x18-inch timbers connected by transverse floorbeams from 6 inches to 11 feet apart to accommodate iron connections on their upper sides. The floorbeams were covered with 3-inch longitudinal planks laid close together and, on the steeper portions of the platform, were provided with cleats to improve the foothold. All connections of the falsework timbers were made with ¾-inch bolts except for some of the lighter braces which were spiked on and all the vertical post splices were made with scabs, like bridge falsework. The falsework contained about 43,400 feet of timber b. m. and with the derricks had an estimated weight of eighty-eight tons.

The falsework was erected with gin poles at the end of the train shed nearest the head house. The arch trusses were received in twelve sections each, delivered on cars running on the regular passenger tracks to the base of the falsework and then hoisted into place and assembled by the three derrick booms which commanded more than a panel of the roof. The pedestals on the south side of the shed are built on solid rock and are only seven feet deep, enough to form an anchorage. The north pedestals are built of concrete founded on a bed of gravel 30 feet below the level of the track and are capped with sandstone. The shoes were in two pieces, as shown in The Engineering Record of Aug. 23.

The bottoms of the shoes on the south side were first set in place and anchored. The bottom chords, formed of 12-inch I beams in 30-foot lengths, were then put in position by drawing them through boxes under the tracks from north to south in the following manner: Two sections of chord were riveted together and pulled through until the north end was clear of the north pedestal. A third section was then riveted on and the whole pulled 30 feet further, when the process was repeated until the whole chord was in position. Both sections of the north shoe and the upper sections of the south shoe were then placed in position and the pins driven home; after which the boxes in which the chords lay were filled with bituminous concrete. This work was completed during the erection of the traveler.

The haunches or vertical end sections of a pair of trusses reaching from the top of the shoe to the hip joint U30-U22, and weighing about 5½ tons each, were then set in position by the side derricks and held until they were bolted to the upper section of the shoe. When they were released, the top of the haunch rested on the traveler. The remaining sections of the truss, about 30 feet long and from 7 to 17 feet wide, were lifted by the derrick booms and set on blocking and camber wedges on the working platform. Both trusses of a pair were assembled simultaneously from both pedestals and were made stable by bolting up the lateral and sway braces in the narrow panel before the sections were released by the derrick booms. The crown hinge pins were driven without trouble as the camber wedges were slacked off to bring the pin holes to match. The purlins, longitudinal struts and intermediate rafters were hoisted and assembled by the main derrick booms, and the falsework was moved out from under the arch rib and advanced one panel length to position for the erection of the next pair of trusses, and so on.

The falsework moved on 16-inch wheels on six lines of rails, and was pulled forward about 50 feet in two or three minutes actual moving time by its three hoisting engines winding up on tackles anchored in the ground in advance of the center and two side bents of falsework trestle. The falsework was not guyed, but the end and adjacent trestle bents were after each movement temporarily braced by inclined shores and the whole structure was jacked up from its wheel bearings when in use. The first arch rib was guyed in both directions by steel cables tightened by tackles anchored to secure fastenings in the ground on both sides of the trusses and care was taken to keep the lateral braces between the trusses well connected during erection. Temporary diagonal bracing of adjustable wire ropes and timber struts were put in the panels between the vertical end posts of the trusses as the work progressed to stiffen it until the sheathing was put on. The lantern and monitor frames were erected with small derricks and gin poles after the falsework had been removed to the next panel in advance.

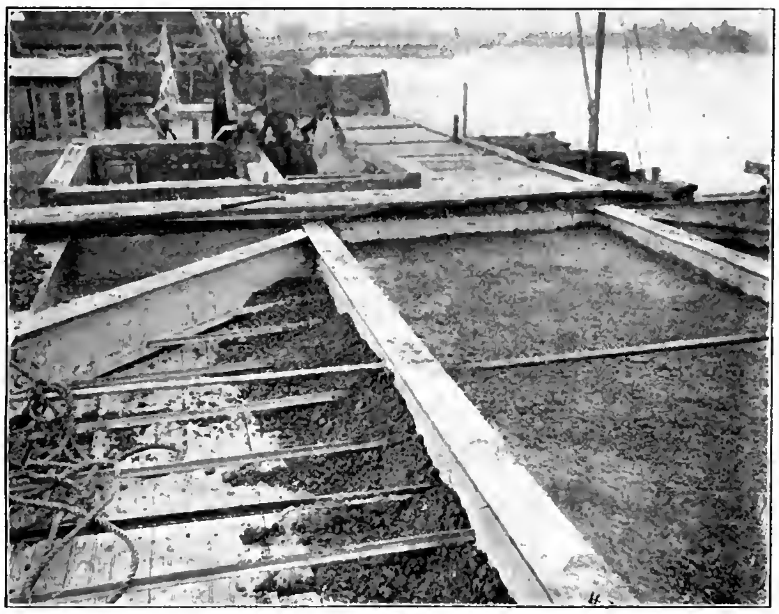
There were from eight to fifteen gangs of riveters who usually kept the work finished within about one panel of the assemblers. Most of the rivets were driven by pneumatic hammers, with flexible pipes to a 2½-inch main laid from end to end of the falsework and connected to a compressor plant and receiver stationed on a flat car on the north track of the shed just west of the traveler and moved along with it. The total erection force comprised from 75 to 130 men and the best record was the assembling and swinging of a 100-ton pair of arch trusses in 2½ days.

The train shed was designed in the engineering department of the Pennsylvania Railroad Company, Mr. W. H. Brown, chief engineer, under the direction of Mr. W. A. Pratt, now assistant to the chief engineer. The structural steel, weighing about 2,350 tons, was furnished by the Edgemoor branch of the American Bridge Company and was erected by the Pennsylvania Railroad Company workmen in charge of Mr. A. Braun, under direction of Mr. George C. Clarke, assistant engineer in charge of construction.

Fire and Load Tests of Concrete-Steel Floors.

Among the fire and loading tests conducted this spring by Mr. W. W. Ewing, while engineer of tests of the Bureau of Buildings of Manhattan, New York, were two made on floors

White Floor System.



American Floor System.

arranged so much alike that both can be described together. The object of the tests is stated in the official reports as follows: "To record the effect of the continuous heat of a wood fire below the floor system, averaging not less than 1,700 degrees Fahrenheit for not less than four hours, the filling between the two beams being loaded with a distributed load of 150 pounds per square foot of its area and all carried by such filling; the fire being extinguished at the end of the test with a stream of water directed against the bottom of the platform and discharged through a 1⅛-inch nozzle under 60 pounds pressure for five minutes; flooding the top of the platform with water under low pressure, and then again applying the stream of water through the nozzle under 60 pounds pressure to the bottom of the platform for five minutes."

Each series of tests was made in a brick building constructed for the purpose, the roof forming the flooring system under investigation. The buildings were approximately 14 feet square internally, 10 feet high, and had grates 2½ feet above the ground level on which the fires were made. There was a large door for placing the wood in the house, and various doors and chimneys for draft.

One of the flooring systems tested was that of the American Fireproof Construction Co., of New York. The roof framing in this case was formed of 10-inch 15-pound channels on the walls, with knee-braces of similar channels at the corners, the braces starting from points 4 feet from each corner. The main supports for the roof were a pair of parallel 10-inch 45-pound I beams spaced 5½ feet apart. These beams and the wall channels parallel to them were connected by two rows of ¾-inch tie rods. The steel reinforcement for the concrete was furnished by 1x1-inch T bars laid on the lower flanges of the roof beams as shown in the illustration. The 5½-inch bottom layer of concrete was placed on April 4; it was mixed in the proportion of one part Portland cement, one part sand and six parts of steam ashes. On April 10 the 6½-inch upper bed was laid; this was a mixture of one part Portland cement and fifteen parts of steam ashes. Two days later the centering was taken down and the ceiling of the center bay plastered with half an inch of Acme plaster.

The other floor system tested was that of the White Fireproof Construction Co., of New York. The framing was practically the same as that just described save that the main floorbeams were 12-inch 31½-pound I beams spaced 6 feet 1-inch on centers. The reinforcement was formed of 9/16-inch round tension rods spaced 12 inches apart and laid on the lower flanges of the beams as shown in the illustration. These were wired to three ½-inch rods, placed parallel with the floorbeams to serve as spacers for the tension rods. The bottom 5½-inch concrete bed was mixed in the proportion of one part Portland cement, two parts sand and five parts steam ashes, and was placed on April 4. On April 17 the top filling of 8 inches of concrete mixed in the proportion of one part Portland cement to ten parts of cinders was put in place, and the centering removed. The ceiling was plastered on May 2 with half an inch of Rockwall plaster.

The fuel used for each test was pine and mixed cord wood, the fire being accelerated at the start with kerosene. The floor was loaded to 150 pounds per square foot with brick. The temperature of the fire was measured with a LeChatelier pyrometer. The deflections were observed at nine stations with a Y level. The results obtained are given in the accompanying table, the temperatures being in Fahrenheit degrees and the deflections in inches at the centers of the beams and arch.

The condition of the American arch after the fire test is described as follows in the official report: "The plaster applied to ceiling was destroyed by the fire and water. Two T bars of the center arch had their bottom flanges exposed, otherwise the floor was intact with only a small amount of the principal concrete filling washed down by the water. The concrete showed a very considerable amount of coherence. The beam protection was effective."

Fire Test of American Floor, May 2.

		Deflections.		
Time.	Temp.	E. Beam.	Arch.	W. Beam.
10:24 a. m.	Cool	0.10	0.05	0.075
10:57 a. m.	1,715	0.20	0.15	0.225
11:22	1,595*	0.225	0.15	0.15
11:45	1,850	0.40	0.15	0.30
12:20	1,802*	0.625	0.325	0.425
12:45	1,949	0.80	0.40	0.60
1:10	1,805*	1.05	0.425	0.775
1:35	1,823*	1.175	0.475	0.975
1:55	2,072*	1.30	0.275	1.075
2:15	2,048	1.325	0.625	1.175
After cooling, loaded		0.425	0.60	0.175
After cooling, unloaded		0.30	0.525	0.05

*These figures are interpolated from readings 3 minutes apart.

The loading test was made on May 3 and the unloading test on May 6. The results are given in the accompanying table, and, in connection with those of the fire test, were so favorable as to lead Mr. Ewing to recommend allowing the system to be used in the Borough.

The loading was applied with brick and the readings were made at the centers of the beams and arches.

Load Test of American Floor.

Load.		Deflections, inches.		
Lbs. per sq. in.	Date.	E. Beam.	Arch.	W. Beam.
150	May 3	0.10	0.025	0.125
300	"	0.125	0.05	0.10
450	"	0.175	0.075	0.175
600	"	0.20	0.125	0.175
600	May 6	0.175	0.20	0.175
450	"	0.125	0.175	0.20
300	"	0.15	0.10	0.175
150	"	0.075	0.125	0.15
0	"	0.0	0.10	0.125

The fire test of the White system was made on May 8, with the floor loaded to 150 pounds per square foot with brick, and the results are given in the accompanying table. The tem-

Fire Test of White Floor, May 8.

		Deflection.		
Time.	Temp.	N. Beam.	Arch.	S. Beam
9:45	Cool	0.00	0.02	0.02
11:05	1,427*	0.35	0.08	0.37
11:20	1,460*	0.28	0.10	0.19
11:40	1,715*	0.19	0.16	0.12
12:00	1,742	0.21	0.19	0.27
12:20	1,767*	0.42	0.26	0.56
12:40	1,795*	0.59	0.26	0.73
1:00	1,820	0.69	0.32	0.87
1:20	1,889*	0.89	0.38	1.07
1:40	1,892*	1.00	0.42	1.24
2:00	1,927	1.23	0.48	1.41
2:20	1,967*	1.41	0.55	1.54
2:40	1,988*	1.55	0.56	1.72
After cooling, loaded		0.25	0.57	0.31
After cooling, unloaded		0.10	0.57	0.16

*These figures are interpolated from readings at 3-minute intervals.

peratures are expressed in Fahrenheit degrees, and the deflections in inches at the centers of the beams and arch.

The official report of the condition of the arch after the fire test reads as follows: "The plaster applied to the ceiling (principal arch) was all destroyed by the fire and water. Two of the 9/16-inch round rods were exposed by the water. The beam protection was in good condition, as was generally the entire arch with the exception of the exposing of the two rods mentioned."

The loading test was made on May 10 and the unloading test on May 12, and the results, in connection with those of the fire test, were so favorable as to lead Mr. Ewing to recommend allowing the construction to be used in the Borough.

Load Test of White System.

Load.	Date.	Deflection, inches. N. Beam.	Arch.	S. Beam.
150	May 10	0.09	0.08	0.03
300	"	0.08	0.18	0.08
450	"	0.10	0.305	0.13
600	"	0.17	0.455	0.20
600	May 12	0.17	0.505	0.22
450	"	0.10	0.505	0.17
300	"	0.07	0.465	0.08
150	"	0.05	0.35	0.09
0	"	—0.01	0.27	0.19

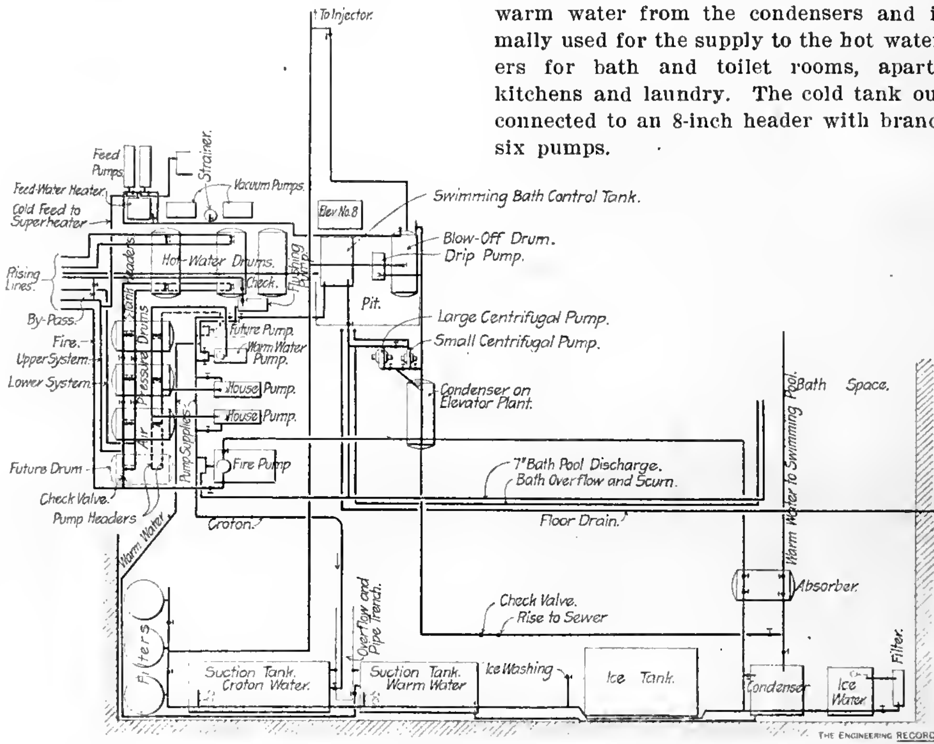
Water Supply Systems in the Ansonia Apartment Hotel.

The Ansonia, at Broadway and 73rd and 74th Streets, New York, is a very large seventeen story, steel and iron building with housekeeping and family hotel apartments for about 1,300 tenants. It is equipped for public and private service and provides from the general installation for individual tenants. It contains three hundred and fifty-five suites of two to thirteen rooms each, every one of which has a toilet room and from one to three private bath rooms. There are 112 private kitchens, 112 butler's pantries, two public dining rooms, a restaurant, a grill room, two large kitchens, a very large laundry, public toilet rooms, Turkish, Russian and swimming baths, a barber shop, reception and assembly rooms for general use, and

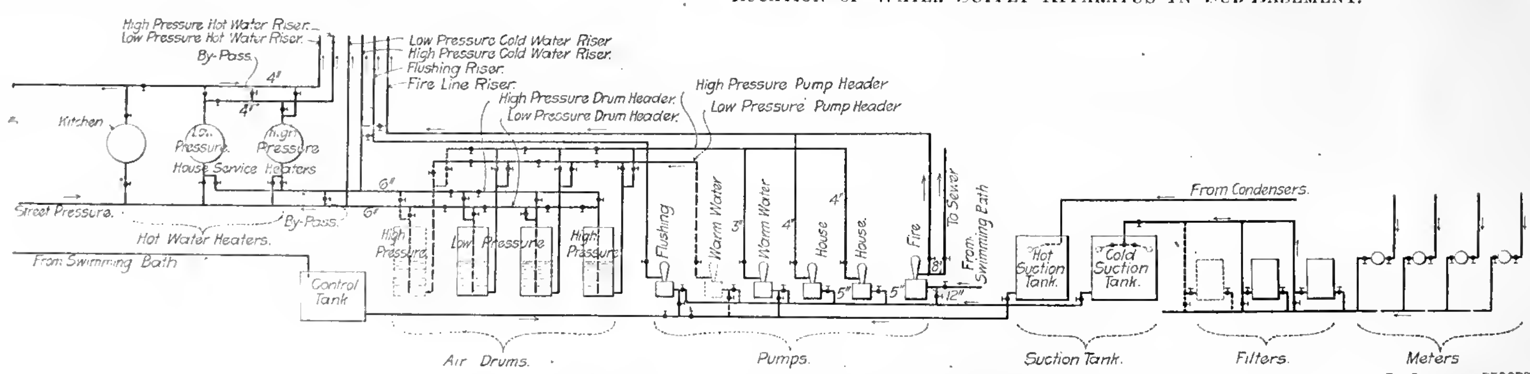
elevator pumps might be properly considered as a tenth system. All water above the first story is supplied under direct pump pressure, with intermediate air cushion drums. The drums and pumps are arranged in double pairs, one set for the supply above the ninth floor and one set for the supply between the first and ninth floors. The upper system is supplied from the top downwards, and the lower from the bottom upwards, thus avoiding excessive pressures and expensive pumping which would be occasioned by the great height of the building if the lower fixtures were under full pressure head. Nearly all the apparatus is located in the sub-basement, and the general plan is to make all the pumps and other apparatus interchangeable and

tor pumps, to the refrigerating plant condensers and to the swimming bath. Between the filters and the suction tank there are direct branches to the boiler feed, to the kitchens and laundry and to the drinking water filter.

There are two 17,500-gallon rectangular suction tanks built of steel plates and angles, mounted on brick piers and covered with wooden tops having locked trap doors. They are painted outside with a shop coat of carbonizing compound and two finishing coats of lead color, and inside with two coats of white enamel. Each is filled through two 4-inch Ludlow valves with cylinder floats and has a 6-inch overflow and a 6-inch outlet. One tank receives cold water directly from the filters, which is used for the cold house supply and the other receives warm water from the condensers and is normally used for the supply to the hot water heaters for bath and toilet rooms, apartments, kitchens and laundry. The cold tank outlet is connected to an 8-inch header with branches to six pumps.



LOCATION OF WATER SUPPLY APPARATUS IN SUB-BASEMENT.



GENERAL ARRANGEMENT OF APPARATUS, CONVENTIONALLY SHOWN.

studios, stores, offices and a bank for rental. It is estimated that there may be about 1,700 people in the building at once and that about 280,000 gallons of water a day, or 84,000,000 gallons a year, will be required for all purposes. This involves a very elaborate water supply and drainage system, which is said to be the largest ever installed under one roof, including as it does 322,000 feet of pipes and over 2,000 fixtures.

The distribution of water may be divided into nine separate systems: high-pressure cold water, high-pressure hot water, low-pressure cold water and low-pressure hot water, all for house service, street pressure cold water and hot water for the basement service, water for the flushing service, water for the fire service, and cold drinking water. Besides these, the street pressure supplies to steam boiler feed, to the refrigerating plant, the hose washing cocks and for the public baths and to the

cross connected so that any given element may be cut out without interfering with the service, can reinforce another similar element, or can be used for any of the systems at will.

Water from the street mains on three sides of the building is received through four 4-inch and one 3-inch lead pipe connections, all of which are controlled by gate valves accessible through manholes with iron sidewalk covers. Each supply has a fish trap and a full size Worthington meter with gate valves each side. All are connected to a main which can discharge into the cold water suction tank directly or through three by-passed Loomis-Manning filters. These filters each have a capacity of 100 gallons a minute under the ordinary street pressure of 30 pounds, and one used for the flushing system has a capacity of 60 gallons a minute under a head of 17 feet. Between the meters and the filters the supply main has direct branches to the fire pump, to the eleva-

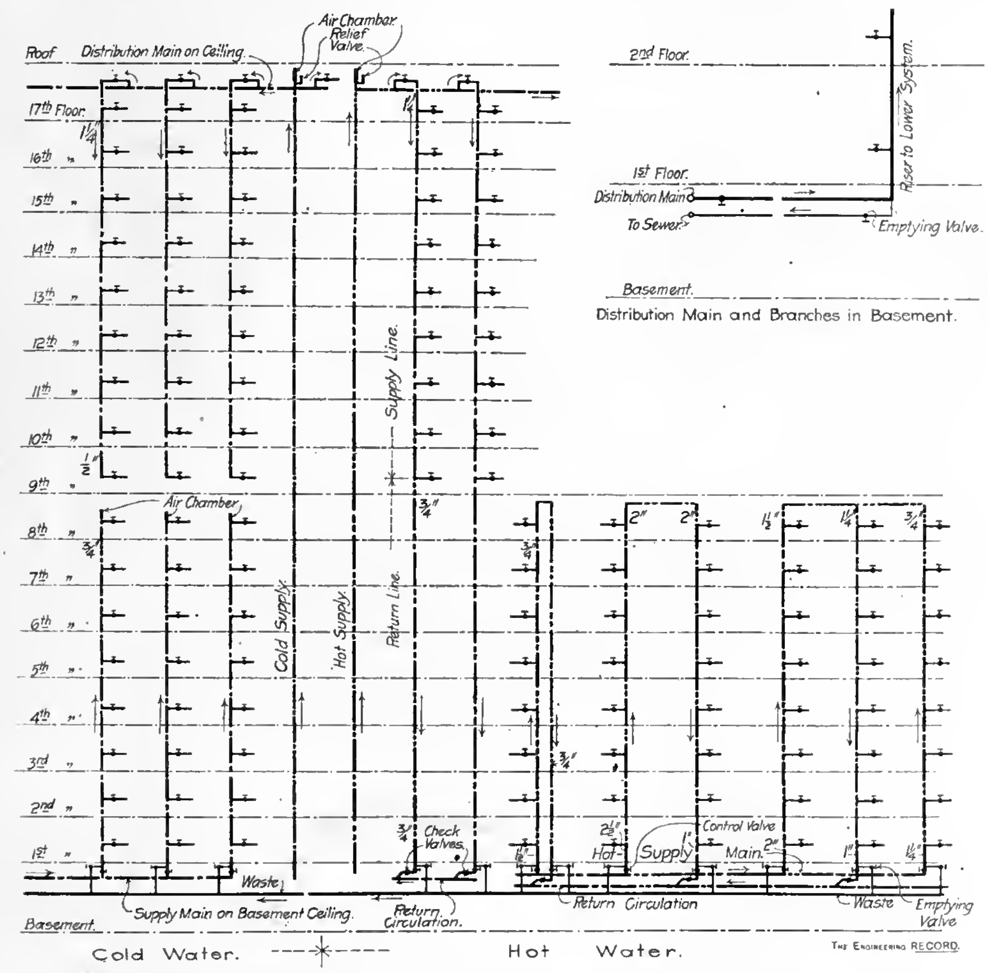
There is an 18x12x10-inch Worthington Underwriter's fire pump with 8-inch suction and 7-inch discharge and a capacity of 1,000 gallons per minute; two compound Davidson direct-acting 9x12-inch cold water high or low pressure pumps, two single Davidson direct acting 12x7x12-inch hot, high or low pressure pumps and a 7½x4½x10-inch Worthington duplex pump for the flushing system. The two hot water pumps are connected to the suction pipe from the warm water tank and the fire pump has a connection to the swimming pool. The flushing pump can draw either from the cold water or warm water suction tanks but is normally supplied from an overflow tank which regulates the level of the water in the swimming bath. The fire pump has two discharges, one to the swimming pool and the other to the fire lines which may be cross-connected to the high-pressure house service cold water system. The flushing pump is also connected to the latter system. All the pumps are automatically controlled by Foster pump regulators. The house pumps are not directly cross connected, but deliver into high and low pressure headers which are valved so that either pump can be put under either pressure.

From both headers supplies are run to each of the air drums, two of which are normally under high and two under low pressure. Each drum is a vertical steel cylinder 5½ feet in diameter and 9 feet high, made with ⅝-inch thick sides and domed heads and supported on iron legs. Each has a 6-inch inlet and outlet and is provided with a 2-inch adjustable relief valve, with extension to the bottom of the drum to act by water pressure, and 8-inch dial Ashcroft pressure gauge indexed to 200 pounds per square inch, a 1½-inch air inlet with valve and swing check, a 1½-inch emptying pipe, a ⅜-inch governor pipe extended to the bottom and connected to the pump controllers so as to regulate the pumps and automatically maintain the pressure in the drums with a variation of not more than 5 pounds. Each drum has a manhole and a mud hole and was shop tested to 220 pounds per square inch, and tested to 150 pounds after its connections were completed. The outlet of each drum is connected to a low-pressure and to a high-pressure header, one valve being always closed so that two of the drums work normally under high and two under low pressure. The headers are cross-connected and have branches to the hot water heaters and to the house distribution lines and risers. By this system the pumps and air drums are usually used in pairs, each pair operating with high or low pressure and with warm or cold water.

There are four distribution mains on the basement ceiling, one for street pressure cold, and one for low pressure hot and separate circulation for the basment fixtures, one for low pump pressure hot, and one for low pump pressure cold to riser lines supplying fixtures between the basement and ninth stories. The hot and cold risers are taken from the ends of branches connected to the upper sides of the distribution mains as shown in the detail sketch.

The low pressure cold water risers are vertical pipes from 2 inches to ½ inch in diameter, diminishing upwards and terminating with an air chamber and air valve in the eighth story. There is no circulation through them except what is caused by the flow of water to the different outlets. The pressure is regulated by the pump governor and is such as to give about 50 pounds at the lowest and 10 pounds at the highest fixtures. The hot water risers in this system are like the cold water risers except that instead of terminating with air chambers at the upper ends they make loops there and return with parallel branches to the basement. In most cases this branch is ¾-inch in diameter and serves simply for the return circulation, but in some cases it is 1½ inches in diameter at the top, reducing to ¾ inch at the bottom, and supplies fixtures. In a third arrangement two hot water risers have a horizontal connection in the eighth story which is connected to a return circulation pipe common to both risers. The feet of all return circulation pipes have horizontal branches in which check valves are set to prevent any reverse flow up the pipes. These are connected to return mains delivering in the usual way to the bottoms of the heaters. The feet of both the flow and return pipes have controlling and emptying valves.

All the hot and cold water for the fixtures above the eighth story is delivered through two main risers, distributed through horizontal belt mains in the seventeenth story, and supplied downwards through vertical pipes diminishing in size as they pass the fixtures in successive stories. The cold water pipes terminate in the ninth story and are emptied through their lowest fixtures. The hot water pipes are reduced to ¾ inch diameter below the ninth story fixtures and thence continue to the basement as return circulation pipes without outlets. At their feet they are connected to a horizontal return main as in the low pressure system. The pressure at the seventeenth story fixtures is about ten, and at the ninth story fixtures about fifty pounds.



Water Supply Systems for Upper Stories Exclusive of Flushing System.

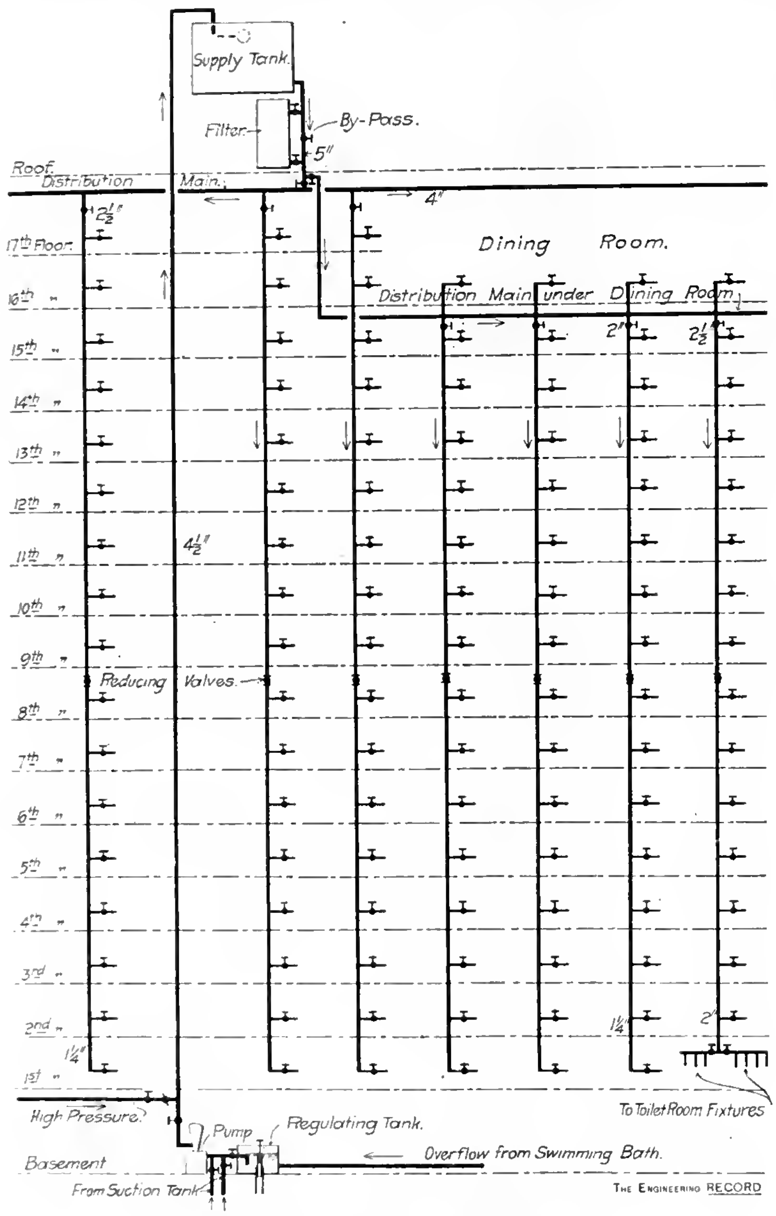
The hot water heaters are 5-foot horizontal cylinders, 12 feet long, made of ½ inch steel plates and tested to 175 pounds. Each has a capacity of 1,800 gallons and contains an 80-foot coil of 2-inch brass steam pipe. Each has a safety valve, a 4-inch inlet and outlet, and a Kiely & Mueller automatic regulating device to maintain a constant temperature in the water which is generally received from the warm water tank at a temperature of about 100 degrees. All the heaters are insulated and are by-passed so that their service is interchangeable.

The swimming baths receive a constant liberal supply of warm water which has passed through the condensers of the refrigerating plant. It overflows into a regulating tank that serves as the normal supply for the flushing system, and is thus used three times so as to effect an important reduction in the water bills. If the flushing supply is in excess of the requirements the surplus is wasted from the regulating tank and is pumped into the sewer; if it is deficient the lack is made up by warm water from the condensers, by cooler water from the absorber, or by cold water direct from the street supply.

The flushing pump delivers through ball cocks into a 21,000 gallon double tank above the roof, and when the tank is full the closing of the cocks develops pressure in the discharge pipe which operates the automatic Ford regulator, shuts off steam and stops the pump. From the roof tank the water passes through a Loomis-Manning filter to a distributing main in the seventeenth story and thence through lateral branches to vertical pipes supplying all the toilet fixtures in the house. The water is so clean that it would not be offensive if not filtered and it may be by-passed around the filter if necessary. A large dining room occupies a part of the sixteenth and seventeenth stories, and as risers cannot pass through it from the general distribution main a special main is run under it in the fifteenth story to supply the lines to the lower fixtures and has also connections upward to the sixteenth story fixtures. There is a Ford pressure reducing valve set in each vertical line of the flushing system at the eighth story to prevent excessive pressures on the lower story fixtures. The lines terminate at groups of fixtures in the first and second stories and some of them are connected at the foot with headers from which connections are made to a number of fixtures.

The fire pump suctions are connected to the cold water storage tank and to the swimming bath, and its 7-inch discharge is connected to 6-inch mains running in opposite directions on the basement ceiling and having four connections to Siamese unions at the sidewalk and four 5-inch stand pipes in the centers of the main corridors besides fourteen outlets with hose lines to various points in the cellar, basement and first floor. Two of the stand pipes have nineteen and two of them have eighteen outlets, with from 50 to 160 feet of hose for each, making a total of eighty-four outlets and 8,810 feet of hose. All of the stand pipes are run full size to the roof and two of them are extended above it. The different hose lines command every portion of every floor and will throw jets across to the opposite sides of all the courts. The fire system has a connection with the high-pressure house supply riser, with a swinging check valve so that all the water in the pressure tanks can be made instantly available, and when the street fire engines are connected to the Siamese unions their pulsation will be absorbed by the air cushions in the pressure drums. The four house pumps with a united capacity of 1,000 gallons a minute are fitted with check valves in their discharge pipes and are cross-connected so that they can supplement the fire pump, and it is also possible to use all the water in the hot and cold suction tanks and in the swimming bath for fire purposes.

The drinking water supply is drawn from the high pressure house main, refiltered and passed through a tank in which there is a coil through which brine from the refrigerating plant is circulated at a low temperature. This cools the water to about 40 degrees and maintains that temperature while it is circulated by duplicate compound 8x12x5x10-inch Knowles pumps to supply a faucet in every housekeeping suite of rooms and a number of public drinking fountains in different stories. The refrigerating plant is installed in the basement and supplied, as previously stated, with filtered water under streeet pressure. It is used for freezing 5 tons a day of ice in cans, and also for cooling a large quantity of brine which, by special compound duplicate Knowles pumps is circulated through coils in the refrigerators in the different apartments and kitchens and cools them without the direct use of ice. Small freezing tanks are, however, arranged in the private refrigerators by which limited quantities of ice may be made, or wine cooled for table use as required.



WATER SUPPLY FOR FLUSHING SYSTEM.

All water pipes are of galvanized iron with extra heavy fittings, tested to 200 pounds pressure at the shop before shipment and to 150 pounds after being put in place. In the three lower stories the high-pressure pipes are made extra thick. Except the exposed connections to fixtures, which are nickel plated, all water pipes are painted and are generally accessibly located in shafts or wall chases. All dead ends terminate with air chambers, and all pipes are pitched to emptying valves by which they can be drained separately without interfering with other portions of the system. The supply to each suite of apartments and to each fixture in the suite, is controlled by independent valves so as to be cut out without stopping the supply to any other part of the system, and the general supplies for the suites, for the kitchens and laundry, for the baths, and for the public service are all separate and independent.

The covering of pipes and apparatus includes both exposed and concealed work and is intended not only to prevent condensation of atmospheric moisture on the surface of the pipes and tanks but to prevent also the cold water from being warmed and the hot water from being cooled by radiation. All hot and cold water pipes, mains and fittings except the short branches to the toilets or fixtures, are covered 1 inch thick with the Philip Carey Company's double felting, canvas wrapped, banded with iron and painted two coats of asbestos paint. The pressure drums and filters are covered with wire net and 1½-inch slabs of Keasbey's magnesia, wired on, and plastered with two coats of hard plaster, finished smooth and painted.

The system is controlled by 80 check valves up to 10 inches in diameter, and by 9,143 other valves exclusive of automatic float and pressure regulating valves. There are 1,848 Jenkins gate valves 2 inches in diameter and larger with iron bodies, composition seats and iron hand wheels, 2,626 1 to 2-inch globe valves with composition bodies and hand wheels, 3,896 globe and 773 lock shields, nickel plated valves at fixtures. All cellar and basement valves have numbered tags corresponding to a chart which shows what service they control. All the supply lines except those for the high-pressure service in the stories above the ninth floor are controlled by basement valves, but these are not concentrated on distribution drums as is sometimes the case. Each separate riser has a control and emptying valve at the foot where it is connected to the ceiling branch from the distribution main.

Mr. Paul E. Duboy was the architect, and Mr. Reginald Pelham Bolton, M. E., consulting engineer, designed and supervised the installation of the water supply and sanitary systems. Milton Schnaier & Company were the contractors for the above described work.

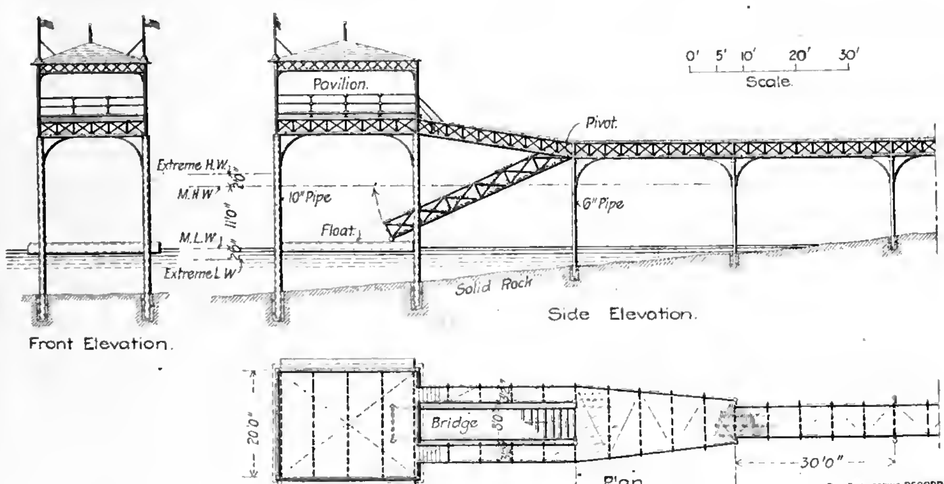
A Seaside Resort Steel Pier and Pavilion.

At Bar Harbor, Me., an elevated steel pavilion has been built about 240 feet from the shore and connected with the promenade from the Mount Desert Reading Room by a light steel pier having a pivoted bridge to the floating landing stage under the pavilion. The pier has six trestle bents, which, together with the masonry abutment and retaining wall at the shore end and the pavilion columns support six regular 30-foot spans and two special spans of the pier floor. Each bent consists of two vertical cast iron columns 6 inches in diameter, ¾ inch thick and 8 feet apart, the tops of which are braced longitudinally by curved knee braces to the lower flanges of the longitudinal girders. Transversely they are connected by cross girders and by stiff angle bracing extending down from 7 feet on the shorter columns to 14 feet on the longer ones.

The columns are from 10 to 22 feet long with their tops in a horizontal plane about 5 feet above mean high water. They are capped by horizontal steel plates riveted to collars or split sleeves made of 9-inch vertical plates bent to semicircles fitting the column and bolted together tightly around it through their projecting flanges. The horizontal struts consist of a pair of 3x2½-inch angles riveted together back to back with connection web plates at the ends which have flange angles tap-bolted to the columns. These plates receive the diagonal struts which are single 3x3-inch angles with top connection plates riveted to the collars which secure the caps. The knee braces are pairs of 3x2½-inch angles curved to quadrants of a circle of about 5 feet radius. A plate is riveted to the bottom of their wide flange and is curved to fit the column to which it is attached by stud bolts. Each cross girder is a pair of 6-inch channels latticed together, 5 inches apart and seated on the cap plates of the columns to which they are secured by rivets through their lower flanges.

About 18 inches from each end each cross girder supports the abutting ends of two riveted trusses 3½ feet deep and 5¾ feet apart on centers. These trusses are formed as indicated in the elevation, with verticals and diagonals and are braced sideways from the top chords to the ends of the floorbeams. The chords are pairs of 3x2½-inch angles back to back, the verticals are single angles and the diagonals are alternately single $2\frac{1}{2}$x2-inch angles and 3x$\frac{1}{4}$-inch flat bars. The trusses serve for hand rails and their top chords are covered by half round wooden strips finished smooth and secured by screws on the under side. At every alternate panel of the truss there is an intermediate floorbeam which consists of a 5x3-inch angle $8\frac{1}{2}$ feet long which is riveted across the flanges of the bottom chord and has sway braces from its ends to the top chords of the trusses. The lower chords are braced laterally by zig-zag $2\frac{1}{2}$x$2\frac{1}{2}$-inch angles, one in each panel between floorbeams. Four lines of 3x4-inch longitudinal joists are laid across the floorbeams and carry the 2x6-inch transverse floor boards, laid with open joints.

In the second span from the pavilion the floor is widened to nearly 14 feet to give room in the span next to the pavilion for a center descending walk to the float and an ascending walk on each side to the pavilion floor. The descending walk is a bridge 6 feet wide which has two trusses similar to those in the regular spans, but somewhat longer and having longer panels. The upper end is pivoted to the floorbeam and the lower end has roller bearings on a floating platform which serves for the boat landing at all stages of the tide. The platform is a few inches narrower than the pavilion floor so as to



Steel Pier, Pavilion and Pivoted Bridge.

clear the four pavilion columns, and extend a little beyond each pair. It is connected to the columns by sleeves which enclose and slide freely on them, allowing the float to rise and fall with the tide between the columns as guides. The four columns supporting the pavilion are 10-inch steel tubes, $\frac{1}{2}$ inch thick. The pavilion platform and steps leading to same are enclosed by a gas pipe railing, and the pavilion has a tin roof supported on 10x3-inch wooden hip rafters.

The pier is built on solid rock, which slopes uniformly about 1: 15 from the shore. A temporary wooden trestle was built on the center line of the pier and supported an artesian well-drilling machine which bored 8 and 12-inch holes 4 or 5 feet deep to receive the cast iron columns. A light derrick traveled on the trestle and set the columns in place where they were filled with Portland cement concrete and Portland cement mortar filled in any spaces in the holes outside the columns. The foundations are thus made very secure and the structure has proved rigid and able to resist the wind and waves. The total weight of metal work is about 25 tons and it was erected in a few days after the foundation holes were bored.

The pier and pavilion were designed and built by Messrs. Snare & Triest, contracting engineers, New York.

Trade Publications.

Conveyors for handling coal and ashes are described in the October bulletin of the Steel Cable Engineering Co., 92 State St., Boston. It builds a gravity bucket conveyor, driven by a continuous chain, the cross-bars of which are located vertically over the edges of the buckets, so as to constitute a lap between them. Its pan and bucket conveyor includes a moving trough of interlapping pans on the lower or filling run of the bucket chain. Some of the conveyors are arranged for steel cable driving. Various methods of application to power, coaling and other plants are illustrated.

Fuel oil equipments is the title of a pamphlet issued by the Petroleum Iron Works Co., Washington, Pa., devoted to the use of oil as a fuel in steam plants. As generally installed, the apparatus consists of a storage tank, a pump, a vertical pipe into which the pump discharges, the pipe having an overflow and used as a constant pressure regulator, and the burners to which the oil passes from the regulator. The burners use steam for atomizing the oil, and for sending it into the furnace in a whirling jet. The recommended form of settling in its application to different classes of boilers is shown.

Readers of the article on the plant of the Cambridge Electric Light Co., in this issue will find in a pamphlet prepared by Mr. Frank B. Gilbreth, 176 Federal St., Boston, inventor of the portable gravity concrete mixer, some nine views of the method of building the foundations for that plant. The interesting feature of the work is that the mixer is carried by derrick from place to place, allowing the concrete to be dumped from the mixer directly into the place where wanted.

The Whitehall Portland Cement Co., 712 Reading Terminal, Philadelphia, has published in one cover a description of its site and raw materials at Cementon, Pa., an historical sketch of the manufacture of cement, the report of Major Marshall, Major Leech and Captain Crosby, Corps of Engineers, U. S. A., on the testing of cement, and some valuable information concerning the use of cement in freezing weather, cement in sidewalks and the composition of concrete for various uses, together with numerous tests of the Whitehall cement. The booklet is interspersed with views of the Cementon works and of buildings, bridges and dams in which the cement has been used.

The Western Electric Co., Chicago, has issued catalogue No. 3020, which is devoted chiefly to direct-connected exhaust fans and steel-plate blower equipment. The exhaust fan motor outfits are designed for 110, 220 and 500 volts. Suggestions are given regarding the proper setting of fans, including a method of mounting fans in places where unusually high temperatures are encountered.

The Christensen Engineering Co., Milwaukee, Wis., has published three beautifully printed and illustrated catalogues. One describes the "Ceco" electrical machinery, including direct-current motors, direct-current generators from 25 to 1,000 kilowatts capacity, alternators of 75 to 1,500 kilowatts capacity, transformers and dynamic interrupters for transformer protection. Another, No. 53, is devoted to straight air-brake equipments, with independent motor compressor, for electric cars; this is a detailed account of the various parts of the system and their operation and is accompanied by instructions for installing and maintenance and by plates of typical application. Publication No. 54 is a description of the works of the company where the air brakes are made and contains a long list of patrons, with a large number of illustrations of railways equipped by it.

The Green traveling link grates are the subject of Catalogue C of the Green Engineering Co., Western Union Building, Chicago. The illustrations show the latest improvements in its chain grate, and the booklet will be found of value alone from a list of bituminous coals of the States of Ohio, Pennsylvania, Illinois, Indiana and Kentucky, giving by counties the output of the mines, the heat value of the coal and its proximate analysis.

The Page concrete mixer consists of a rectangular box with filler blocks in the corners, the box being revolved by a central shaft inclined at about 45 degrees. The top of the box is open and being inclined, allows for ready charging; a door in the side of the box is the discharging outlet. Page & Shnable, Security Building, Chicago, show its operation in a circular they are distributing.

A 47-page catalogue, $9\frac{3}{4}$x$12\frac{1}{4}$ inches, in size, has been issued by the Gurney Heater Manufacturing Co., 74 Franklin St., Boston, covering the complete range of steam and hot-water boilers, radiators and heating accessories which it manufactures. Full page illustrations of the boilers and radiators are given, and the book includes corresponding tables of dimensions, capacities and prices.

The Eugene Dietzgen Co., 181 Monroe St., Chicago, is distributing a circular describing a new electric blue-printing machine. This consists of a cylindrical printing frame composed of two heavy curved plates of glass, which is carried by a base which also holds the printing frame and which supports the arc lamp and an automatic lamp driving gear. The cylindrical frame revolves on trunnions, so that it can be swung into a horizontal position for loading. When the lamp reaches the end of its downward travel, it is automatically reversed and returns quickly to the original position.

The Buffalo Forge Co., Buffalo, N. Y., has issued a booklet illustrating its horizontal center and side-crank, horizontal tandem compound, vertical center-crank and compound and marine types of steam engines. It has also prepared a booklet on mechanical induced draft in which are shown a number of different types of induced draft fans.

The G. Drouvé Co., Bridgeport, Conn., has prepared two circulars, one describing the Lovell window and shutter operating device and the other a portable stove it makes for burning either hard coal or coke and designed primarily for temporary warming, as in a building undergoing erection. The Lovell device is said to be capable of operating a line of sash 500 feet long from one station, if desired, and is adaptable to any kind of sash.

The Pittsburg Blue Print Co., Park Building, Pittsburg, has prepared an illustrated catalogue of its electric blue-printing machines. These are furnished in both upright and tilting types, the latter allowing the cylinder about which the sensitized paper and tracings are wrapped to be held in a horizontal position while loading and placed in the vertical position for printing. This type is intended especially for making copies of small tracings which can thus be easily handled.

The 1902-1903 catalogue of the Dunning boilers and tanks has been issued by the New York Central Iron Works Co., Geneva, N. Y. It is a book of 56 pages, containing a detailed description of the boilers, illustrations and tables of the different types and a large number of testimonial letters. The descriptive matter is liberally indented with catch heads so that specific features may be studied at a glance.

The Watertown Engine Co., Watertown, N. Y., is distributing a folder giving a concise statement of the points of the Watertown four-valve steam engine, and showing a section through the cylinder and valves.

The Robins belt conveyor as applied to mining operations, where it is designed to handle as much as 1,200 tons of tailings and waste per hour, is described in a circular published by the Robins Conveying Belt Co., Park Row Building, New York City. An interesting illustrated account is given of the operations at the plant of the Gold Pan Engineering & Mine Supply Co., at Breckenridge, Colo.

Personal and Obituary Notes.

Mr. E. G. Barrow has been elected city engineer of Hamilton, Ont.

Mr. E. R. Gayler and Mr. E. H. Brownell have been appointed civil engineers in the U. S. Navy.

Mr. W. H. Daub has been transferred to the engineering department of the Chicago, Rock Island & Pacific Railway.

Mr. Clifford B. Moore and Mr. Abraham U. Whitson have been appointed transitmen for the Aqueduct Commission of New York City.

Mr. Bernard Haentzchel has been appointed superintendent on the Mines and Metallurgy building for the Louisiana Purchase Exposition at St. Louis.

Mr. D. M. Quay has resigned his position with the George A. Fuller Co., to become president of the Mannados Enginnering Co., Townsend Building, New York.

Mr. W. E. Belknap, M. Am. Soc. C. E., has resigned his position as assistant engineer in the Department of Docks and Ferries of New York City to accept a business engagement.

Mr. Justin Burns, Assoc. M. Am. Soc. C. E., has resigned his position with the Rapid Transit Railroad Commission of New York to take charge of the construction of some 700 miles of railroad in China.

Mr. M. M. Richey, Jr., acting general superintendent of the Central Railroad of New Jersey, has been appointed superintendent of the Birmingham division of the Southern Railway, at Birmingham, Ala., to succeed Mr. C. S. Hayden, resigned.

Mr. Samuel M. Gray, M. Am. Soc. C. E., has been engaged by the Citizens' Association of Paterson, N. J., to make a preliminary examination of the Passaic River, in connection with an investigation of the best system for the disposal of sewage of that city.

The officers of the Jamestown, Va., exposition to be held in 1907 to commemorate the foundation of the Anglo-Saxon civilization in the Western Hemisphere are Fitzhugh Lee, president; Gen. D. Lowenberg, Norfolk, Va., director; Gwynn F. Shepperd, Norfolk, secretary.

Mr. Arthur J. Cox, who is a partner of Mr. Charles P. Chase in the engineering business conducted by the Iowa Engineering Co. at Clinton, Ia., has returned from a fourteen months' trip in Europe, where he has made an investigation of sewerage and sewage disposal systems of France, Germany and England.

The National Association of Railway Superintendents of Bridges and Buildings has elected the following officers: B. F. Pickering, Seabomville, N. H., president; C. C. Mallard, Algiers, La.; A. Shane, A. Zimmerman, Denver; A. Moritzheimer, Milwaukee, vice-presidents; S. F. Patterson, Concord, N. H., secretary; N. W. Thompson, Ft. Wayne, Ind., treasurer.

Col. Washington A. Roebling has submitted to an operation in a New York hospital in the effort to regain the physical comfort which he has not enjoyed during the thirty years that have elapsed since he contracted caisson fever in the construction of the New York and Brooklyn bridge. His physicians are reported as saying that there is every reason that he will be restored to health.

Frederick Tudor, a well-known engineer and contractor in the heating and ventilating business, died October 28 at Lincoln, Mass., aged 57 years. He was graduated from Harvard in 1867, and first began as a civil engineer in the construction of the White Mountain extension of the Boston & Maine Railroad. He was best known as the inventor of the Tudor system of steam heating, patented about 1885.

Mr. James Corbett has been appointed superintendent of the Chicago & Erie division of the Erie Railroad, at Huntington, Ind., and is succeeded as superintendent of the Susquehanna & Tioga divisions at Elmira, N. Y., by Mr. T. H. Pindell, who resigns the superintendency of the Greenwood Lake division, with headquarters at Jersey City. He will be succeeded by Mr. J. C. Tucker, of Rochester, and Mr. Tucker by Mr. E. T. Resiler.

The following nominations for officers for the ensuing year of the American Society of Mechanical Engineers have been made by the nominating committee: President, William Sellers, Philadelphia; treasurer, F. H. Stillman, New York City; vice-presidents, F. H. Daniels, Worcester; James Christie, Philadelphia, and John R. Freeman, Providence; managers, R. C. McKinney, New York City; S. S. Webber, Trenton, and Newell Sanders, Chattanooga.

Prof. Sidney H. Short, one of the first experimenters of electric street traction, died of appendicitis in London the early part of last week. He was between 43 and 44 years of age. In the early eighties he became professor of chemistry of the University of Denver, where he began experimenting in electricity, building an underground high-tension road, in which the cars were operated in series. Although this system proved a failure it led him into a field in which he made a great number of inventions. He established the Short Electric Railway of Columbus and was at one time connected with the Walker Electric Co., of Cleveland.

The Recovery of Bridge Steel from the bed of the Des Moines River near Des Moines, Iowa, is being carried on by the American Bridge Company with the aid of divers. Two hundred thousand pounds of steel that had been placed on the falsework of the eastern span of the Chicago Great Western bridge were dropped into the river during a flood in July.

The Wearing Surfaces of Highway bridge floors were made the subject matter of a recent report by a committee of the Association of Railway Superintendents of Bridges and Buildings. In response to a set of questions sent out by the committee, a number of interesting replies were received. Mr. J. B. Sheldon, superintendent of bridges and buildings of the New York, New Haven & Hartford R. R., reports that with a traffic that will wear out 3-inch plank in two years Trinidad asphalt will last from six to seven years, and states it to be his experience that where a large volume of business is done, requiring a strong bridge with a wearing surface of asphalt or granite blocks, the paving will last enough longer to more than pay for the extra cost of a bridge strong enough to carry the added weight and the expense of an under floor to support the paving. Mr. A. S. Markley, superintendent of bridges and buildings of the Chicago & Eastern Illinois R. R., reports that white oak plank 4 inches thick, laid on 6-inch string pieces 2 feet apart, will last from six to eight years, excepting where traffic is very heavy, and in such cases the life of the plank does not exceed three years. It will always wear out before it decays.

The Extensive Use of Automobiles in France is strongly impressed upon one by the great number met on the streets of Paris and the roads of its environs, writes a correspondent of The Engineering Record. Every form and size, from the autocycle, with two wheels, for one passenger, to the heavy waggonette, for several passengers and heavy baggage, is common. The machines are operated at high speed generally, and driven with great skill. Their durability and reliability are shown, in a way, by the number of "dead" machines hauled along, and the number halted for repairs by the wayside; but few dead machines are seen in the streets of Paris. Probably the best place in the country, and the most favorable time, to observe the automobiles is the ten miles of road between Paris and Versailles, on a day that the fountains play at Versailles. This occurs but once or twice a month during the summer, and on a very few especial occasions. The flow of water lasts only a fraction of an hour, but the spectacle is magnificent and attracts a vast crowd. After the exhibition, late in the afternoon, the road to Paris is traveled by a large number of the spectators. While driving from Versailles to Paris, starting just before the completion of the flow, between fifty and sixty automobiles passed by the coach. Nearly all were four-wheeled and carried four passengers or more. Four or five were electric; the others were of the internal-combustion, oil-burning type. The road is excellent, but has several long inclines of considerable grade. The speed up grade was anywhere from four to twelve miles an hour for different machines. Down grade all ran at high speed, many at thirty, and some apparently at nearly forty, miles an hour. Although the driveway is generally narrow, three vehicles abreast filling it, there was no evidence of accidents or of near approach to any. Upon coming near Paris a considerable number of the machines were seen halted for repairs. From twenty to twenty-five per cent. of the machines on the home trip were stopped and undergoing repairs, nearly all with the machinery uncovered. This is a very large proportion. Possibly it is due to the high speed that every *chauffeur* seemed bent on making down grade.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see page xv, xvii, xviii and xxvii.

WATER.

Washington, D. C.—A. G. Lakenaw, Ch. Clk., Engr. Dept., D. C., writes that the contract for furnishing 135 tons of cast-iron specials (bids opened Oct. 18) has been let to the Dimmick Pipe Co., Birmingham, Ala., at $90 per ton; total, $12,150.

New York, N. Y.—Bids will be received Nov. 6, by Robert Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing single and double nozzle case hydrants, lead-lined iron pipe, unions, elbows and couplings.

Meadville, Pa.—City Engr. W. A. Doane writes that contracts are about to be let for a 150-H.-P. boiler and 20-in. suction pipe for the new water supply.

Penngrove, N. J.—Bids will be received Nov. 12 by the Mayor and Council for the erection of water works, consisting of two 500,000-gal. compound duplex steam pumps, 1 boiler feed pump, 1 heater, two 75-H.-P. boilers, steam and water fitting, 1 steel smokestack; tower and tank 18x32 ft., 90 ft. above foundations; brick power house; 4 miles of cast-iron pipe, 10 to 4 in. diameters; 29 valves and 41 fire hydrants. John P. Leap, Chmn. Water Com.

Hammonton, N. J.—Bids will be received Nov. 7 by the Water Comrs. for furnishing and erecting two 500,000-gal. compound duplex steam pumps, two 100-H.-P. boilers, heater and boiler feed pump, and steam fitting. J. L. O'Donnell, Secy.

Long Island City, N. Y.—The Dept. of Water, Gas & Electricity is said to be planning water main extensions in the Boro. of Queens. Over 8½ miles of pipe will be required, including a relief main in Astoria, 2 miles in length and 12, 14 and 16 ins. in diameter.

Brooklyn, N. Y.—Ch. Engr. N. P. Lewis, of the Bd. of Estimate has reported in favor of the construction of pipe galleries in the subway in Fulton St., between Boerum Pl. and Flatbush Ave.; estimated cost, $150,000. Also in the subway on Broadway, between Ann and Morris Sts.; estimated cost, $250,000.

McKeesport, Pa.—The Water Comrs. are considering plans for the improvement of the water supply. Supt. T. H. Verner recommends the installation of a filtering plant and the construction of another reservoir.

Allentown, Pa.—The City Council has adopted a resolution requesting the Mayor to communicate with an expert engineer to visit this city and recommend a plan to bring in and store the water from Schantz's Spring.

Bloomsburg, Pa.—Robt. Snodgrass, of Harrisburg, W. H. Dale and Victor Koch, of Scranton, with others, have incorporated the Town Water Co. and applied for a charter. Their purpose is said to be to supply water to all the towns between Bloomsburg and Berwick.

Timberville, Va.—Local press reports state that this town is about to install a gravity system of water works.

Barnesville, Ga.—The City Council has decided to purchase a duplicate pump for the electric light and water works department.

Savannah, Ga.—Hal H. Bacon, Chmn. of Water Com., writes that the following bids were opened Oct. 25 for a Corliss cross-compound duplex compressor air pump, condenser, pipes, valves and necessary fittings for connecting a duplicate compressor: Bacon Air-Lift Co., New York, $15,415; Pneumatic Eng. Co., $13,987.

Xenia, O.—Consulting Engr. O. H. Jewell and Walter Wagner, of Chicago, having been engaged by the Water Works Trus. to make plans and specifications for a water purification plant for this city, have reported recommending that a filtration plant having a daily capacity of 10,000,000 gals. be located on the banks of Mahoning River opposite the present city water works; they also recommend the installation of meters. For the low-service pumping station two 10,000,000-gal. pumps, each, connected to a vertical compound condensing engine, are recommended.

Findlay, O.—City Engr. John W. S. Riegle writes that all bids recently received for contemplated water main extension have been rejected and new bids will be asked soon upon 20-in. cast iron pipe and upon 24-in. vitrified pipe. Proposed line, 10.6 miles long.

Prophetstown, Ill.—Village Clk. B. J. Loomis writes that on Oct. 21 it was voted to construct water works, and that the village is now ready to receive plans and specifications for works.

Lake Park, Minn.—Bonds to the amount of $15,000 are to be voted for water works, sewerage and electric lighting, according to press reports.

Duluth, Minn.—At the recent election it was voted to purchase the West Duluth water plant for $140,000.

Ottumwa, Ia.—The Supreme Court has decided that the city may levy a tax for the municipal ownership of water works, and press reports state that the city will construct a plant to cost $400,000, the contract for which has been let.

West Bay City, Mich.—The Water Comrs. are reported to have decided to install the meter system.

Victoria, Tex.—The Refugio Land & Irrigation Co. has been incorporated, with a capital of $600,000 to construct, maintain and operate dams, ditches, etc., for irrigation purposes The incorporators are: J. C. Dilworth, of Gonzales, Tex.; J. C. McDowell, of the Guffey Oil Co., Pittsburg, Pa.; Preston Austin, of Victoria, and others.

Webster Grove, Mo.—Bids are wanted Nov. 3 for furnishing fire hydrants, valves, meters, etc., and laying 47,485 ft. of 4 to 12-in. cast iron water pipe. Wm. H. Bryan, Consulting Engr., Lincoln Trust Bldg., St. Louis. Edw. S. Hart, Chmn. Com. on Water Supply.

New Orleans, La.—According to local press reports Wellman Bradford, of Crowley, La., has organized an irrigation company, to construct a canal at a probable cost of $1,000,000; total length of canal about 64 miles, in the parishes of St. Landry, Acadia and Calcasiu, with the Mississippi River as the source of supply. Geo. Thompson, of New York City, is said to be Pres. of the Co.

St. Louis, Mo.—The Bd. of Pub. Improv. has rejected all plans of the World's Fair engineers for laying wrought-iron water mains on the Fair Grounds and referred the matter to the Water Comr., with the suggestion that he notify the World's Fair engineers to use cast-iron pipe.

Eagle Lake, Tex.—A franchise is said to have been granted for the establishment of water works and an electric light plant.

El Paso, Tex.—The Olio & Fruitland Canal Co., of Olio, New Mex., has been incorporated. Capital stock, $50,000. The company is organized to construct canals and irrigation ditches from the San Juan River. The term of existence is fifty years. The directors are Henry T. Stotworthy, J. G. Biggs, Walter O. Ashcroft John R. Young and others.

Kenton, Wash.—It is stated that bids are wanted Nov. 10 for $4,900 water-works bonds. Geo. W. Custer, Clk.

Maybell, Colo.—Wm. P. Wagner, Gen. Mgr. of the Maybell Canal Co., writes that bids are desired for work contemplated by said company. Estimated cost, $30,000. J. Q. Ellis, Pres.; Wm. Taylor, Engr.-in-Charge.

Santa Fe, New Mex.—Important improvements are to be made in the water works of this city, which are owned by the Santa Fe Water & Light Co. Edgar L. Street, Advising Engr., 44 Wall St., New York City.

Antonito, Colo.—Chas. Brickinstein, Surveyor of Customs; Zeph Charles Felt, of Denver, and Albert R. Smith, of Manassa, are said to be interested in a scheme to build dams to store water on the Mogote and Elk Creek reservoir sites, west of Antonito, on Conejos River, said reservoirs to hold from 50,000 to 75,000 acre ft. of water each. J. C. Ulrich, of Denver, Consulting Engr.

Sterling, Colo.—Bids are wanted Nov. 10 for the purchase of water works bonds, not less than $40,000 nor more than $63,000, as advertised in The Engineering Record.

San Bernardino, Cal.—City Clk. Legare Allen writes that at the election to be held Dec. 20 a vote will be taken on the issue of water works bonds, as follows: $163,000, $68,000 and $66,000; total, $297,000. All three propositions to be voted upon separately.

Salt Lake City, Utah.—Preliminary work and plans are now being made for work contemplated by the Weber River Irrigation Co., which work includes storage dams for flood water, water power, etc. The company has been organized by the community of irrigators whose source of supply is the Weber River. Probable cost of work, $300,000. Engrs.-in-Charge, Doremus & Kelsey, of Salt Lake City.

Wessington Springs, S. Dak.—This place is said to be considering the project of sinking an artesian well for a water supply and fire protection.

Evans, Colo.—Press reports state that the Union Ditch Co., of Evans, proposes to build a reservoir 3 miles northwest of Longmont; capacity of reservoir, 500,000,000 gals.

The Union Reservoir Co. has been incorporated, with a capital of $25,000, to operate in Weld Co.; principal place of business, Evans. Directors: Jas. S. Barber, A. W. James and others.

Salem, Ore.—Local press reports state that the State of Oregon has awarded contracts, as follows, for the reclamation of arid land: To the Pilot Butte Development Co., of which A. M. Drake is Pres., for the reclamation of 84,707 acres of land, the main body of which lies south and east of the town of Bend in Cook Co.; to the Oregon Development Co., of which J. E. Morson is Pres., 68,091 acres of land in the southern part of Cook Co. and the northern part of Klamath Co.

Sacramento, Cal.—Bids are wanted Dec. 15 for the purchase of $150,000 bonds to complete the system of water mains for this city. M. J. Desmond, City Clk. C. M. Phinney, Deputy City Surveyor, writes that as soon as said bonds are sold it is presumed the City Trus. will adopt specifications and let contracts for laying water mains.

Santa Ana, Cal.—P. H. Krick, Secy. Anaheim Union Water Co., writes that said Co. proposes to cement its main canal from Placentia to the head gate at a probable cost of $110,000. The work is likely to be done under the supervision of the Co.'s superintendent, and will require several years for completion. G. W. Sherwood, of Fullerton, Engr.-in-Charge. Said Co. is investigating site for dam and reservoir which may be built at a probable cost of $75,000. C. C. Chapman, of Fullerton, and Fred. Eaton, of Los Angeles, are interested.

Grand Junction, Colo.—The Council is said to contemplate the expenditure of $10,000 in improving the water works system. A 3,000,000-gal. pump is to be bought.

Basalt, Colo.—At a special election to be held Nov. 12 a vote will be taken on proposition to construct a municipal system of water works. I. H. Mitchell, Town Clk.

San Jose, Cal.—Local press reports state that the Spring Valley Water Co., of which Mr. Scussler is Supt., has in contemplation extensive improvements, including the construction of a large reservoir.

Denver, Colo.—The Denver Eureka Power Co. has been incorporated by G. H. Sethman, W. H. Sherrod and W. F. Sperry, of Denver, with a capital of $3,000,000. The articles of incorporation set forth that it is the purpose of the company to generate power and to take water from Middle Boulder Creek and to convey it to patrons throughout the State. In addition to irrigation projects it is proposed to generate and sell electricity.

Los Angeles, Cal.—The Imperial Water Co., No. 7, principal place of business, Los Angeles, has been incorporated by W. F. Holt, R. T. Perry, F. C. Paulin and others. Capital stock, $200,000.

The Sierra Vista Water Co., principal place of business, Los Angeles, has been incorporated by C. S. Munn, M. P. Phipps, F. A. Nance and others. Capital stock, $100,000.

San Francisco, Cal.—The Bay Cities Water Co. has been incorporated with a capital of $10,000,000. The incorporators are Wm. S. Tevis, Clinton E. Worden, Henry L. Tevis and others. According to local press reports the watershed which the company has secured comprises an area of about 250 square miles, beginning about 10 miles southeasterly from San Jose and extending back into the mountains, embodying the valleys of the Coyote, the San Felipe, Las Animas, Packwood and numerous other streams.

Cheney, Wash.—The Citizens' Com. has reported favorably on the proposition for the city to purchase the water plant.

Bonesteel, S. D.—Water works bonds to the amount of $5,000 are reported to have been voted.

Provo City, Utah.—The Council Water Com. has reported estimating the cost of piping spring water to the city at $29,060 to $33,990. The cost of a filtering apparatus which would be needed if the city did not use water from the springs is estimated at $25,000.

Colorado.—Ch. Hydrographer F. H. Newell, of the Geological Survey, Washington, D. C., is reported to have announced that the first definite selection of sites for irrigation reservoirs to be constructed by the Federal Government has been made. The reservoirs are to be located on St. Mary's River, Montana; the Gunnison River, Colo.; the Carson and Truckee rivers, in Nevada; the Salt and Gila rivers, in Southern Arizona; the Big Horn, in Wyo.; the Sweetwater, in Wyo., and the Grand River, in Colo.

Springville, Utah.—The City Council is said to be considering the issue of bonds for water works and electric lights.

Mancos, Colo.—In a report to the Bd. of Trus. Blair Burwell, C. E., places the estimated cost of a complete system of water works at $20,000.

Montreal, Que.—The Water Com. has awarded the contract for the erection of new pumping building at the high level station to McDonald, Ouimet & Co., for $4,275.

SEWERAGE AND SEWAGE DISPOSAL.

Waterbury, Conn.—The Bd. of Pub. Wks. has awarded contracts for storm water sewers as follows: To Edw. McManus, sewers in Bronson, Bishop and other streets, for $4,596. To Pasquale Contaldi, sewers in North Willow and Ridgewood Sts., for $5,239.

Woonsocket, R. I.—The City Council has made an appropriation for an additional filter bed for sewage disposal.

New Britain, Conn.—Local papers quote Sewer Comr. and Supt. Beach as having stated that work on the trunk sewer and two large interceptors will be started early in the spring.

Laconia, N. H.—The City Council has referred the proposition to construct a system of sewers in that portion of the city known as The Weirs to the Com. on Sewers. Chas. O. Downing, Chmn.

Hartford, Conn.—The contract for constructing Folly Brook culvert has been awarded to Chas. H. Slocum, his bid being $11,352 with expanded metal or $11,758 without metal.

Albany, N. Y.—Mayor Gaus has approved ordinances providing for vitrified pipe sewers in Washington Ave., and Alexander St.

Jersey City, N. J.—The Street and Water Bd. has adopted specifications for proposed sewer in Carleton Ave.

Syracuse, N. Y.—The only bid received Oct. 27 for the construction of the tunnel sewer in the 4th Ward, which is to pass through a hill for a distance of 4,700 ft., is stated to have been from Thos. Moore, at $43,439 for 33-in. brick sewer, or $42,416 for a 28x42-in. web tile sewer.

Brooklyn, N. Y.—Bids will be received Nov. 12 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and constructing sewer in portions of 3 streets. Engineer's estimate is as follows: 1,410 lin. ft. 12 and 15-in. vitrified stoneware pipe sewer laid in concrete, 12 manholes and 2 receiving basins.

Wilkesbarre, Pa.—This city is contemplating a loan of $300,000 for sewer, street and Fire Dept. improvements.

Newark, N. J.—Plans for a sewer along Badger Ave. and Peddie St., to cost about $140,000, were submitted by City Engr. Ernest Adam at a committee meeting of the Bd. of Wks. Oct. 28. The specifications were recommended for approval.

Brooklyn, N. Y.—The following bids for constructing a sewer in 92d St. from 11th Ave. to N. Y. Bay were opened Oct. 29 by J. Edw. Swanstrom, Boro. Pres.: A, Jas. Malloy & Co., Williamsbridge, N. Y.; B, John J. Creem, 799 Willoughby Ave.; C, John McNamee, 16 Court St.:

Items and Quantities.	A	B	C
159-in., triple section outlet, 165 ft. (Sec. F)	$160.	$125.	$110.
Reducing chamber, 1	13,500.	7,500.	10,000.
Circular brick sewer, in tunnel:			
132-in., 4,025 ft. (Sec. A)	83.	115.	110.
126-in., 1,700 ft. (Sec. B)	81.	115.	110.
120-in., 400 ft. (Sec. C)	80.	60.	100.
Egg-shape brick:			
54-in., 60 ft. (Sec. G)	20.	25.	20.
36-in., 70 ft. (Sec. H)	15.	6.	5.
30-in., 275 ft. (Sec. I)	5.25	4.00	5.00
Vit. stoneware pipe laid in concrete:			
24-in., 875 ft. (Sec. J)	4.00	4.00	5.00
18-in., 450 ft. (Sec. K)	3.50	3.00	4.00
15-in., 300 ft. (Sec. L)	2.50	2.50	3.00
12-in., 3,850 ft. (Sec. M)	2.50	2.00	2.00
12-in. vit. pipe subdrain, in broken stone, 6,125 ft.	0.40	0.50	0.75
Manholes, Class A, 11	1,500.	1,000.	800.
Manholes, Class B, 5	40.	60.	50.
Manholes, Class C, 49	60.	30.	25.
Catch basins, 26	100.	90.	100.
Bearing piles, 66,000 lin. ft.	0.20	0.18	0.20
Oak fender piles, 6,100 lin. ft.	0.25	0.40	0.40
Sheet piling for cofferdam, 260,000 ft., B. M.	40.	60.	55.
Foundation planking and cradle, 400,000 ft., B. M.	20.	25.	20.
Sheeting, rangers, etc., 850,000 ft., B. M.	12.	20.	20.
Add. brk. mas., 8,150 cu. yds.	0.01	0.01	0.01
Ad. port. cem. con., 4,100 c. y.	0.01	0.01	0.01
Riprap stone fill at outlet, 2,000 cu. yds.	1.00	1.00	0.75
Sand fill at outlet, 2,000 c. y.	0.15	0.10	0.30

Niagara Falls, N. Y.—Chasm Ave. trunk sewer bonds, to the amount of $27,000, have been sold by the Bd. of Pub. Wks.

Jamestown, N. Y.—Bd. of Pub. Wks. recommends the extension of the sewer system at a cost of $40,000.

Paterson, N. J.—The executive committee of the Citizens' Association is reported to have made arrangements with Samuel M. Gray, of Providence, R. I., to make preliminary examination hydraulic and topographical of the Passaic River, together with an investigation of the sewerage system of Paterson, to ascertain what system will be best for the disposal of the sewage of this city.

Findlay, O.—Bids will be received by Frank C. Ray, Clk. of Bd. of Improv., Nov. 6, for constructing a sewer in a portion of East Main-Cross St., known as combined local sewer No. 1 in Sub-Dist. No. 1 of sewer Dist. No. 2; also for constructing a sewer in a portion of West Hardin St., known as combined local sewer No. 8, in Sub-Dist. No. 2 of sewer Dist. No. 2.

Canal Dover, O.—Bids are wanted Nov. 20 for furnishing material and constructing a storm water sewer in Calico Ditch in portions of Broad St. Approximate quantities of the work to be done are as follows: 1,549 lin. ft. of 2-ring brick sewer 36 in. in diameter; 450 lin. ft. 12-in. first class double strength, vitrified pipe sewer; 200 lin. ft. 24-in. first class double strength, vitrified pipe; 6 catch basins, 5 manholes and 1 concrete outlet pier. Alfred Nydegger, Village Clk.

Davenport, Ia.—Bids will be received Nov. 4 by the Bd. of Pub. Wks. for constructing 1,078 lin. ft. of 10-in. pipe sewer in portions of 2 streets. Thos. Murray, City Engr.

Eau Claire, Wis.—Bids are wanted Nov. 5 for constructing a sewer on 2d Ave. and Fulton St. Martin Severson, Chmn. Com. on Sewers.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service Nov. 12 for the construction of sewers and drains in portions of Grace Ave. and Ferdinand alley, and on Nov. 26 for constructing sewers and drains in portions of Observatory Ave., State Ave. and the ravine west of Torrence road. Robt. Allison, Pres.

The contract for constructing Linwood Ave. sewer has been awarded to F. H. Kirchner & Co. for $51,596. The City Engr's estimate was $51,891. The other bids were as follows: T. P. Strack, $51,623; Thomas Maloney, $53,416; A. J. Henkel & Bro., $52,439; VanSandt & Meeds, $52,016.

Grand Rapids, Mich.—Local press reports state that the following bids were opened Oct. 17 for building the West Side sewer: *a*, with concrete; *b*, with a combination of steel and concrete: Albert Prange, *a*, $120,347; *b*, $120,937; Jas. McDermott, *a*, $124,115, *b*, $124,469; H. A. Heinman, of Chicago, $147,248.

Springfield, O.—The Bd. of Pub. Affairs has passed 4 ordinances for the construction of main sewers for the carrying off of surface water.

Brazil, Ind.—The contract for constructing Franklin St. sewer has been awarded to W. C. Dorsey, of Terre Haute, Ind., for $6,372. The sewer is said to be about 5,000 ft. in length.

Toledo, O.—The Sewer Com. of the City Council has decided upon the location of the main sewer for Sewer Dist. No. 36, draining Walbridge Park and vicinity; also the location (on Swan Creek, near Champion St.) for a disposal plant for same.

Wabash, Ind.—The contract for constructing a sanitary sewer in Main St. has been awarded to Philip Hipskind & Sons at $1.16 per lin. ft.

Shenandoah, Ia.—City Clk. J. Swain writes that the contract for constructing sewers on Summit and Valley Aves. (bids opened Oct. 20) has been awarded to Dunnegan & Sullivan, as follows: 6-in. junction at 50 cts. per ft.; 8, 10, 12 and 15-in. pipe at 65 cts., 70 cts., 75 cts. and 85 cts., respectively; manhole at $35; catch basins, $40, and flush tanks at $95.

Elk Rapids, Mich.—It is reported that a portion of the sewer system designed recently by Blomshield & McCloy, of Bay City, Mich., will be built soon.

Lake Park, Minn.—See "Water."

Chicago, Ill.—Bids are wanted Nov. 6 for constructing sewers in several streets. John C. May, Secy.

According to local press reports the city officials have agreed upon plans for draining the southwest part of the city. Probable cost of proposed sewers about $1,000,000.

Johnson City, Tex.—Local press reports state that this city has decided to secure the services of an engineer to prepare plans and specifications for a sewer system.

Oak Cliff, Tex.—C. F. Cohron, representing Dr. E. G. Patton, W. I. Addison and others, who have organized the Citizens' Sewerage Co., has asked the City Council for a 50-year franchise.

Marysville, Cal.—The Common Council has taken preliminary steps toward the construction of a sewerage system. Bonds to the amount of $50,000 will probably be issued.

Long Beach, Cal.—The City Council Com. on Pub. Wks. and City Engr. Foster are preparing plans for the proposed sewerage system. Mr. Wallbrick, of Los Angeles, is Consulting Engr.

Colorado Springs, Colo.—The Special Drainage Com. has reported at a recent meeting of the operators of Cripple Creek Dist., recommending the construction of a tunnel, not to exceed 10,000 ft. in length, to drain the mines of Cripple Creek Dist. Sherwood Aldrich, Chmn. of Com.

Toronto, Ont.—City Engr. Rust, in a recent report to the Bd. of Control recommends, as the most satisfactory and economical method of disposal, that crude sewage be taken out into the lake 9 miles east of the water works pipe, or if ratepayers are opposed to this plan he recommends the treatment of sewage in septic tanks. The cost of this method of disposal is $635,000 more than the first plan recommended, and the annual cost $60,000.

BRIDGES.

Norwich, Conn.—The County Bd. has adopted a resolution to the effect that the Selectmen shall without delay cause to be built an iron or steel footbridge across Yantic River near the Falls, said bridge to pass over the tracks of the Central Vt R. R.

Dalton, Mass.—Local press reports state that new iron bridges of a heavier tonnage capacity are to be placed on the Pittsfield trolley line between Knight's Hill and Wayside, replacing those now in use.

Pittsburg, Pa.—Upon the recommendation of Capt. W. L. Sibert, U. S. Engineer at Pittsburg, the War Dept. has indorsed the raising of Union St. and 6th St. bridges across Allegheny River.

Philadelphia, Pa.—Local press reports state that the Survey Com. of the Councils will probably soon recommend the passage of an ordinance to build a bridge over Allegheny Ave. near 9th St. Probable cost, $60,000.

New York, N. Y.—The New York Central R. R. Co. is reported to have agreed to bear the expense of building a bridge over the tracks at 233d St., the city to purchase property for the approach.

Oswego, N. Y.—State Bridge Inspector W. H. Davis, after an examination of the Oswego River bridge connecting East and West Oswego, has condemned the structure and recommended that it be closed to traffic and repairs to the amount of $40,000 be made, or a new bridge costing $120,000 be built.

Harrisburg, Pa.—Bids are wanted Nov. 18 for rebuilding the substructure and superstructure of 8 bridges to be erected by the State and located in the following counties: Perry, 1; Columbia, 2; Centre, 1; Lycoming, 1, and Wayne, 3. The total cost to be about $135,000. T. L. Eyre, Supt. Bd. of Comrs. of Pub. Grounds and Bldgs.

Press reports state that the Northern Central Ry. proposes to build a new steel bridge across the Susquehanna at a point below Harrisburg. W. H. Brown, Ch. Engr., Philadelphia.

Contracts for the erection of the Harrisburg Bridge Co.'s Market St. bridge are stated to have been awarded as follows: Steel structure and erection, to the Pennsylvania Steel Co., for $152,500; the thirty piers of stone, to H. S. Kerbaugh & Co., for $95,000. According to press reports the bridge is to be 2,800 ft. in length, with an asphalt floor. The roadway will be 18 ft. between curbs, with a footwalk 7 ft. wide.

Schenectady, N. Y.—Local press reports state that the Schenectady Ry. Co. is investigating the feasibility of constructing a bridge across the Mohawk above the dam at aqueduct. R. H. Fraser, Mgr., Schenectady.

Doylestown, Pa.—Local press reports state that bids will be received Nov. 20 by the Township Clk. for constructing a bridge at Leatherman's Ford across Deep Run Creek in Bedminster Township.

West Point, Va.—The question of having the county erect an iron bridge at Norments, on Pamunkey River, is being agitated.

Miami, Fla.—The County Comrs. have received permission from the Secy. of War to build a steel bridge, to be about 200 ft. long with 16-ft. driveway and 5-ft. walk, across Miami River at the foot of Ave. D.

Paoli, Ind.—Bids will be received Nov. 6 by the Bd. of Co. Comrs. for constructing a bridge over the bayou on Lost River, in North West township; also for constructing a bridge over Sam's Branch in French Lick township. John H. Weeks, Chmn.

Oskaloosa, Ia.—Bids will be received by the Bd. of Co. Supervisors Nov. 12 for constructing an iron bridge, 110 ft. in length, across South Skunk, to be built by Jan. 1, 1903; also an iron bridge, 93 ft. in length, across North Skunk River, to be built Aug. 1, 1903.

Moline, Ill.—The Bridge Com. of the Co. Bd. of Superv. is investigating sites at Cleveland and Colona for the proposed bridge to cross Rock River.

Bay City, Mich.—The Bay County Road Comn. has asked for bids on the sub-structure for new bridge across KawKawlin River. Blomshield & McCloy, of Bay City, are the consulting engineers.

Chicago, Ill.—Bids will be received Dec. 17 by A. R. Porter, Sanitary Dist. Clk., Security Bldg., for constructing the superstructure of a bridge across Chicago River and main drainage channel of the Sanitary Dist.

Cincinnati, O.—A press report states that the old wooden Ida St. bridge will probably be replaced by a steel or iron structure. This is urged by the U. S. Marshal, V. J. Fagin, in a letter to the Bd. of Pub. Service.

Lebanon, O.—Bids are wanted Nov. 18 for $40,000 county bridge bonds. S. A. Stilwell, Co. Aud.

Monmouth, Ill.—It is stated that bids are wanted Nov. 5 for constructing a steel bridge on stone or concrete abutments in Swan Township. H. B. Roberts, Town Clk.

Marshalltown, Ia.—The Council has passed an ordinance providing for the construction of a viaduct across the R. R. tracks on Center St.; probable cost, $60,000.

Vicksburg, Miss.—U. S. Secy. E. Root is stated to have approved plans and authorized the construction of a viaduct over Stouts Bayou on the battlefield of Vicksburg.

Oakville, Tex.—Judge T. S. Johnson, Office Assistant Attorney General at Austin, Oct. 21 approved $8,000 of Live Oak County bridge bonds.

Oberlin, Kan.—It is stated that bids will be received Nov. 13 by J. E. Platts, Co. Clk., for constructing a steel bridge over Sappa Creek.

Gannvalley, S. D.—Bids are wanted Nov. 8 for constructing a bridge across Elm Creek. W. H. Abernathy, Co. Aud.

Sulphur Springs, Colo.—The Grand Co. Comrs. are stated to have awarded to Wm. C. Call the contract for a bridge across Grand River at Kremmling, for $5,000.

Centralia, Wash.—It is stated that bids are wanted Nov. 9 for constructing a bridge across Cowlitz River at Mayfield, span to be 140 ft. long. A. Schooley, Co. Aud.

Goldendale, Wash.—It is stated that bids are wanted Nov. 8 for constructing a bridge across the little Klickitat River on the Goldendale and Yakima Roads. Address Wm. McEwen.

Folsom, Cal.—It is stated that bids are wanted Nov. 6 for constructing a stone arch bridge at Alden Creek. V. B. Hamilton, Clk. Superv., Sacramento.

PAVING AND ROADMAKING.

Thomaston, Conn.—Bids will be received Nov. 7 by the Town Bd. of Selectmen for the grading of 3 sections of road in this town. Geo. P. Bradstreet, Chmn. Bd. of Selectmen.

Syracuse, N. Y.—The Council has designated brick as the material to be used for the paving of East and West Colvin Sts., the lowest bid for which was from John W. Bustin, of Syracuse, at $27,487, using N. Y. Brick & Paving Co.'s brick.

Cohoes, N. Y.—Local press reports state that bids will be received by the Pub. Improv. Comn. Nov. 12 for paving Amity St.

Niagara Falls, N. Y.—The Common Council has declared its intention to pave Niagara Ave. with asphalt.

Pittsburg, Pa.—The Bd. of Pub. Wks. has affirmatively recommended ordinances for grading, paving and curbing Griffin, Sterrett, Orphan, Beatty, Matthew and other streets.

Binghamton, N. Y.—Local papers quote State Inspector of Good Roads Frank D. Lyon as having stated that about $100,000 will probably be expended next year in the improvement of State roads leading into this city.

Baltimore, Md.—Two ordinances have been introduced in the 1st Branch of the Council for the paving of O'Donnell St.; one provides for asphalt block at a cost of $47,395, and the other provides for wood blocks at a cost of $49,900.

Brooklyn, N. Y.—The following bids for macadam pavement on Albany Ave. from Lincoln Rd. to Clarkson St. were opened Oct. 29, by J. Edw. Swanstrom, Boro. Pres.: A, Jas. P. Graham; B, McDermott & Foxton; C, Thos. F. Byrnes; D, Frank J. Gallagher; E, Dennis Norton; F, Isaac Harris:

Bidders.	Macadam, 9,960 sq. yds.	Excav., 750 cu. yds.	Fill (finished) 1,610 cu. yds.	Belgian blk. gutters, 1,440 sq. yds.	Concrete curb, 4,250 ft.	Cement sidewalk, 20,800 sq. ft.
A.....	$.73	$.30	$.29	$1.25	$.45	$.15
B.....	.75	.30	.20	1.70	.48	.14¾
C.....	.75	.25	.35	1.90	.50	.18
D.....	.74	.20	.14	1.45	.45	.15
E.....	.79	.29	.29	1.80	.55	.15
F.....	.73	.40	.40	1.50	.40	.15

Bids were also opened Oct. 29 for paving Jerome St. from Jamaica to Glenmore Aves. with asphalt on concrete foundation, as follows: A, Uvalde Asph. Pavg. Co., 1 Broadway, N. Y.; B, Brooklyn Alcatraz Asph. Co., 3d St. nr. 3d Ave.; C, Crawford Co., 215 Montague St.:

Bidders.	Asph., 6,870 sq. yds.	Concrete, 960 cu. yds.	Old curb reset, 100 ft.	Excav., 1,725 cu. yds.	Concrete curb, 5,050 ft.	Cement sidewalks, 18,320 sq. ft.
A.......	$1.50	$4.50	$.25	$.45	$.50	$.16
B.......	1.75	4.40	.35	.50	.58	.18
C.......	1.05	4.40	.35	.40	.60	.15

Bids were also opened Oct. 29 for paving Hamburg Ave. from Cornelia St. to Moffat St. with granite pavt. on sand foundation, as follows: A, John O'Grady; B, Jas. H. Holmes & Co.; C, Frank J. Gallagher; D, Thos. F. Byrnes; E, Dennis Norton:

Bidders.	Granite, 5,900 sq. yds.	New curb, 4,540 ft.	Excav., 5,550 cu. yds.	New bluestone bridging, 180 s.f.	Cement sidewalk, 13,500 sq. ft.	New granite bridgestone, 860 sq. ft.
A........	$1.90	$.70	$.50	$.40	$.15	$.80
B........	1.79	.73	.39	.75	.17	.83
C........	2.10	.76	.55	.50	.15	.85
D........	2.07	.80	.30	.70	.18	.80
E........	1.99	.79	.75	.45	.16	.85

Buffalo, N. Y.—The lowest bids received Oct. 21 by the Comr. of Pub. Wks. for street improvements were as follows, bidders all of Buffalo:

Paving Hamburg Turnpike, 36 ft. wide, 9,410 sq. yds.: German Rock A. & C. Co., brick, $25,470; F. V. E. Bardol, block stone, $33,000; H. P. Burgard, asphalt, $28,000.

Repaving Louisiana St., 17,967 sq. yds.: F. V. E. Bardol, stone, $4,700; Barber Asphalt Co., brick, $3,538, asphalt, $2,766.

Repaving Louisiana St., 24,317 sq. yds.; F. V. E. Bardol, stone, $6,200; Barber Asphalt Paving Co., asphalt, $3,695; brick, $4,911; Eastern Const. Co., asphalt rock, $35,000.

Erie Co. good road bonds to the amount of $70,000 are reported to have been sold.

West Hoboken, N. J.—Town Surveyor Sebastian Maulbeck writes that the following bids for bituminous macadam waterproof pavement were opened by the Town Council on Oct. 22: Time, 60 working days.

Demott St.—Palisade Ave. To Hudson Boul.	Warren Bros.	H. M. Schneider.	Callery & Murphy.
800 cu. rock excav........	$2.25	$0.50	$0.70
2,700 cu. earth excav......	.45	.35	.70
3,000 lin. ft. new curb......	.90	.40	.45
1,100 lin. ft. old curb reset.	.25	.04	.06
6,000 sq. ft. new flagging..	.18	.16	.14
10,000 sq. ft. old flag. relay	.03	.01½	.01
10 sq. ft. new crosswalks..	1.00	.47	.85
600 sq ft. old cr'sw'ks relay	.25	.03	.05
5,700 sq. yds. macadam...	2.10	2.00	1.80
1,580 sq. yds. resurfacing..	1.90	1.90	1.00
1 receiving basin.........	80.00	85.00	150.00
25 lin. ft. 12-in. pipe......	.35	.60	1.00
Totals	$22,591	$18,224	$16,859

Rome, N. Y.—Bids are wanted Nov. 7 for $30,000 street improvement bonds. K. S. Putnam, Chamberlain.

Jersey City, N. J.—The Street and Water Bd. is stated to have awarded the contract for asphalting Orient Ave., from the Boulevard to Bergen Ave., at 87⅞ per cent. of the Ch. Engr's standard price, or about $1.54 per sq. yd.

Wilkesbarre, Pa.—See "Sewerage and Sewage Disposal."

Washington, D. C.—The contract for constructing the riverside speedway, which will extend about 1 mile through Potomac Park, is stated to have been awarded to Martin McNamara, of Washington; it is to be built of telford and macadam and will cost about $50,000.

Fredericksburg, Va.—Engr. C. E. Dickinson writes that the contract for paving Commerce and Main Sts. (bids opened Oct. 20) has been awarded to G. A. Gude, of Richmond, Va., as follows: 10,756 sq. yds. granite spalls on sand at $1.10, 3,727 cu. yds. excavating at 40 cts., 4,464 lin. ft. curbing at 90 cts., 161 cu. yds. of concrete at $6, etc.; total, $23,466.

Cincinnati, O.—The Bd. of Pub. Service has decided to improve Rockdale Ave. with asphalt.

Salem, O.—City Engr. B. M. French writes that the City Council has adopted plans and specifications and passed resolutions for the construction of 30,000 sq. yds. of asphalt pavement. Contracts to be let some time in March, 1903.

Danville, Ill.—Press reports state that the Council has decided to pave Washington St.

Lockland, O.—The Council has authorized the issue of $6,000 street-improvement bonds, according to press reports.

Cincinnati, O.—The Bd. of Pub. Service has directed the City Engr. to prepare plans and specifications for the improvement of Reading Road, from Rockdale Ave. to Burnet Ave., with asphalt. One-fourth of the cost will be paid by the city, the remainder by property owners.

Bids are wanted Nov. 17 for improving portions of Pleasant St. by paving the roadway with asphalt, setting curbs, etc. Robert Allison, Pres. Bd. of Pub. Service.

Pontiac, Mich.—City Engr. Wm. J. Fisher writes that bids will be wanted about Feb. or Mar. of 1903 for paving Huron St. west from Saginaw St. to Johnson Ave. Probable cost $75,000.

Ft. Dodge, Ia.—The City Council is said to have under consideration the paving of portions of 8th St. and 1st Ave.

Aurora, Ill.—Petitions are being circulated for the paving of portions of 2d Ave. and Benton St. with asphalt.

Duluth, Minn.—The Council has been petitioned to pave E. Superior St. from 16th and 23d with asphalt.

Toledo, O.—The Toledo Railways & Light Co., through Gen. Mgr. Beilstein, has signified to Mayor Jones its intention to pave St. Clair St., between Knapp and Newton Sts., as provided in the franchise granted the Metropolitan St. Ry. Co. some years ago.

Des Moines, Ia.—City Engr. John W. Budd writes that the following bids were opened Oct. 22 for the improvement of several streets by paving with asphalt:

Items and Quantities.	Barber Asph. Paving Co.	Andrew Jaicks, Chicago, Ill.	Western Const. Co., Lafayette, Ind.
E. Walnut St., 20,300 sq. yds...	$1.96	$1.99	$2.07
E. 12th St., 22,789 sq. yds.....	1.975	1.99	2.07
*E. 5th St., 4,856 sq. yds.......	1.50	1.70	1.77
*Maple St., 1,727 sq. yds.......	1.50	1.70	1.77
Extra concrete, per cu. yd......	4.00	4.45	3.75
Extra gravel, per cu. yd........	1.40	1.60	1.60

*Asphalt on E. 5th and Maple Sts. to be laid on old concrete.

The lowest bids received at the same time for paving with brick on a 6-in. concrete foundation were as follows: O. P. Herrick, of Des Moines, at $1.69 per yd. for 1,962 sq. yds. in State St., and Bennett Bros., Des Moines, at $1.73 per sq. yd. for 1,009 sq. yds. in Alley Blk. 32 Ft. Des Moines.

The lowest bids for Portland cement curbing in several streets were from J. C. Likes, of Des Moines, as follows: W. 10th St., 2,098 lin. ft.; W. 15th St., 1,284 lin. ft., and W. 16th St., 1,678 lin. ft., each at 45 cts. per lin. ft.; W. 12th St., 4,626 lin. ft., at 44 cts. per lin. ft.

St. Joseph, Mo.—Ordinances under consideration provide for the paving of Julie St., from 6th to 19th Sts., with brick.

Beaumont, Tex.—The Street and Bridge Com. has been authorized to have additional pavement laid at a cost of $15,000.

Guthrie, Okla. Ter.—City Engr. T. A. White writes that this city will receive bids Dec. 11 for about 40,000 sq. yds. of vitrified brick paving on concrete foundation. Geo. Sendelbach, City Clk.

Hamilton, Ont.—Co. Clk. J. N. Jardine writes that on Oct. 22 it was voted to issue $98,000 bonds for the improvement of county roads and the purchase of existing toll roads in Wentworth Co.

POWER PLANTS, GAS AND ELECTRICITY.

Taunton, Mass.—Abner Coleman, Mgr. Municipal Lighting Plant, writes that the following bids were opened Oct. 11 for furnishing materials and constructing a municipal light and power station: D. J. Sullivan, Taunton, $50,749; F. D. Williams, Taunton, $43,100; F. B. Gilbreth, Boston, $42,887; Benj. F. Smith Co., Pawtucket, R. I., $36,000; J. W. Bishop Co., Worcester, $35,180 (awarded).

Jamestown, N. Y.—The Bd. of Pub. Wks. is stated to have recommended that a $40,000 addition be constructed to the electric light plant.

Patchogue, L. I., N. Y.—The Brook Haven Gas Co., of Patchogue, has been incorporated; capital, $65,000. Directors: Edwin Bailey, J. L. Gerety and A. H. Carmon, Patchogue.

Brooklyn, N. Y.—A permit has been issued for the construction of a gas tank, 170 ft. diameter, for the Brooklyn Gas Co., to be constructed on Belmont and Williams Aves., to cost $225,000. Architects Bartlett, Heyward & Co., of Baltimore, Md. Builders, J. H. Davies & Bro., United Charity Bldg., N. Y. City.

Bids will be received Nov. 10 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures, etc., in School No. 138, Boro. of Brooklyn.

Niagara Falls, N. Y.—The Council is stated to have granted a franchise to the Ontario Transmission Co. to string its wires and furnish electricity in this city. The company has petitioned for a franchise in La Salle.

Canandaigua, N. Y.—H. A. Rose is stated to have petitioned the Village Trus. for a franchise to lay pipes and operate a plant to supply natural gas from a well in West Bloomfield.

Port Royal, Pa.—The Boro. Council is stated to have granted a franchise to the Juniata Electric Light Co.

South Bethlehem, Pa.—The Fountain Hill & West Bethlehem Light, Heat & Power Co. and the Consumers' Light, Heat & Power Co., both of South Bethlehem, have been incorporated, each with a capital of $1,000.

Baltimore, Md.—Bids will be received Nov. 5 by Geo. N. Numsen, City Register, for installing and maintaining such number of naphtha street lamps (using incandescent mantles) as may be necessary for a term of 1, 2, 3 and 5 years, beginning Jan. 1, 1903. Robt. J. McCuen, Supt. of Lamps & Lighting.

Penngrove, N. J.—Bids will be received Nov. 12 by the Mayor and Council for constructing an electric light plant, consisting of approximately one 105 H.-P. engine, one 60 Kw., 60 cycle, single-phase generator, switchboard, power, etc. John P. Leap, Chmn. Water Com.

Villa Rica, Ga.—The Villa Rica Light & Power Co. is reported organized, with C. M. Griffin, Pres., and E. R. Ayers, Secy. A plant will soon be constructed.

Morgantown, W. Va.—Geo. H. Switzer, Supt. of Construction, writes that the Bd. of Dirs. of the Morgantown Electric Light & Power Co. have authorized him to contract with the Stirling Co., of Chicago, Ill., for 3 boilers aggregating 910 H.-P., with Westinghouse, Church, Kerr & Co., New York City, for two 325 H.-P. and two 275 H.-P. Westinghouse compound engines, and with Westinghouse Elec. & Mfg. Co., Pittsburg, for two 200 Kw., 600 volt engine-type generators with switchboard and two 180 Kw., 2,200 volt, 60-cycle, two phase, belted alternators, with switchboard; total amount, $46,500. (Bids opened Oct. 24.)

Muncie, Ind.—The City Council is stated to have granted a franchise to the Mutual Gas Co.

Janesville, Wis.—The property of the Janesville Electric Co. is reported to have passed into the hands of a company of local capitalists, Stanley B. Smith, Levi B. Carle being among the new stockholders. The company is to be entirely reorganized and the capital stock increased from $30,000 to $100,000.

Superior, Wis.—The Highland Canal & Power Co. is reported to have purchased the Jay Cooke water power on the St. Louis River and will develop the power as required.

Escanaba, Mich.—The citizens are stated to have voted to issue $50,000 bonds to purchase the gas and electric plant of the Lighting Co.

Big Rapids, Mich.—The Bd. of Superv. are stated to have granted a franchise for the erection of 3 steel or stone dams across Muskegon River to Irwin & Co., of Muskegon; about 30,000 H.-P. will be developed from the 3 dams.

Lake Park, Minn.—See "Water."

Mankato, Minn.—Bids will be received Nov. 7 by D. V. Williams, City Recorder, for lighting the city streets for 1, 3 or 5 years with arc or incandescent electric lights, or other light.

Stillwater, Minn.—It is stated that the State Bd. of Control will install an electric light plant in the Stillwater Prison, at a cost of $4,500.

Canby, Minn.—The Practical Gas Co., of Chicago, Ill., will, it is reported, furnish plans and specifications for a gas plant.

Pleasantville, Ia.—The proposition to issue $5,000 gas lighting bonds is reported to have carried.

Manilla, Ia.—The citizens are reported to have voted to issue light bonds.

Findlay, O.—City Engr. John W. S. Riegle writes that this city is preparing plans and specifications for electric lighting.

Detroit, Mich.—A press report states that a syndicate of eastern capitalists acting through the North American Co. have acquired 90 per cent. of the stock of the Edison Illuminating Co. of Detroit and plans are being prepared by them to construct a mammoth electric light and power plant in Detroit which will cost about $2,000,000.

Minneapolis, Minn.—City Engr. G. W. Sublette writes that bids will be asked Nov. 14 for engine and dynamo, oil separator, and steam lines to connect boilers, N. E. Station, with steam line from engines.

Phillipsburg, Kan.—Wm. Cheif, proprietor of the Pioneer Flouring Mill, is reported to be making arrangements to light this city with electricity.

Eagle Lake, Tex.—See "Water."

Pass Christian, Miss.—The Council is reported to have contracted with E. H. Merrick to light the town for a period of 10 years with arc lights of 2,000 c. p.; work on the plant will begin at once.

Palestine, Tex.—See "Electric Railways."

Abilene, Tex.—Bids are wanted Nov. 15 for the installation of machinery and complete apparatus for power, electric lights, water supply system, ventilating and steam heating at the Epileptic Colony at Abilene. J. L. O'Connor, Archt. R. M. Love, Compt. of Pub. Accounts, Austin, Tex.

Williston, N. D.—Johnson & Kennedy, of Fargo, are reported to have secured a franchise for an electric light plant. It will cost about $40,000.

De Smet, S. D.—The Practical Gas Co., of Chicago, Ill., is stated to have secured the contract for constructing a gas plant at De Smet, to cost about $7,000.

Helena, Mont.—The power plant of the Helena Light & Power Co. is reported to have been destroyed by fire Oct. 20.

Las Animas, Colo.—The Las Animas Electric Co. has been incorporated, with a capital of $25,000. Incorporators: Tom. J. Gardner, R. C. Thayer and others, of Las Animas.

Springville, Utah.—See "Water."

Denver, Colo.—See "Water."

Tacoma, Wash.—The Snoqualmie Falls & White River Co. is reported incorporated, with a capital of $2,000,000. This company proposes to drain part of the flow of the White River into Lake Taps, whence the water will be carried over the high bluff near Sumner. This water power will generate electricity to the amount of 12,500 H.-P. Chas. H. Baker and associates, of the Snoqualmie Falls Power Co., are the incorporators.

Whittier, Cal.—The Whittier Light & Fuel Co. has been incorporated, to manufacture and sell gas and electricity; capital, $100,000. Directors: A. Hadley, Whittier; W. H. Schweppe, Los Angeles, and W. F. Jordan, Riverside.

Manila, P. I.—A press report states that the Bureau of Insular Affairs of the War Dept. at Washington, D. C., has received a despatch from Governor Taft stating that the Philippine Comn. has passed an act inviting bids for street railroad, electric light and other franchises in Manila; the bids to be opened Mar. 5, 1903.

ELECTRIC RAILWAYS.

Auburn, Me.—The R. R. Comrs. are stated to have approved the articles of association of the Auburn, Mechanic Falls & Norway St. Ry Co., which proposes to build a street railroad to be operated by electricity or compressed air through Auburn, Minot, Poland, Mechanic Falls, Oxford and Norway; length of line will be about 24 miles. Directors: Albert H. Shaw, Bath; Fred'k H. Wilson, Brunswick, and others.

South Windham, Conn.—It is reported that the Willimantic Traction Co. will this fall begin the erection of a power plant at South Windham. W. D. Grant, Pres., Willimantic.

Frankfort, N. Y.—The Village Trus. are stated to have granted a franchise to the Utica & Mohawk Ry. Co. C. L. Allen, Gen. Mgr., Utica.

Far Rockaway, L. I., N. Y.—A press report states that the Long Island R. R. Co. is to operate the entire Rockaway Branch by electricity. Additional tracks are to be laid between Hammel's and Valley Stream, double tracks between Far Rockaway and Valley Stream, and two more tracks on either side of the present line between Hammel's and Far Rockaway. The trestle across Jamaica Bay is to be widened, and the power house at Hammel's Station will be enlarged. W. F. Potter, Gen. Supt., Long Island City, N. Y.

Vernon, N. Y.—The Town Trus. are stated to have granted a franchise to the Oneida Ry. Co. H. J. Clark, Ch. Engr., Syracuse.

Auburn, N. Y.—It is stated that final surveys for the electric railway from Ithaca to Auburn are about to be commenced. E. G. Wyckoff, of Ithaca, Pres. Ithaca St. Ry. Co., is reported interested.

West Collingswood, N. J.—The Haddon Township Com. is stated to have granted the Camden & Suburban Ry. Co. permission to continue its line from West Collingswood to Haddon Heights. W. E. Harrington, Mgr., Camden.

Glen Gardner, N. J.—Robt. Petty, of Washington, Pres. of the Easton & Washington Traction Co., is stated to have petitioned the Lebanon Township Com. for a franchise to operate a trolley line along the old Spruce Run turnpike, through the township. The turnpike begins at the Washington Boro. line and runs through Changewater, New Hampton, Junction, Glen Gardner and Clinton.

Trenton, N. J.—The Council is stated to have granted the New Jersey & Pennsylvania Traction Co. a right of way on Willow St.

New Castle, Pa.—The New Castle & Sharon Electric St. Ry. Co. is stated to have petitioned for a franchise to extend its line from the city line at Franklin Ave., and to provide for terminal facilities at the public square. T. P. Toler, Ch. Engr., New Castle.

Frankford, Pa.—The Philadelphia Rapid Transit Co. is stated to have decided to construct a power house at the junction of the Bustleton and Bristol turnpikes, above Frankford. W. S. Twining, of Philadelphia, Ch. Engr. of the Co., will prepare the plans for the power house.

Canastota, N. Y.—The Oneida Ry. Co. is stated to have secured a franchise through the village. H. J. Clark, Ch. Engr., Syracuse.

Rome, Ga.—The City Electric Ry. Co. is reported to be considering the advisability of extending its line to Lindale. J. B. Marvin, Mgr.

Akron, O.—The Cleveland, Akron & Southern Fast Line Ry. Co., Akron, has been incorporated, with a capital of $10,000, by C. R. Grant, T. L. Childs and others, to construct an electric railway to connect Cleveland Akron and Massillon, with the privilege of constructing a branch to Canton.

Cincinnati, O.—The Cincinnati Traction Co. is about to petition the Bd. of Pub. Service for permission to extend the East End line to the city corporation line. W. K. Schoepf, Gen. Mgr., Cincinnati.

New Comerstown, O.—The Village Council is stated to have granted a franchise to C. E. Mitchener, of New Philadelphia, O.

South Whitley, Ind.—The Huntington & Winona Traction Co., of South Whitley, has been incorporated, with a capital of $10,000, to build an electric line in and through Huntington, South Whitley, Pierceton, Winona, Warsaw and North Webster. Directors: Geo. Lee, Edw. B. Bowers and others, all of South Whitley.

Evansville, Ind.—It is stated that surveys are about complete for the extension of the Evansville, Suburban & Newburg Ry. to Rockport, a distance of 23 miles. F. W. Cook, Pres.

Springfield, Ill.—It is stated that the Springfield & Central Illinois Ry. Co. will take over the Springfield Consolidated Ry. and the rights of way, franchises, etc., of the Springfield & St. Louis R. R. In addition it will build an interurban line to Riverton.

Chicago, Ill.—The Chicago, Elgin & Waukegan Electric Ry. Co. is reported incorporated, to operate an electric railway in Cook, Kane, Dupage, Will and Lake Counties. The route proposed is from Waukegan to Fox Lake, Wauconda, Barrington, Elgin, St. Charles, Aurora and Joliet. E. W. Stees, of Chicago, is the principal promoter.

South Haven, Mich.—The Council is stated to have granted Geo. E. Bardeen, of Otsego; Wm. S. Dewing, of Kalamazoo, and others, a franchise for an electric railway.

Ft. Wayne, Ind.—The Ft. Wayne, Bluffton & Richmond Traction Co. is reported incorporated, with a capital of $50,000, to construct an interurban road between Ft. Wayne and Richmond, passing through Ossian, Bluffton, Camden, Portland, Ridgeville, Winchester, Lynn and Fountain City. Directors: Edw. Manier, Frank X. Schaffer and others.

East St. Louis, Ill.—The St. Louis & East Shore Ry. Co., of St. Louis, has been incorporated, with a capital stock of $50,000, to construct a line from East St. Louis to Ft. Gage and Shawneetown, and also from a point in Jackson Co. to Brookport. Incorporators: Z. W. Tinker, St. Louis, Mo.; F. J. Kraft and Luther Robinson, of East St. Louis.

Kansas City, Kan.—A charter has been granted to the Kansas City, Olathe & Southwestern Suburban Electric R. R. & Power Co. to build a short line electric road from Olathe to Kansas City; capital, $10,000. L. C. Boyle, of Kansas City, is one of the incorporators.

Joplin, Mo.—It is stated that the Southwest Missouri Electric Ry. is to be extended from Joplin to Carl Junction, Mo., 10 miles north. E. J. Pratt, of Webb City, Ch. Elecn.

Guthrie, Okla. Ter.—The Guthrie Commercial Club is reported to have closed a contract with John Shartel and others now building an electric railway system in Oklahoma City to extend the line to Guthrie, a distance of 30 miles.

Palestine, Tex.—Two ordinances are stated to have been introduced in Council asking for franchises. One from Hunter & Taylor, of Greensboro, S. C., asking for a franchise for an electric railway, an electric light plant and heating plant; the other from J. S. Tritle, of St. Louis, Mo., and R. V. Gray, of Texarkana, for a franchise for an electric railway, a light plant and a gas lighting and heating system.

Pass Christian, Miss.—Jos. Murphy, of Mississippi City, is stated to have petitioned for a franchise on 2d St.

Little Rock, Ark.—It is reported that a company is about to be formed, with a capital of $250,000, to build an interurban trolley line from Little Rock to Toltec, a distance of 15 miles, by way of Baucum and Scotts. Judge P. C. Dooley and W. P. Field are reported interested.

Beaumont, Tex.—Geo. H. White, of Beaumont, with a corps of assistants, is stated to have completed a survey from Beaumont to Sour Lake Springs for an electric railroad.

Springville, Utah.—Jesse Knight, S. R. Thurmond and others, of Provo, are stated to have asked the City Council for a franchise along State St. for an electric railway. The proposed line will run from Lehi to Goshen.

Tacoma, Wash.—Elmer J. Felt is stated to have petitioned the Co. Comrs. for a franchise for an electric railway connecting Tacoma with American Lake, Ft. Steilacoom, Steilacoom, Lake View, Higgins Beach and Lemon's Beach.

Spokane, Wash.—The Coeur d'Alene & Spokane Ry. Co., Ltd., is reported formed, with a capital of $500,000, to construct an electric railway between Spokane and Coeur d'Alene. Directors: F. A. Blackwell, representing the Howard Lumber Co., of Williamsport, Pa.; A. Bettes, of Detroit, Mich; C. P. Lindsley, of the Lindsley Bros. Co., of Menominee, Mich., and others.

RAILROADS.

New Castle, Pa.—The Pittsburg, Lisbon & Western R. R. Co. is reported to have increased its capital from $1,000,000 to $5,000,000 for the purpose of building 3 extensions, one from New Castle to New Galilee, the other from New Castle to Pittsburg, and the third from Lisbon, O., to Ashtabula Harbor. R. W. Billingsley, Supt., Lisbon, O.

Washington, Pa.—J. W. McKay, of Waynesburg, is reported to be securing a right of way through Washington and Greene Counties for the construction of the Wabash R. R. W. S. Newhall, Ch. Engr., St. Louis, Mo.

Pittsburg, Pa.—A press report states that the Jones & Laughlins Steel Co., of Pittsburg, will construct a railroad from Pittsburg to a new Lake Erie port near Girard, Pa., at a cost of about $15,000,000.

The Ft. Pitt Connecting R. R. Co. is reported incorporated to build a steam road from 14th to the 17th Wards, Pittsburg. Incorporators: J. D. Evans, Geo. W. J. Bissell and John S. Graham.

Martin's Creek, Pa.—The Lehigh & New England R. R. Co. (Wm. Jay Turner, of Philadelphia, Pres.) is reported to be surveying another branch to be built from Martin's Creek to Bangor and Pen Argyl, so as to connect with the Northampton R. R. at Martin's Creek.

Southport, N. C.—The Cape Fear Terminal R. R. Co. is reported incorporated, to construct a railroad from Southport to Wilmington.

Jefferson, S. C.—It is reported that the Charlotte, Monroe & Columbia R. R. Co. is to extend its line from Hamburg to Jefferson, a distance of about 11 miles.

Reynoldsville, W. Va.—A charter has been granted to the Katy Lick R. R. Co. to build a railroad from Reynoldsville to Mannington; capital, $50,000. Incorporators: E. A. Humphries and J. W. Anawalt, of Scottdale, Pa.; Harry Dunn, of Connellsville, Pa., and others.

Peshtigo, Wis.—A press report states that the Wisconsin & Michigan Ry. Co. has decided to expend about $100,000 in terminal improvements at Peshtigo and Peshtigo Harbor. B. C. Gowen, Ch. Engr., Peshtigo.

South Bend, Ind.—The New Jersey, Indiana & Illinois R. R. Co. has been incorporated, with a capital of $100,000, to construct a railroad from South Bend to Lakeville or some intermediate point on the line of the Wabash R. R. between Lakeville and North Liberty. The road will be 11 miles in length. Directors: Christian B. Zabriskie, DeWitt Van Buskirk and others.

Newport, Tenn.—The Tennessee & North Carolina R. R. Co. has filed an amendment to its charter providing for an increase of its capital stock from $50,000 to $500,000. It also empowers the company to construct and operate a railroad from Newport, Tenn., to the N. C. State line, in Haywood County, at or near the Big Pigeon River. H. T. Wilson, Gen. Supt., Newport.

Columbia, Miss.—It is stated that the Gulf & Ship Island R. R. Co. will build a branch road from Mendenhall to Columbia, a distance of 50 miles. L. A. Washington, Ch. Engr., Gulfport.

Sheridan, Ark.—The Pine Bluff & Western Ry. Co. is stated to have awarded to McArthur Bros. Co., of St. Louis, Mo., the contract for the completion of its line from Sheridan to Benton, a distance of about 24 miles. The contract price is reported to be about $15,000 a mile.

Houston, Tex.—The International & Great Northern R. R. Co. is stated to have about secured right of way for its line from Houston to Beaumont and New Orleans, La. J. D. Trammel, Ch. Engr., Palestine.

Memphis, Tenn.—City Engr. Omberg is reported to be considering plans and specifications submitted by H. W. Parkhurst, of Chicago, Ill., Eng. of the Illinois Central R. R., for a $30,000 subway, to be constructed by this company at Iowa and Texas Aves. The plans provide for a subway about 800 ft. long, and the purpose of its erection is to get street traffic off the same level with the railroad traffic and abolish a dangerous grade crossing.

San Jose, Cal.—The Southern Pacific Co. is reported to have decided to expend about $100,000 in improvements, including the enlargement of the depot. Wm. Hood, Ch. Engr., San Francisco.

Manila, P. I.—See "Power Plants, Gas and Electricity."

PUBLIC BUILDINGS.

Stockbridge, Mass.—Jas. F. Pilling, of Stockbridge, is stated to have secured the contract for erecting the town hall for $13,452.

Boston, Mass.—Bids will be received Nov. 4 by the Trus. of the Insane Hospital at the office of Kendall, Taylor & Stevens, 93 Federal St., for furnishing material and erecting 3 buildings for said hospital. Separate bids for heating and plumbing will also be received on same date.

The following bids for the erection and completion of a bath house on Cabot St., Roxbury, were opened Oct. 30 by the Trus. of the Bath Dept. and taken under consideration: Chas. Logue, $114,247; John J. Flynn, 1011 Tremont Bldg., $98,411; Chas. H. Dodge Const. Co., $108,900; Frank B. Gilbreth, $117,880; McNeil Bros., $109,450; F. G. Coburn & Co., $102,280; John W. Bruty, $104,000; Jas. Fagan, $99,126; Whiton Building & Lumber Co., $109,000, all Boston parties. On the ground floor there will be a swimming tank 26x70 ft., shower and tub baths, lockers, etc.; on the 2d floor will be a gymnasium.

New York, N. Y.—Bids will be received Nov. 6 (re-advertisement) by John W. Brannan, Pres. of Bd. of Trus., Bellevue and Allied Hospitals, for erecting a dormitory in the Medical College Bldg., on Bellevue Hospital grounds.

Brooklyn, N. Y.—The following bids for an interior public bath building on Hicks St., near Degraw St., were opened Oct. 29 by J. Edw. Swanstrom, Boro. Pres.: P. J. Carlin & Co., $66,000; Danl. J. Ryan, $69,000; Thos. Dwyer, $69,900; Thos. G. Carlin, $68,000; W. & T. Lamb, 99 Nassau St., New York, $54,564.

Bids will be received Nov. 12 by J. Edw. Swanstrom, Boro. Pres., for erecting an interior bath building on Pitkin Ave.

Iroquois, N. Y.—Bids are wanted Nov. 6 for the construction, heating, plumbing and electric wiring of a dormitory; also for the construction and plumbing of a laundry and power house, including the chimney stack, at Thomas Asylum for Orphan and Destitute Indian Children. G. L. Heins, State Archt., Albany, Henry R. Howland, Pres. Bd. of Mgrs.

Catonsville, Md.—Owens & Sisco, 323 N. Charles St., Baltimore, are stated to be preparing plans for an edifice for the Salem Lutheran Church, to cost about $15,000.

Brooklyn, N. Y.—Bids will be received by Homer Folks, Comr. of Pub. Charities, N. Y. City, Nov. 13 for the following work for the Kings Co. Bldgs. for erecting a coal storage building, for installing a heating and power plant, an electric lighting plant, and for the erection of a building for a heating, lighting and power plant and for underground trenches or conduits.

Richmond, Va.—The Penitentiary Bldg. Com. opened bids Oct. 23 for the erection of a new cell building. Alsop & Pierce, of Newport News, were the lowest bidders for the shell of building at $83,000. Stewart Iron Co.'s bid of $97,000 was the lowest for a steel cell building.

Jacksonville, Fla.—The contract for the erection of a Baptist church, to be located at Church and Hogan Sts., has been awarded to the Owens Building Co., Jacksonville, for $31,397. Architects, T. F. Lockwood & Co., of Jacksonville.

Portsmouth, O.—The plans of Richards, McCarty & Bulford, of Columbus, have been accepted for the Carnegie Library, to cost $50,000.

Flora, Ill.—The First Christian Society is stated to have decided to erect a $16,000 church.

Moline, Ill.—Peter Peterson, 1209 12th Ave., is stated to have secured the contract for erecting the Carnegie Library, for $38,500.

Juneau, Wis.—The congregation of St. Mary's Church is stated to have decided to erect a $15,000 edifice. Rev. J. J. Salentine, Pastor.

Marinette, Wis.—Bids will be received Nov. 5 by the Bd. of Pub. Wks. for erecting an armory, including a council chamber and an office for the City Clk. Dan J. Madagin, Chmn.

Stevens Point, Wis.—The Library Bd. is stated to have approved plans for the Carnegie Library, to cost about $18,000.

Muskegon, Mich.—The Trus. of the Hackley Hospital are stated to have accepted the plans of Fuller & Pitcher, of Albany, N. Y., for their new buildings. They will be grouped on the pavilion plan.

Painesdale, Mich.—It is reported that a memorial library will be erected at Painesdale, donated by Wm. A. Paine, of Boston, Mass. It will cost $30,000. Plans for the structure have been prepared.

Columbus, O.—Bids will be received Nov. 20 by the Bd. of Co. Comrs. for furnishing material and erecting a barn at the Co. Infirmary. R. Z. Dawson, Jr., Archt., 609 Outlook Bldg. L. E. Jones, Co. Aud.

Chicago, Ill.—Bids are wanted Nov. 27 for erecting 2 cottages. Jenney & Mundie, Archts., 171 La Salle St. Address N. W. McLain, Secy. Bd. of Trus. of St. Charles Home for Boys, 1412 Marquette Bldg.

Topeka, Kan.—The Kansas World's Fair Comn., at a meeting here Oct. 22, decided to secure bids for the erection of the Kansas Bldg. at the Fair, to cost about $40,000.

Shreveport, La.—Bids will be received Nov. 20 by the Bd. of Administration of the Shreveport Charity Hospital for erecting the new hospital. Thos. Sully, Archt., New Orleans; P. M. Welsh, Secy.

Kentville, N. S.—It is stated that bids are wanted Nov. 15 for erecting a brick and stone court house. A. E. McMahon, Chmn. Com., Aylesford.

BUSINESS BUILDINGS.

Attleboro, Mass.—Karl H. Hyde, of Attleboro, is reported to have prepared plans for a 4-story business building to be erected on N. Main and County Sts., for the Attleboro Land Co., to cost about $40,000.

Gouverneur, N. Y.—The H. P. Cummings Co., of Ware, Mass., is stated to have secured the contract for erecting a $100,000 mill for the International Lace Co.

Brooklyn, N. Y.—H. C. Pelton, 1133 Broadway, N. Y. City, is stated to have prepared plans for the Woodruff Hotel, to be erected on Montague, Hicks and Remsen Sts., for the Brooklyn Heights Realty Co., of which Jas. H. Breslin is Pres. and Geo. C. Austin, Secy. It will be fireproof, 12 stories high, and contain 400 rooms.

Pittsburg, Pa.—The Erie R. R. Co. is reported as having plans prepared for a station to be erected on Forbes and High Sts., to cost about $500,000. C. W. Buchholz, Ch. Engr., New York, N. Y.

Groveton, Pa.—It is stated that the engineers of the Pittsburg & Lake Erie R. R. Co. are preparing plans for 2 new water, coaling and cleaning stations to be erected at Groveton and Hazelton. Each station will cost $20,000. J. A. Atwood, Ch. Engr., Pittsburg.

Pottstown, Pa.—Brown & Gerhard will proceed at once with the erection of the Auditorium Bldg. Cost, $30,000. Archt., Geo. A. Gerhard.

Carnegie, Pa.—A press report states that the Chartiers Valley Brewing Co. will soon erect here an office building and stables, to cost about $50,000. Wm. Borgman, of Carnegie, is Mgr.

A press report states that a 7-story brick building will be erected on Fayette St. and Duquesne Way, for Haugh & Keenan, to cost about $300,000.

Wilmington, Del.—A building permit has been granted to the Pennsylvania R. R. Co. for the erection of locomotive shops, to cost $125,000; a roundhouse, $100,000; blacksmith shop, $26,000; woodworking mill, $25,467, and power house, $19,500. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Baltimore, Md.—Bids will be received Nov. 19 by the Bd. of Awards for furnishing material and erecting a brick storehouse at the Gay St. Yard of the Water Bd. Thos. G. Hayes, Pres.

Wheeling, W. Va.—Henry Schmulbach is reported to be considering the erection of an opera house on the site of the Musee Theatre, to cost about $150,000.

Cincinnati, O.—The Traction Terminal Co. has been incorporated, with a capital of $100,000, to erect a central depot here. Incorporators: J. B. Foraker, Randolph Mathews and others.

The Dirs. of the First Natl. Bank are stated to have decided to erect an 18-story building on 4th and Walnut Sts.

Cleveland, O.—It is stated that L. A. Stone will erect a 7-story brick business building on Superior and Muirson Sts.

Columbus, O.—Plans are being prepared by Richards, McCarty & Bulford, "The Ruggery," for 2 brick car sheds, 134x180 and 100x180, respectively, to be erected on the west side for the Columbus, London & Springfield R. R. Co.

Marinette, Wis.—Wm. Brown, of Menominee, Mich., is reported to be preparing plans for new car barns which the Menominee & Marinette Electric St. Ry. Co. intends to build in Marinette this fall or in the spring. The plans will call for a building 150x50 ft., a frame structure covered with corrugated iron.

Bay City, Mich.—The stockholders of the Wood Opera House Co. are stated to have selected J. M. Wood to prepare plans for rebuilding the theatre.

Detroit, Mich.—The American Blower Co. is about to erect a $10,000 office building, 40 ft. x 80 ft. Malcomson & Higginbotham, Moffat Bldg., Archts.

Toledo, O.—Bacon & Huber, "The Spitzer," are reported to be preparing plans for a 4-story brick building, to be erected by Geo. A. Chase, to cost about $50,000.

Chicago, Ill.—It is stated that Herman Eickmeier will erect a store and flat at 218 to 220 N. Clark St., to cost about $75,000.

Kansas City, Mo.—The following buildings are about to be constructed: Brick store at 1013 and 1015 Grand Ave.; owner, A. R. Meyer; cost, $20,000. Brick store at 9th Ave. and Hickory St.; owner, S. H. Mc-Necklin; cost, $12,000. Alterations and additions to building at 10th and Walnut Sts.; owner, Chas. Schoelkopf; cost, $50,000. Brick store at 10th St. and Bway.; architect, W. E. Brown, N. Y. Life Bldg.; cost, $70,000. Brick store at 18th and Vine Sts.; owner, S. W. Smith Estate; architects, Van Brunt & Howe, Bayard Bldg.; cost, $15,000.

Lexington, Ky.—It is stated that the Elks Assoc. will erect a $30,000 club house.

Ft. Smith, Ark.—The Reynold Davis Grocer Co. is about to erect a 6-story brick wholesale house, costing about $60,000.

Denver, Colo.— A. J. Dockarty is reported to have prepared plans for a theater of 3,800 seating capacity, to cost about $75,000. Clarence L. Crater, of Denver, is reported interested.

Wallace, Idaho.—The Northern Pacific R. R. Co. is stated to have decided to erect a $30,000 freight depot at Wallace. W. L. Darling, Ch. Engr., St. Paul, Minn.

San Francisco, Cal.—The Bldg. Com. of the Pacific Union Club is stated to have accepted the plans of Reid Bros., Claus Spreckels Bldg., for a club house to be erected on Post and Stockton Sts., to cost about $200,000. Jas. W. Byrne, Chmn. Bldg. Com.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

115 and 117 Cannon St, 6-story br tenemt and stores; c, $42,000; o, Feldman & Weiss; a, G F Pelham.

108th St and Bway, 4-story br stable; c, $25,000; o, Nicholas Henry; a, Jas W Cole.

Broadway and Leonard St, new front, court beams and girders, stairs, elevator, etc, in 5-story br loft and store bldg; c, $60,000; o, Louis M Jones; a, Fredk C Browne.

Brooklyn, N. Y.

John and Plymouth Sts, 6-story br factory; c, $90,000; o, National Licorice Co; a, W Higginson.

Smith St and and Hamilton Ave, repair damage by fire; c, $45,000; o, American Tartar Co; a, E Greene; b, C F Bond.

DWELLINGS.

Boston, Mass.—Plans have been filed for 6 stone and brick houses to be erected on Bay State Road, near Sherborn St., for Geo. Wheatland, at a total cost of $135,000. S. D. Kelley, 209 Washington St., is the architect.

A block of 5 apartment houses, with court, will be built on Audubon Road, near Beacon St., for E. A. Bangs. The houses will be of brick and limestone, 4 stories high. Danl' Howard Woodbury, 53 State St., is the architect.

Long Branch, N. J.—Mrs. Norman L. Munro is stated to have decided to rebuild her summer home at Norwood Park, which was destroyed by fire about a year ago. The new residence will cost about $150,000.

Pittsburg, Pa.—S. A. Hall is stated to have prepared plans for an apartment house to be erected on Forbes and Craig Sts. for Geo. A. Charles, to cost about $60,000.

Chicago, Ill.—It is stated that Geo. C. Watts is to erect two 3-story apartment houses on Madison Ave. and 62d Pl., at a total cost of $75,000.

Minneapolis, Minn.—A permit has been issued to J. H. Edmonds and L. M. Hill for a 4-story brick flat to be erected at 311-17 W. 15th St., to cost $20,000.

Kansas City, Mo.—S. R. Frink, Mass. Bldg., has prepared plans for a $20,000 brick dwelling, to be erected at 15th and Wabash Ave. Owner, W. A. Rule.

San Francisco, Cal.—Shea & Shea, 26 Montgomery St., are stated to have prepared plans for an 8-story fireproof building, to be erected on Mason and Ellis Sts. for Mr. and Mrs. A. F. Charnot, to cost about $100,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

299 to 305 E 8th St, 2 6-story br tenemts; c, total, $90,000; o, Nathan Silverson; a, G T Pelham.

72d St and Ave A, 5-story br and stone flat; c, $20,000; o, Godfrey Knoche; a, Rudolph Moeller.

117th St and 5th Ave, 6-story br flat; c, $65,000; o, Chas Adams; a, Lorenz F J Welher.

Union Ave and 168th St, 5-story br tenemt; c, $25,000; o, Frank Mezger; a, Vincent Bonagm.

1 E 42d St, 5-story extension to 4 and 5-story br dwell; c, $25,000; o, Mrs Margaret Schley; a, Chas E. Reid.

Brooklyn, N. Y.

43d St and 5th Ave, 9 3-story br dwells; c, total, $36,000; o, J K Stockton & O Abram; a, H. L. Spicer.

SCHOOLS.

New Bedford, Mass.—City Engr. W. F. Williams writes that plans are being prepared by S. C. Hunt, of this city, for a high school which will probably cost $500,000 or more. Contracts will not be let before 1903, as certain legislation must first be secured.

Pawtucket, R. I.—Frank G. Rowley, 161 Main St., is stated to have secured the contract for erecting the South Woodlawn school, for $36,571.

Boston, Mass.—Bids will be received Nov. 10 by the Schoolhouse Comrs. for erecting a school on Norman St., Phillips Dist., exclusive of plumbing, heating and electrical work and giving bond for the sum of $50,000. Everett & Mead, Archts., 60 Devonshire St. R. Clipston Sturgis, Chmn.

New York, N. Y.—Bids will be received Nov. 10 by C. B. J. Snyder, Supt. of School Bldgs., for alterations and repairs to the 3 buildings in E. 52d St., converting them into annex of school No. 18; also to a building in E. 46th St., converting it into annex of school No. 73.

Bids will be received Nov. 7 by C. B. J. Snyder, Supt. of School Bldgs., for erecting a school at 176 Amethyst Ave., and for installing electric elevators in Morris High School, Boro. Bronx. Bids will also be received for erecting 2 outside iron stairs at front of school No. 70, Boro. Manhattan.

The following bids were opened Oct. 24 by Supt. of School Bldgs., C. B. J. Snyder, Dept. of Educ., for installing electric elevators in the new High School of Commerce, Manhattan Boro.: Marine Engine & Machine Co., $9,745; Otis Elevator Co., 71 Broadway, $9,994.

Brooklyn, N. Y.—The followings bids were opened Oct. 22 by Supt. of School Bldgs., C. B. J. Snyder, Dept. of Educ., New York City, for installing heating and ventilating apparatus for school 139, Boro. of Brooklyn: Williams & Gerstle, $18,934; John Neal's Sons, $19,910; Frank Dobson, $18,832; United Heating Co., $18,741; Jas. Curran Mfg. Co., $21,000; E. Rutzler, 178 Centre St., $18,240.

Bids opened Oct. 24 for installing electric light wiring, fixtures and electric bell system in school 139, were as follows: Fred'k Pearce, $6,350; Weiderman & Conklin, $7,507; United Engineering & Contracting Co., 21 Park Row, $4,995; T. Fred'k Jackson, $6,410; Commercial Const. Co., $6,300.

Bids opened Oct. 24 for electric light wiring, fixtures, etc., in school 141, Boro. of Brooklyn, were as follows: T. Fred'k Jackson, $8,410; Commercial Const. Co., $8,375; Fred'k Pearce, $8,350; United Engineering & Contracting Co., $7,492.

Ithaca, N. Y.—The Trus. of Cornell Univ. are stated to have agreed on the location of the Rockefeller Hall of Physics, to cost $250,000, and have recommended the erection of a hall for arts and humanities, to cost $250,000. A site is also reported purchased west of the library, and on it 6 new costly buildings will be erected at once and 8 more in the remote future.

Bordentown, N. J.—The contract for erecting the Manual Training and Industrial School for Colored Youths, at Bordentown, is stated to have been awarded to Jas. W. Lanning, of Trenton, for $20,000.

Braddock, Pa.—E. J. Carlisle & Co., Lewis Blk., Pittsburg, are stated to be completing plans for the Carnegie Sub-District School, to be erected on Talbot Ave. and 11th St., Braddock, to cost about $80,000.

Philadelphia, Pa.—The Councils Com. on Schools has recommended that about $2,000,000 be appropriated for permanent school improvements.

Washington, D. C.—The proposition of Pararini & Grier, Washington, to build an 8-room school at 9th and D Sts., N. E., for $33,375, has been accepted by the Comrs., D. C.

Watertown, N. Y.—Bids will be received Nov. 11 by Frank S. Tisdale, Supt. of Schools, for furnishing material and performing the plumbing work for the new high school.

Newburgh, N. Y.—A. H. Pickens, of Newburgh, is stated to have received the contract for ventilating and heating the South St. school, for $6,850.

South Orange, N. J.—Bids are wanted Nov. 11 for erecting the new South Orange school. Chas. Granville Jones, Archt., 280 Bway., New York, N. Y. Wm. H. Kemp, Chmn. Com. on Bldgs.

Brooklyn, N. Y.—Bids will be received Nov. 12 by C. B. J. Snyder, Supt. of School Bldg., N. Y. City, for the general construction of Public school No. 143, Boro. of Brooklyn, and also on same date for installing ventilating and heating apparatus in school No. 138, also in Boro. of Brooklyn.

Mineral Point, Wis.—The citizens are stated to have voted to issue $30,000 bonds for the erection of a school.

Delray, Mich.—Malcomson & Higginbotham, of Detroit, are the architects for a 15-room school to be erected of brick and stone with slate roof and hardwood finish. Cost, $60,000.

Youngstown, O.—Bids are wanted Nov. 10 for furnishing material and erecting a school in sub-district No. 1, Park Hill. R. F. & E. R. Thompson, Archts., Diamond Blk. O. C. Grant Jacobs, Clk. of Youngstown Township.

Fayetteville, Ark.—The shops of the Univ. of Arkansas are reported to have been destroyed by fire Oct. 20.

Danville, Ky.—Augustus Rogers, Supt. Kentucky School for Deaf Mutes, writes that no contracts were let for the work on the contemplated new buildings, bids for which were opened Oct. 28, as all bids exceeded the amount of the State's appropriation. The architect is at work on new plans, and it will be several months before the matter will be taken up again.

Ft. Morgan, Colo.—M. W. Fuller is stated to be preparing plans for a high school, to cost $35,000.

San Francisco, Cal.—The Bd. of Educ. is stated to have adopted plans for the Noe Valley School, to cost about $40,000.

Berkeley, Cal.—Bids are wanted Nov. 22 for erecting a recitation and dormitory building, including plumbing, gasfitting, heating, etc. W. H. Weeks, Archt., Watsonville; E. J. Wickson, Secy. Bd. of Trus. of the California Polytechnic School.

STREET CLEANING AND GARBAGE DISPOSAL.

Bridgeport, Conn.—This city is said to be considering a proposition from the United States Garbage Reduction Co. of Boston for the disposal of garbage and ashes for a term of years.

Newburyport, Mass.—The City Council is considering the question of garbage disposal by cremation.

New York, N. Y.—Bids are wanted Nov. 7 (re-advertisement) for furnishing labor and materials required for the removal of snow and ice of the Boro. of Manhattan until Apr. 15, 1903. John McG. Woodbury, Comr. of Street Cleaning.

Brooklyn, N. Y.—The Bd. of Estimate has approved the award of a 5-year contract for the removal of ashes and rubbish collected in Brooklyn to H. M. Kennedy.

Parkersburg, W. Va.—Bids will be received Nov. 12 by the Health Com. for the removal of all kitchen garbage and offal accumulating in this city for 1 year beginning Jan. 1, 1903. Jesse L. Cramer, City Clk.

Elwood, Ind.—The City Council has appointed a special committee composed of Mayor W. C. Smith and Councilmen Brown, Ploughe and Haynes to visit other cities and inspect garbage furnaces with a view of having the one here rebuilt.

Marietta, O.—The City Council is said to be receiving bids for 15 and 20-ton garbage crematories.

Kansas City, Mo.—John T. Elkins has made a proposition to the Joint Garbage Com. for the collection and disposal of city garbage.

Montreal, Que.—Bids are wanted Nov. 6 for the removal of snow and ice from the streets in which the Montreal St. Ry. Co. runs its cars. Contracts may be awarded for 1 or 3 years at the option of the City Council. Address L. O. David, City Clk.

GOVERNMENT WORK.

Boston, Mass.—Bids are wanted at the U. S. Engineer Office until Dec. 2 for dredging in Chelsea Creek and Malden River, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted at the U. S. Engineer Office until Nov. 26 for dredging and for furnishing and placing rip-rap stone in Anacostia River, D. C., as advertised in The Engineering Record.

Wilmington, Del.—U. S. Engr. Jared A. Smith is stated to have received the following bids Oct. 23 for extensive improvements to streams and harbors along the Eastern Shore of Maryland, the entire project to cost about $90,000: American Paving & Const. Co., of Philadelphia, 19 cts. a cu. yd. for dredging; Maryland Dredging & Const. Co., of Baltimore, 20½ cts. a cu. yd.; Sanford & Brooks Co., of Baltimore, 23 cts. a cu. yd.; River & Harbor Improv. Co., of Philadelphia, 24 cts. a cu. yd.; American Dredging Co., of Philadelphia, 26 cts. a cu. yd.

Patchogue, L. I., N. Y.—The contract for dredging the big channel of Great South Bay is stated to have been awarded to Kirk, Driscoll & Co., of Syracuse, for about $65,000.

Philadelphia, Pa.—The American Paving & Con. Co., of Philadelphia, has been awarded a contract by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Washington, for the coppersmith shop addition to the steam engineering building at League Island Navy Yard, for $102,570.

Annapolis, Md.—The lowest bid received Oct. 22 for dredging the channel from Chesapeake Bay to the Naval Academy is stated to have been from the Baltimore Dredging Co., of Baltimore, at $195,000.

Brunswick, Ga.—The following bids were opened Oct. 23 by Capt. Cassius E. Gillette, Corps of Engrs., U. S. A., at Savannah, for 560,000 cu. yds. of dredging in Inner Harbor, Brunswick: Atlantic Gulf & Pacific Co., New York, N. Y., 21.1 cts. per cu. yd.; R. Moore, Agent, Tallulah Falls, Ga., 22 cts.; Bowers Southern Dredging Co., Galveston, Tex., 23 cts.; Morris & Cummings Dredging Co., New York, N. Y., 20 cts., total $112,000 (recommended for award); P. Sanford Ross, Inc., Jersey City, N. J., 20.9 cts. Amount available, $117,000

Savannah, Ga.—The following bids were opened Oct. 23 by Capt. Cassius E. Gillette, Corps of Engrs., U. S. A., for dredging Savannah Harbor: Amount available, $1,055,000.

Bidder and Addresses.	Lot No. 1, 3,310,000 cu. yds. Cts.	Lot No. 2, 2,800,000 cu. yds. Cts.
P. Sanford Ross, Inc., Jersey City.....	17.5	*17.5
Morris & Cummings Drdg. Co., New York.	18.	18.
Atlantic, Gulf & Pac. Co., New York..	*16.9	17.7
Bowers So. Dredg. Co., Galveston, Tex..	19.	19½
R. Moore, Agent, Tallulah Falls, Ga...	..	19½

*Recommended for award.

Grand Rapids, Mich.—The lowest bid opened Oct. 22 at the U. S. Engineer Office, Grand Rapids, for pier extension and repair of piers and revetment at Ludington, Mich., was from T. J. Bennett & Co., of Muskegon, Mich., at approximately $92,453.

Conneaut, O.—The Donnelly Contracting Co. of Buffalo, N. Y., is stated to have received the government contract for building piers and breakwaters at Conneaut; aggregate amount of contract, $438,000.

Ft. Riley, Kan.—Bids are wanted Nov. 25 for the construction of 2 double sets of quarters, as advertised in The Engineering Record.

Emporia, Kan.—Bids are wanted at the Treasury Dept., Washington, D. C., until Dec. 3 for the construction, including plumbing, heating and ventilating apparatus, electric wiring and conduits, of the U. S. Post Office at Emporia, as advertised in The Engineering Record.

Johnson City, Tenn.—The contract for constructing a dining-hall in connection with the Mountain Branch of the Nat. Soldiers' Home, at Johnson City, is stated to have been awarded to Herman Probst, of New York City, for $124,000.

Anniston, Ala.—Miles & Bradt, of Atlanta, are stated to have been awarded the contract for the erection of the Anniston government building for $59,000.

Bremerton, Wash.—The following bids were opened Oct. 25 at Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing an extension of the concrete wing wall, Navy Yard, Bremerton: Bromley & Wells, Seattle, $15,800; Puget Sound Bridge & Dredging Co., Seattle, $14,624; Pacific Construction Co., Seattle, $15,695.

Tacoma, Wash.—Government Engr. Ricksecker, who is in Tacoma in charge of the proposed improvement of the city waterway, has perfected his plans and specifications for the work and forwarded same to Washington for approval. The plans provide for dredging the channel from 11th to 15th Sts., removing the core in the waterway north of 11th St. bridge and extending channel southward from 15th St. Amount available, $175,000.

Ft. Columbia, Wash.—Bids are wanted Nov. 15 for constructing a water and sewer system, etc., at Ft. Columbia. Address Capt. Geo. L. Goodale, Q. M., U. S. Army.

San Francisco, Cal.—The lowest bid received by Cal. Debris Comn. for the construction of the first of the Yuba River barriers above Marysville is stated to have been from the Atlantic, Gulf & Pacific Co. at $27,940.

Ft. Assinniboine, Mont.—Press reports state that among the improvements contemplated for this post is a sewer system to be constructed during the fiscal year.

MISCELLANEOUS.

Buffalo, N. Y.—Bids will be received Nov. 7 by Chas. S. Boyd, Supt. of Pub. Wks., Albany, for deepening and improving the channel of Erie basin, between Buffalo River and slip No. 2.

Buffalo, N. Y.—The Bd. of Aldermen has granted the petition of the Buffalo & Susquehanna Iron Co. for permission to construct a canal across Hamburg turnpike, near the city line.

Syracuse, N. Y.—The contract for the improvement of Onondaga Creek has been awarded to John Kelly for $26,380.

Duluth, Minn.—Local press reports state that the Boston Coal Dock & Wharf Co., that has docks at the west end of this city, will more than double its capacity for another year.

Louisville, Ky.—The Com. on Eastern Parkway and Western Parkway (Chas. F. Grainger, Chmn.) has reported to the Bd. of Park Comrs., placing the estimated cost of each parkway at about $100,000.

Oakland, Cal.—The lowest bid received for reconstructing and widening 12th St. dam is reported to have been from Hutchison, Ransom Co. for $36,000.

Richmond, Que.—Bids are wanted Nov. 7 for the construction of 4 ice piers. Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont.

NEW INDUSTRIAL PLANTS.

The Virginia Vehicle Co., So. Boston, Va., is building a 4-story, 60x250-ft. factory, and is in the market for machinery for iron working and making bodies of vehicles.

The plant of the Springstein Mills, Chester, S. C., was badly damaged by fire and will be rebuilt at once, the new part being 2 stories and about 40x250 ft. Dyeing, drying and dressing machinery will be required.

The Hudson, Mass., Worsted Co. is erecting a 3-story building to be about 200x60 ft. The power plant will be about 150 H.-P.

The plant of the Alpena, Mich., Hoop & Lumber Co. was destroyed by fire, and it is likely that a 2-band mill will be built to replace it.

J. A. Pardue, Quanah, Tex., contemplates erecting a cement mill.

The Decatur, Ill., Bridge Co. is being organized to build bridges and structural steelwork, and contemplates erecting a 70x200-ft. main building; 40x50-ft. blacksmith shop; machine shop, engine room and boiler room, each 25x30 ft.; office building, storehouse, etc. The power plant will include an engine of about 50 H.-P., with generator and boilers of corresponding capacity. Electricity will be used throughout the plant. E. B. Tyler, Muncie, Ind., is interested.

The American Glue Co., 415-429 Atlantic Ave., Boston, Mass., will erect a 2-story, 300x100-ft. brick building at its Springdale, Pa., plant to replace a building recently burned.

The Goderich, Ont., Organ Co., whose plant was recently burned, expects to erect two 2-story and basement buildings, 126x45 and 120x45 ft., respectively; 2-story, 140x40-ft. shipping and stock rooms, and a 140x40-ft. finishing room. A 100-H.-P. engine and a 100-light dynamo will be installed. The company desires catalogues of woodworking and special machinery.

The Johnson-Ingman Air Motor Co., Cumberland, Md., will erect a new plant.

The National Cereal Milling Co., Peoria, Ill., expects to erect a plant next March and install an 800 to 1,000-H.-P. power plant. J. E. Goodrich, Act. Sec'y.

The American Ice & Industries Co., Birmingham, Ala., expects to erect a new plant and install two 60-ton ice machines, 200,000 cu. ft. cold-storage and an electric light plant. W. H. Morris is interested.

A company is being organized in Johnstown, Pa., to erect a brick plant having a daily capacity of not less than 50,000. D. W., W. P. and D. P. Coulter, O. C. Harris and J. Wallace Paul are interested.

The J. Geo. Leyner Engineering Works Co., Denver, Colo., has decided to build new works in some suburb of Denver, as yet not chosen, which will comprise a 2-story brick office building, and the following 1-story brick and steel buildings: 100x224-ft. main machine shop, with central erecting bay: 75x204-ft. warehouse; 60x204-ft. blacksmith and forge shop; 100x144-ft. foundry of 30 tons daily capacity with brass moulding equipment in addition; 50x164-ft. pattern shop; 30x60-ft. pattern storage and a power house. The shops are to be electrically driven throughout and the installation contemplates 100 motors, from 2 to 25 H.-P., aggregating 550 H.-P. The load factor at average load is estimated at one-third, and the preliminary plans for power include four 150-H.-P. tubular boilers, two 200-kilowatt tandem-compound condensing generating units and a compound condensing steam-driven air compressor of 1,000 cu. ft. per min. capacity. Tunnel connections are to be made with the buildings and the hot-blast system of warming will be employed. In addition to the manufacture of air compressors, drills and coal cutters, complete mining equipments are to be built.

The Smith's Falls, Ont., Malleable Iron Works will erect a 250x66-ft. addition to be used for moulding and annealing purposes. No additional power plant will be required.

BUSINESS NOTES.

The American Blower Co., Detroit, Mich., reports the following among recent orders: Heating apparatus for factory of Wickham, Chapman & Co., Springfield, O.; ten large steel plate fans and over 16,000 ft. of heating surface for the University of Chicago; heating plant and forced draft apparatus for the Lehigh Valley Silk Mills, So. Bethlehem, Pa.; mechanical draft apparatus for Bryn Mawr and Wellesley Colleges; heating and drying apparatus for the Lumiere North American Co., Burlington, Vt.; drying apparatus for the Composite Board Co., Niagara Falls, N. Y.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: National Tube Works, Middletown, Pa., two 450-H.-P. direct-connected engines; West Jersey & Seashore Line of the Penna. R. R. Co., Atlantic City, N. J., two 150 H.-P. cross-compound engines.

Sargent, Conant & Co., Boston, Mass., have purchased the construction business of the Hawks Electric Co., of that city, and will complete its outstanding contracts.

The Otis Elevator Co. has recently received the contract for the elevator and dumb-waiter equipment of the new Astor Hotel, New York. The plant consists of seven electric passenger elevators, two electric servants' elevators, eleven electric dumb-waiters, and three electric sidewalk lifts. Clinton & Russell are the architects, and John Downey, the general contractor.

The Berlin Construction Co., Berlin, Conn., has opened an office in the Board of Trade Building, Boston, which is in charge of H. C. Collins, who has been for many years identified with the structural steel business in New England. The company also maintains offices at 220 Broadway, New York, and 142 Market St., Newark, N. J.

The contract for the steel framework for the addition to the Boston Athletic Association Building has been awarded to the New England Structural Co., of Boston.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Nov. 3.	Webster Grove, Mo.	Nov. 1
Nov. 4.	Gueydan, La.	Oct. 4
Nov. 5.	Lawton, Okla. Ter.	Oct. 11
Nov. 6.	New York, N. Y.	Nov. 1
Nov. 7.	Hammonton, N. J.	Nov. 1
Nov. 7.	Fremont, O.	Oct. 25
Nov. 8.	Pipe, etc., Bremerton, Wash.	Oct. 11
Nov. 8.	**Pumping plant, Brockton, Mass.**	**Sept. 27**
	Adv., Eng. Record, Sept. 27, Oct. 4.	
Nov. 10.	Bonds, Sterling, Colo.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Nov. 12.	Penngrove, N. J.	Nov. 1
Nov. 15.	Ft. Columbia, Wash.	Nov. 1
Nov. 26.	Newport, R. I.	Oct. 25
Dec 1.	**Pumps, Seguin, Tex.**	**July 26**
Dec. 20.	Pumping engines, Louisville, Ky.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Nov. 4.	Davenport, Ia.	Nov. 1
Nov. 4.	Bessemer, Ala.	Oct. 18
Nov. 5.	Eau Claire, Wis.	Nov. 1
Nov. 5.	Jamesburg, N. J.	Oct. 25
Nov. 5.	Westfield, Mass.	Oct. 18
	Adv., Eng. Record, Oct. 18.	
Nov. 6.	Findlay, O.	Nov. 1
Nov. 6.	Chicago, Ill.	Nov. 1
Nov. 6.	Nashville, Tenn.	Oct. 11
Nov 8.	Roselle Park N. J.	Oct. 18
Nov. 11.	Oneida, N. Y.	Oct. 25
Nov. 12.	Brooklyn, N. Y.	Nov. 1
Nov. 12.	Cincinnati, O.	Nov. 1
Nov. 15.	Ft. Columbia, Wash.	Nov. 1
Nov. 15.	Washington, D. C.	Oct. 25
	Adv., Eng. Record, Oct. 25.	
Nov. 15.	Akron, O.	Oct. 25
Nov. 20.	Canal Dover, O.	Nov. 1
Nov. 26.	Cincinnati, O.	Nov. 1
Dec. 15.	**Montevideo, Uruguay**	**Sept. 13**

BRIDGES.

Bids Close.		See Eng. Record.
Nov. 5.	Monmouth, Ill.	Nov. 1
Nov. 5.	**Cordova, Ala.**	**Oct. 11**
Nov. 5.	**Chicago, Ill.**	**Sept. 6**
Nov. 6.	Paoli, Ind.	Nov. 1
Nov. 6.	Folsom, Cal.	Nov. 1
Nov. 6.	Chehalis, Wash.	Oct. 25
Nov. 6.	Indianapolis, Ind.	Oct. 18
Nov. 7.	New Castle, Ind.	Oct. 25
Nov. 8.	Goldendale, Wash.	Nov. 1
Nov. 8.	Gannvalley, S. D.	Nov. 1
Nov. 9.	Centralia, Wash.	Nov. 1
Nov. 10.	Chillicothe, O.	Oct. 25
Nov. 10.	Washington, Ind.	Oct. 25
Nov. 10.	Topeka, Kan.	Oct. 18
Nov. 12.	Oskaloosa, Ia.	Nov. 1
Nov. 13.	Oberlin, Kan.	Nov. 1
Nov. 13.	Shreveport, La.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 14.	Paulding, O.	Oct. 25
Dec. 17.	Chicago, Ill.	Nov. 1
Nov. 18.	Harrisburg, Pa.	Nov. 1
Nov. 20.	Doylestown, Pa.	Nov. 1
Dec. 1.	**Bigtimber, Mont.**	**Sept. 27**
———	Lake Charles, La.	Oct. 25

PAVING AND ROADMAKING.

Bids Close.		See Eng. Record.
Nov. 4.	Hammond, Ind.	Oct. 25
Nov. 7.	Thomaston, Conn.	Nov. 1
Nov. 12.	Cohoes, N. Y.	Nov. 1
Nov. 12.	Cincinnati, O.	Oct. 18
Nov. 15.	Akron, O.	Oct. 25
Nov. 17.	Cincinnati, O.	Nov. 1
Dec. 1.	Delphi, Ind.	Oct. 25
Dec. 11.	Guthrie, Okla. Ter.	Nov. 1
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	

POWER, GAS AND ELECTRICITY.

Bids Close.		See Eng. Record.
Nov. 5.	Baltimore, Md.	Nov. 1
Nov. 6.	Akron, O.	Oct. 25
Nov. 7.	Mankato, Minn.	Nov. 1
Nov. 10.	Brooklyn, N. Y.	Nov. 1
Nov. 12.	Penngrove, N. J.	Nov. 1
Nov. 14.	Eng., Dynamo, etc., Minneapolis, Minn.	Nov. 1
Nov. 15.	Abilene, Tex.	Nov. 1
Nov. 15.	Baton Rouge, La.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 15	Norfolk, Va.	Sept. 13
Nov. 18.	Superior, Wis.	Oct. 25
Nov. 18.	Washington, D. C.	Oct. 25
Jan. 15.	Rome, Ga.	Oct. 11
Mar. 5.	Franchise, Manila, P. I.	Nov. 1

GOVERNMENT WORK.

Bids Close.		See Eng. Record.
Nov. 4.	Philadelphia, Pa.	Oct. 25
Nov. 4.	Htg Hosp., Flandreau, S. D.	Oct. 11
Nov. 4.	Cheyenne, Wyo.	Oct. 4
	Adv., Eng. Record, Oct. 4, 11.	
Nov. 5.	Floor in Post Office, New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 6.	Breakwater, Cleveland, O.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 6.	Entrance to harbor, Cleveland, O.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 6.	Chicago, Ill.	Oct. 11
Nov. 7.	Ft. Wadsworth, N. Y.	Oct. 25
Nov. 7.	Ft. Monroe, Va.	Oct. 18
Nov. 8.	(Ft. Greble) Newport, R. I.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 8.	Completing Post Office, Chicago, Ill.	Oct. 11
Nov. 8.	Water mains, Bremerton, Wash.	Oct. 11
Nov. 10.	Ft. Banks, Winthrop, Mass.	Oct. 18
Nov. 10.	Ft. Ethan Allen, Vt.	Oct. 18
	Adv., Eng. Record, Oct. 18 to Nov. 1.	
Nov. 10.	La Purchase Expo. Bldgs., St. Louis, Mo.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 10.	(Lemon Creek) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	Newport, R. I.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	(Raritan Bay) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	(Woodbridge Creek) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	Removal of ledge, New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 12.	Mobile, Ala.	Oct. 18
	Adv., Eng. Record, Oct. 18 to Nov. 1.	
Nov. 12.	Sewer, Salem, Ore.	Oct. 18
Nov. 12.	Denver, Colo.	Oct. 4
	Adv., Eng. Record, Oct. 4, 11.	
Nov. 12.	Charleston, S. C.	Oct. 4
	Adv., Eng. Record, Oct. 4 to 18.	
Nov. 13.	Dredging, New York, N. Y.	Oct. 18
	Adv., Eng. Record, Oct. 18 to Nov. 1.	
Nov. 15.	Oilhouse (Ft. Greble), Newport, R. I.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Nov. 15.	Ft. Columbia, Wash.	Nov. 1
Nov. 15.	Washington, D. C.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 17.	U. S. Post Office shed, Buffalo, N. Y.	Oct. 18.
	Adv., Eng. Record, Oct. 18, 25.	
Nov. 18.	Washington, D. C.	Oct. 25
Nov. 20.	Post Office Bldg., Rome, N. Y.	Oct. 18
Nov. 20.	Dredging, Norfolk, Va.	Oct. 18
Nov. 22.	Lock, etc., Pittsburg, Pa.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 22.	(Ft. Morgan), Mobile, Ala.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 22.	Coal plant, Portsmouth, N. H.	Oct. 18
Nov. 22.	Navy Bldg., Portsmouth, N. H.	Oct. 18
Nov. 24.	Nashville, Tenn.	Oct. 25
	Adv., Eng. Record, Nov. 1.	
Nov. 25.	Ft. Riley, Kan.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Nov. 25.	El. wiring Pub. Bldg., Boise, Idaho	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 26.	Storehouse (Ft. Greble), Newport, R. I.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Nov. 26.	Washington, D. C.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Nov. 26.	Newport, R. I.	Oct. 25
Nov. 29.	Htg. & Vent. Pub. Bldg., Boise, Ida.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Dec. 2.	Dredging, Boston, Mass.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Dec. 3.	Emporia, Kan.	Nov. 1
	Adv., Eng. Record, Nov. 1.	
Dec. 6.	Dredging, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Dec. 10.	Jetty work, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	

BUILDINGS.

Bids Close.		See Eng. Record.
Nov. 4.	Hospital cottages, Boston, Mass.	Nov. 1
Nov. 5.	Armory, Marinette, Wis.	Nov. 1
Nov. 6.	Hospital, New York, N. Y.	Nov. 1
Nov. 6.	Dormitory, etc., Iroquois, N. Y.	Nov. 1
Nov. 6.	Capitol, Richmond, Va.	Oct. 25
Nov. 6.	Hospital, Farnhurst, Del.	Oct. 25
Nov. 7.	School, New York, N. Y.	Nov. 1
Nov. 7.	Court house plans, Tuscaloosa, Ala.	Oct. 25
Nov. 7.	Club, Montgomery, Ala.	Oct. 25
Nov. 7.	Drill Hall, London, Ont.	Oct. 25
Nov. 8.	Library, Tipton, Ia.	Oct. 25
Nov. 10.	School, New York, N. Y.	Nov. 1
Nov. 10.	School, Boston, Mass.	Nov. 1
Nov. 10.	School, Youngstown, O.	Nov. 1
Nov. 10.	School, Lexington, Ky.	Oct. 25
Nov. 11.	School, Watertown, N. Y.	Nov. 1
Nov. 11.	School, South Orange, N. J.	Nov. 1
Nov. 11.	Library, Fond du Lac, Wis.	Oct. 25
Nov. 12.	Bath Bldg., Brooklyn, N. Y.	Nov. 1
Nov. 12.	School, htg., etc., Brooklyn, N. Y.	Nov. 1
Nov. 13.	Pub. Bldg., htg., etc., Brooklyn, N. Y.	Nov. 1
Nov. 14.	Work at reformatory, Elmira, N. Y.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 14.	Court House, Riverside, Cal.	Oct. 25
Nov. 15.	Court house, Kentville, N. S.	Nov. 1
Nov. 19.	Storehouse, Baltimore, Md.	Nov. 1
Nov. 20.	Barn, Columbus, O.	Nov. 1
Nov. 20.	Charity hospital, Shreveport, Pa.	Nov. 1
Nov. 22.	School, Berkeley, Cal.	Nov. 1
Nov. 26.	School, New Prague, Minn.	Oct. 25
Nov. 27.	Cottages, Chicago, Ill.	Nov. 1
Dec. 1.	Library plans, Albert Lea, Minn.	Oct. 25
Dec. 2.	Capitol work, St. Paul, Minn.	Aug. 16
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Dec. 15.	Htg. Capitol, Columbia, S. C.	Oct. 4
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Nov. 4.	Drainage Canals, Gueydan, La.	Oct. 18
Nov. 6.	Levees, Bossier City, La.	Oct. 18
Nov. 6.	Rem. of snow, Montreal, Que.	Nov. 1
Nov. 7.	Rem. of snow, New York, N. Y.	Nov. 1
Nov. 7.	Piers, Richmond, Que.	Nov. 1
Nov. 7.	Deepening channel, Buffalo, N. Y.	Nov. 1
Nov. 12.	Rem. of Garb., Parkersburg, W. Va.	Nov. 1
Dec. 1.	**Garb. disposal, Atlanta, Ga.**	**Oct. 4**
Mar. 5.	St. R. R. franchise, Manila, P. I.	Nov. 1

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The John Fritz Medal.

On the evening of October 31, there was a noteworthy gathering at the Waldorf-Astoria of men eminent in engineering and the iron industry. They came from all parts of the country to do honor to one of the greatest iron-masters of the country, to celebrate the eightieth birthday of a clear-thinking, quietly energetic man who began his career when iron was king and has seen all those changes in this industry which has replaced iron by steel. And not only has John Fritz seen these changes of such far-reaching influence in the country's progress, but he has also been responsible for many more of them than people unacquainted with the facts can ever appreciate. He has always let his work speak for him, and as his work appealed only to those in the industry his influence has not been appreciated generally by the public. His place is well expressed in the cablegram from Mr. Schwab, which was read at the birthday banquet: "He has done more for the steel industry than any man living, and we all acknowledge him as our master and prize him as our friend."

Just what part Mr. Fritz has played in the metallurgy of iron and steel can be guessed best, although imperfectly, from an address on the iron industry that he made before the Franklin Institute a few years ago. His story is so entertaining as well as instructive that all should read it. Aside from its technical and historical value it is everywhere marked by a true manly modesty which is refreshing and endearing in these days of push and puff. This characteristic was well expressed, also, in his brief remarks at the gathering, in which, in acknowledging the honors paid him, he said: "I think of the laboring men who have stood by me and who will ever be held in high regard in my memory. I regret my insufficient education in the inefficient facilities of my native place, but I am glad that my worthy father inculcated in me economy and faithfulness and the religious training that taught me to revere a Supreme Being."

Abram S. Hewitt, also an octogenarian iron-master as well as a man of public affairs, sent a letter that was read at the banquet, in which he pointed out that the life-work of Mr. Fritz affords a very conspicuous example of the operation of American institutions during the century which has just closed. It is not surprising, moreover, to those acquainted with the writer's deep study of national affairs that he should refer to the career of the guest of honor as follows: "That a boy born in humble life, with no advantages of education or opportunities for position, without influential friends or the favoring accidents of fortune, should be able to advance steadily in usefulness, power and the respect of his fellow men, until by common consent he occupies the first place in the domain of practical industry with which he has been connected, gives conclusive evidence that political institutions which afford free play to individual ambition, industry, ability and strict integrity, are worthy of all loyalty and should be cherished and preserved at all costs and hazards. The developments of the twentieth century show that these institutions are in great peril. Their essence is to be found in individual liberty, involving the right of free labor and the acquisition of private property under lawful conditions. When the right of free action shall be suppressed the possibility of a career like that of John Fritz will be destroyed. Collectivism, ending in socialism, may afford other advantages, but let it not be overlooked that these advantages will be obtained only by the sacrifice of personal freedom, and will arrest the progress of civilization due during the ages that have passed to the substitution of freedom for force. John Fritz is a living proof of the results of individual and industrial liberty in a country endowed with boundless resources. In vain shall we seek for a like career in nations or in countries where the individual initiative has been suppressed."

The name and fame of John Fritz have become so endeared to the engineers and iron-masters of this and other countries that nearly five hundred of them have established a fund to pay for a John Fritz Medal to be awarded annually for eminent scientific and industrial achievements. Naturally the first medal was given to the man in whose honor it was established, and the presentation was made by Mr. John Thomson at the banquet. The gathering was an unusual one, even for the Waldorf-Astoria, and the comment of one of the New York papers on its character is worth reprinting: "Although much is heard of American engineering enterprise being in the hands of young men, this gathering presented more bald polls to the raptured sight of the box guests than almost any New York dinner function except the annual banquet of the Chamber of Commerce when a President or Cabinet Ministers are present to make addresses." The first medal was specially prepared for the purpose and consisted of two bronze plaques, for the obverse and reverse sides respectively, and Mr. Thomson stated that he was directed by the founders to announce the award as follows: "We ask that you, John Fritz, accept these bronze plaques, the first John Fritz Medal, the only one of its kind which will ever be presented, as an award made by and coming directly from the founders, our unanimous finding being that, of all the Captains of Industry, this medal may most worthily be bestowed upon you."

The young men in engineering may well reflect on the meaning of this unusual and brilliant affair in honor of one practically unknown to many of them. The Bessemer Medal, hitherto the crowning mark of distinction an iron-master could receive, bears the name of a man of social influence in his youth, of combative temperament, and of considerable financial resources during the perfection of his inventions. The John Fritz Medal, which the founders established with the intention of making it the supreme international award for scientific and industrial achievement, honors a once poor boy whose native abilities made him a great engineer, whose character made him a model citizen, whose modesty has kept him unknown to the public at large. This medal has been founded by no single society, but by contributions from nearly five hundred of Mr. Fritz's professional and business friends and acquaintances; the individual contributions were kept as small as possible in order that the number of contributors might be many. The annual award will be in charge of a committee of representatives of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. May this committee always administer its trust with the same patience, skill and impartiality that has marked the work of the great engineer in whose honor the medal was established.

John Fritz was born in 1822 in Chester County, Pennsylvania, and at sixteen commenced work in a country machine shop. In 1854 he moved to Johnstown for the purpose of rebuilding the plant of what is now the Cambria Steel Company. In 1860 Fritz returned to the Lehigh Valley and at Bethlehem, Pa., began the construction of a blast furnace, an iron rolling mill for merchant bar and later a mill for rolling iron rails; thus inaugurating the construction of the immense plant now owned by the Bethlehem Steel Company. At a later date, in connection with Alexander Holley, he constructed a plant for making Bessemer steel at this works. He also designed and erected the plant for the fluid compression of steel ingots previous to forging for the Bethlehem Company. It is the only one of its kind in America. The armor making plant with its immense forges operated by hydraulic power, at Bethlehem, was also constructed by Mr. Fritz and in this plant a considerable proportion of the armor used on the warships of the United States Navy was made. After Mr. Fritz resigned his position as manager and superintendent of the Bethlehem Steel Company, the United States Government considered the construction of an armor plant and he was retained to make plans and specifications for such a plant, also estimates as to the cost of producing armor in it. The result of the matter was the wise abandonment of the project by the Government.

At the Louisiana Purchase Exposition the building of the State of Washington is to be in the form of an octagonal tower 114 feet high. The framing is to be all of wood and the main members will be eight great diagonal timbers resting on the foundations and meeting in an apex. Each timber will be over 90 feet long and 24x28 inches in cross-section in one piece.

A High Concrete Dam is to be built at once across the McCloud River, 15 miles east of Baird Station, on the California & Oregon Railroad. The contract has been let for the work and the contractors are just beginning operations. The dam is to be 100 feet high and 700 feet long on the crest. Four hundred feet of the crest will be used as an overflow. The low-water discharge of the river is about 1,300 cubic feet per second. Power is to be generated for use in mines and smelters within 40 miles' radius and also for transmission to cities and towns in the Sacramento Valley. The work is to be completed within fourteen months. Mr. James D. Schuyler, of Los Angeles, is the chief engineer for the work, and Mr. F. S. Hyde is assistant engineer.

The Rio Grande Bridge of the Pacific Railway of Costa Rica.—II.

As stated in the preceding article, the final calculations for the 448-foot spandrel braced arch of the Rio Grande bridge were made by a method derived from the formula

$$H = \frac{\Sigma S_0 \times S1 \times \frac{m}{A}}{\Sigma S_0^2 \times \frac{m}{A}}$$

In which H = total unit stress in a member; S_0 = total stress in a member from vertical unit reaction only; S1 = total stress in a member from horizontal unit reaction; m = length of a member; and A = area of cross-section of a member. This formula was first presented by Professor Clerk Maxwell, and is used by Professor G. E. Greene for the determination of stresses in his text book on arches. For a long span this determination requires so many operations that it becomes very laborious, and in applying it to this case Mr. Theodore Cooper was convinced that it might be much simplified. A careful analysis demonstrated the correctness of this belief and by the application of the formula to two symmetrical panels, simple formulas were developed containing progressive factors which make it possible to write the formulas for any panel length and panel number after they have been developed for a given panel length and panel number.

The formulas were tabulated and applied, the computations made and the strain sheet prepared by Mr. Gunvald Aus and approved by Mr. Cooper. The development of the simplified formula and its application to this truss is clearly and concisely explained by Mr. Aus, as follows:

If in the truss shown in the figure, which is the simplest form of a spandrel arch, we assume a member A B of length m under a stress F to be shortened an amount dm, we know that the abutment O would have to move through a space ds, such motion being due to a rotation around panel point E, and, provided the motion is very small and no other members are strained and the other abutment remain fixed, we know that

$$\frac{ds}{dm} = \frac{y}{r} \text{ or } ds = \frac{y}{r}\ dm \ldots\ldots\ldots\ldots\ldots (1)$$

From the theory of elasticity we further know that

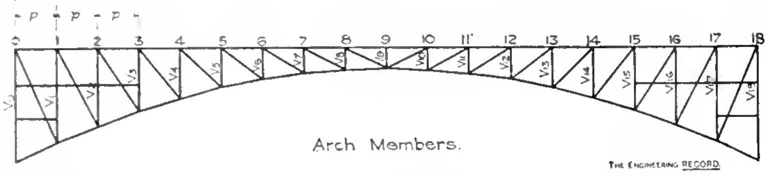
$$dm = \frac{m}{EA} \cdot F \ldots\ldots\ldots\ldots\ldots (2)$$

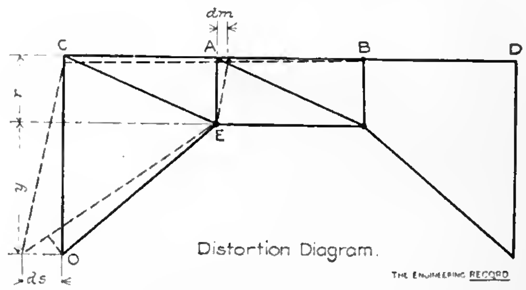
In which m, as already stated, is the length of AB; A the cross-section of the member, and E the elastic modulus.

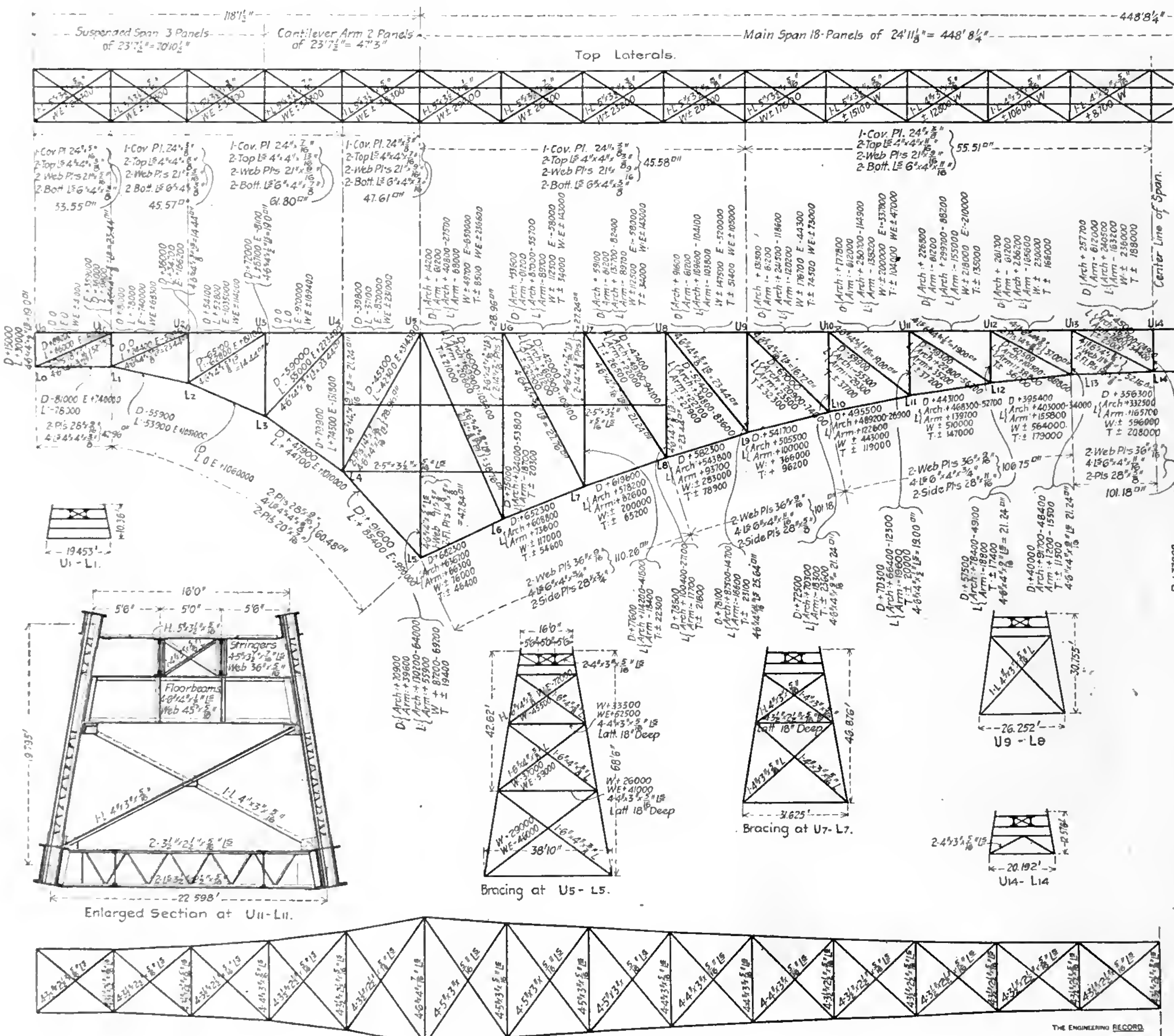
If we now further assume the stress F to be due to vertical and horizontal reactions v and h, we find that part of F due to v to be equal to $v\frac{x}{r}$, and the part due to h to be equal to $h\frac{y}{r}$, in other words:

$$F = v\frac{x}{r} + h\frac{y}{r},$$ and introducing this in equation (2) we get:

$$dm = \left(v\frac{x}{r} + h\frac{y}{r}\right)\frac{m}{EA} \ldots\ldots\ldots\ldots (3)$$







Bottom Laterals.

Strain Sheet and Material Diagram.

If we introduce this value of dm in equation (1) we find:

$$ds = \left(v \frac{x}{r} + h \frac{y}{r} \right) \frac{y}{r} \times \frac{m}{E A} \quad \ldots\ldots (4)$$

Evidently the expressions $\frac{x}{r}$ and $\frac{y}{r}$ are the stresses due to a vertical and a horizontal unit reaction, since such units would cause stresses $= 1 \times \frac{x}{r}$ and $1 \times \frac{y}{r}$, and for convenience we will call the former S_1 and the latter S_0, or $\frac{x}{r} = S_1$; $\frac{y}{r} = S_0$; we can then write equation (4) in the form:

$$ds = (v\, s_1 + h\, S_0)\, S_0 \frac{m}{E a} \text{ or}$$

$$ds = (v\, S_1\, S_0 + h\, S_0^2) \frac{m}{E a} \quad \ldots\ldots\ldots\ldots (5)$$

This equation holds good for any kind of truss, but applied to a spandrel arch where the abutments are fixed in a horizontal direction we know that $ds = O$, and therefore get

$$h\, S_0^2 \frac{m}{E a} = v \times S_1 \times S_0 \frac{m}{E a}, \text{ or}$$

$$h = \frac{v\, S_1\, S_0 \frac{m}{E a}}{S_0^2 \frac{m}{E a}}$$

That is to say, the stress F in a member AB produces a horizontal reaction expressed by this equation; or if we summarize the amounts of horizontal reaction produced by a stress F in each member of the truss to find the total horizontal reaction, we get:

$$H = \frac{\Sigma\, v\, S_1\, S_0 \frac{m}{E a}}{\Sigma\, S_0^2 \frac{m}{E a}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

As soon as we have the H for any given loading, the calculation of the stresses in the members is, of course, perfectly simple, either by graphical diagrams or by the methods of moments.

Professor Greene's method is to make a diagram for the stresses in each member of the truss, under a panel load applied to each panel, putting the resulting stresses $v\, S_1$ in the members in a table, and to construct a diagram for a unit horizontal reaction with the resulting stresses S_0 in another table.

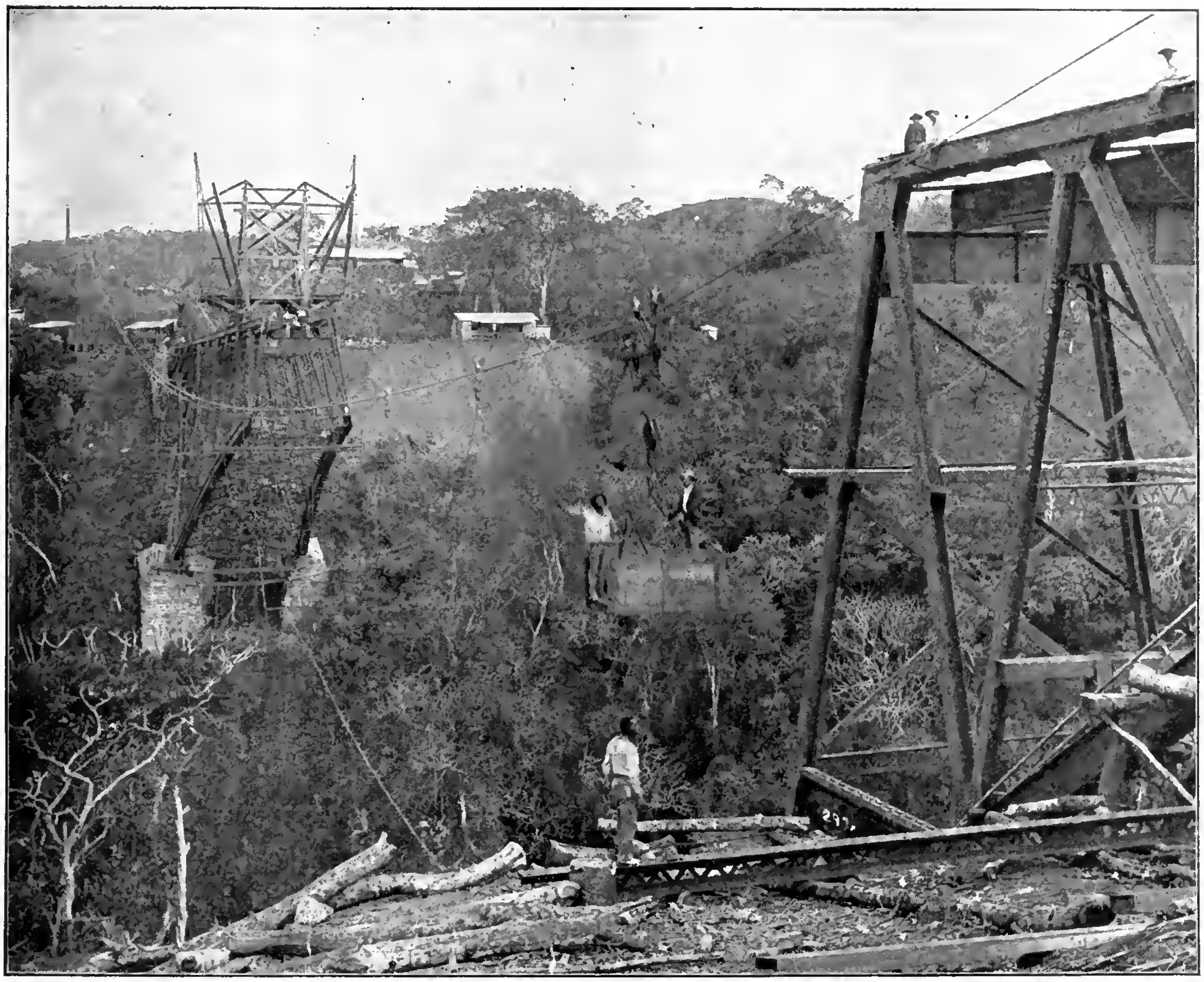
By multiplying and squaring the $h = \frac{v\, S_1\, S_0}{S_0^2}$ is now found, neglecting the $\frac{m}{E a}$ which has very little effect on the horizontal reaction.

By means of this approximately correct H, found by summarizing all the individual h's, he then calculates the stresses F in the members and proportions them for this approximately correct stress. He then introduces the cross-sections so found and the lengths of the members in equation (5) and again calculates the H which is now very nearly correct, and from this H again calculates the stresses F and proportions the members for the corrected stresses.

As already stated, it was a very tedious and trying operation to graphically construct the 18 diagrams needed for the Rio Grande bridge, and so Mr. Cooper suggested doing the operation by writing the formulas for S_0 and S_1 for a load on any panel point for two symmetrical members of the bridge and summarizing these formulas. The approximately correct $h = \frac{v\, S_0\, S_1}{S_0^2}$ could thus be written in very simple formula for each member and these formulas be very readily solved by logarithms or by Thatcher's Slide Rule. To make this method a little clearer, we will write the formula: $h = \frac{v\, S_0\, S_1}{S_0^2}$ for the first and the last panels of the top chord of the Rio Grande bridge for a panel load w on the first panel point. For these points the formula can be written $h = \frac{v\, S_1}{S_0}$.

We get for a load w on panel point 1, bearing in mind that the left reaction v is equal to $\frac{17}{18}$ w and that the right reaction is equal to $\frac{1}{18}$ w,

for member $0 - 1$, $S_1 = w \frac{17}{18} \times \frac{p}{v_1}$,
for member $17 - 18$, $S_1 = w \frac{1}{18} \times \frac{p}{v_1}$, and summarizing these two we get $w \frac{p}{v_1}$.



CABLEWAY AND TRAVELER USED FOR ERECTION OF RIO GRANDE BRIDGE ARCH.

We further get S_0 for each panel $= \frac{v_0 - v_1}{v_1}$ and for the two panels $= 2 \frac{(v_0 - v_1)}{v_1}$ and consequently

$$h = \frac{\frac{w\, p}{v_1}}{\frac{2\,(v_0 - v_1)}{v_1}} = \frac{w\, p}{2\,(v_0 - v_1)} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Exactly the same equation will be found for any other panels of the top chord for a panel load on (1) only. In exactly the same manner the formulas are written for all other loadings and for all other members of the truss. It will be found that it is only necessary to develop the formulas for one or two members for each loading, after which the others can be written out mechanically, as they have an easily established relation to one another.

An Economical Mill Engine.

Engineers who have followed the discussions regarding the use of high cylinder ratios for compound engines advocated for a number of years back by Mr. George I. Rockwood and have read in The Engineering Record of the excellent results obtained from several mill engines proportioned in accordance with his specifications will be interested to know that the high economy obtained at Grosvernordale, Conn., where a compound engine, when tested by Mr. George H. Barrus, developed a horse power with a consumption of 11.89 pounds of steam per hour, as described in our issue of November 20, 1897, has been lowered by more than half a pound by a compound engine built by the C. & G. Cooper Company, to Mr. Rockwood's specifications, for the Atlantic Mills at Providence, R. I. Three of the tests at the Atlantic Mills were made under different conditions as regards jacketing and the use of a reheating receiver. The fourth test included the efficiency of the boilers and gives the economy of the entire plant working under ordinary conditions. Mr. Barrus' report upon the engine was made to Mr. Thomas B. Owen, superintendent of the Atlantic Mills and to the C. & G. Cooper Company, of Mount Vernon, Ohio. Through the courtesy of these gentlemen, Mr. Barrus and Mr. Rockwood, the latter consulting engineer of the plant, The Engineering Record is enabled to print practically in full Mr. Barrus' report, which is, after being slightly changed for convenience in printing, as follows:

The accompanying tables give the data and results of the feed water tests of a 16 and 40x48-inch Cooper-Corliss engine, and coal test of the plant connected therewith, at the Atlantic Mills, which the writer made January 17 and 18, 1902.

In conjunction with Mr. George I. Rockwood, consulting engineer in charge of the design and erection of the plant, the writer made several preliminary feed water tests on the engines December 19 and 21, 1901. The final tests were conducted by the writer alone, Mr. Rockwood having unfortunately met with an accident that prevented his presence. These consisted of three feed-water tests; the first of which was made with the cylinder jackets and reheater coil shut off, the second, with the cylinder jackets and reheater coil in use in the customary manner, and the third, with the cylinder jackets shut off and the reheater coil alone in use. The first test extended from 7.45 to 11.45 A. M., the second from 1.30 to 5.30 P. M., and the third from 5.30 to 9.30 P. M. During the feed water tests, the steam was furnished to the engine, jackets and reheater from boilers Nos. 1 and 2 (the two boilers farthest from the engine room) fed with water from the weighing apparatus, which was supplied direct by means of the steam pump in the boiler room. The third boiler was run independently and used solely for supplying the steam in the mill for heating purposes and for running the auxiliaries, that is, the boiler feed pump, the air pump, the Webster heater pump, and the economizer engine. The No. 3 boiler was fed by the triplex power pump through the ordinary channels, the water being supplied to this pump from the economizer. The air pump during these tests exhausted into the Webster heater. The jacket water, which is ordinarily pumped into the boilers direct by means of the jacket pump, was discharged through a vent pipe attached to the jacket receiver, and passed through a surface condenser temporarily constructed, and thence into a barrel resting on scales, where it was weighed and then emptied and thrown away. During these tests, every precaution was taken to prevent accidental leakage of water or steam through drips or blow-offs, and the writer made sure by personal observation that all the water weighed entered the boilers, and that there was no leakage of steam from the plant save that recorded in the table, or elsewhere mentioned.

The coal test of the plant was made during the afternoon and evening of January 18, 1902, the time selected being Saturday afternoon after the usual "bell-time," when all the steam made could be used by the plant and none used for steam heating. The plant was run under the ordinary working conditions, with the exception that the steam exhausted from the air pump was utilized in the reheater, and thence in the low pressure cylinder, instead of being exhausted into the Webster heater, and used for heating feed water. In regard to this it may be said that the amount of steam used by the condenser, which, owing to the leaky condition of the packing rings in the steam pistons, was exceedingly wasteful, was too great to be utilized under the circumstances for heating the feed water; and it was concluded that the most economical method of using it would be to exhaust it into the reheater in the manner noted.

The steam was generated in Nos. 1 and 2 boilers, and that used by the auxiliaries was drawn from the low pressure pipe in the customary manner, this pipe being supplied through the reducing valve of No. 1 boiler. The No. 3 boiler (the one nearest the engine room), was shut

Table No. 1.—Data and Results of Feed Water Tests, 16 and 40x48-inch Cross Compound Cooper Corliss Engine, Atlantic Mills, Providence, R. I.

	Condition as to Use of Jackets.	Cylinder jackets and re-heater coil all off.	Cylinder jackets and re-heater coil all on.	Cylinder jackets off and re-heater coil on.
	Total Quantities, Etc.			
1.	Duration of test, hrs.	4.	4.	4.
2.	Total water fed to boilers, lbs.	26,567.	26,703.	26,222.
	Hourly Quantities.			
3.	Water fed to boilers per hour, lbs.	6,641.7	6,675.7	6,555.5
4.	Loss of steam and water per hour, due to leakage of plant, lbs.	240.0	215.0	215.0
5.	Net weight of steam consumed per hour by engine, including jackets and re-heater coil, lbs.	6,401.7	6,460.7	6,340.5
6.	Weight of steam consumed per hour by engine, exclusive of that condensed in jackets and re-heater coil, lbs.	6,401.7	5,588.0	5,686.3
7.	Steam condensed in jackets and re-heater coil per hour, lbs.	...	872.7	654.2
	Pressures and Temperatures.			
8.	Steam pipe pressure by engine room gauge, corrected, lbs.	171.9	169.7	172.2
9.	Receiver pressure by engineroom gauge, corrected, lbs.	13.2	13.4	13.3
10.	Vacuum in condenser by engineroom gauge, corrected, in.	28.0	27.4	27.7
11.	Temperature of steam near throttle valve, deg.	414.0	415.0	418.0
12.	Number of degrees of superheating in steam near throttle valve, lbs.	41.0	41.0	46.0
13.	Temperature of steam supplied to L. P. cylinder, lbs.	242.0	279.0	280.0
14.	Superheating of steam supplied to L. P. cylinder, lbs.	0.0	37.0	38.0
	Indicator Diagrams.			
15.	Mean effective pressure measured from all the diagrams, H. P. cylinder, lbs.	78.81	70.82	70.79
16	Mean effective pressure measured from all the diagrams, L. P. cylinder, lbs.	10.81	12.09	12.01
	(Measurements taken from 3 sets of Sample Diagrams, H. P. cylinder.)			
17.	Initial pressure in pounds per square inch above atmosphere, lbs.	173.7	170.7	167.5
18.	Corresponding steam pipe pressure by engineroom gauge, corrected, lbs.	176.0	174.0	171.7
19.	Pressure above zero in pounds per square inch, lbs.:			
	(a) Cut-off	163.9	164.3	155.9
	(b) Release	51.0	45.2	45.9
	(c) Compression	41.2	38.6	40.5
20.	Back pressure at mid-stroke in pounds per square inch, above atmosphere, lbs.	14.8	14.8	14.8
21.	Proportion of stroke measured at			
	(a) Cut-off	.285	.244	.278
	(b) Release	.966	.973	.970
	(c) Compression	.086	.102	.089
	(Measurements taken from 3 sets of Sample Diagrams, L. P. cylinder.)			
22.	Initial pressure in pounds per square inch above atmosphere, lbs.	11.4	13.1	12.4
23.	Corresponding receiver pressure by engineroom gauge, corrected, lbs.	13.2	13.5	12.8
24.	Pressure above zero in pounds per square inch, lbs.:			
	(a) Cut-off	19.1	20.6	19.2
	(b) Release	5.5	5.6	5.6
	(c) Compression	2.9	2.4	2.8
25.	Back pressure at mid-stroke in pounds per square inch, below atmosphere, lbs.	13.0	13.3	13.3
26.	Proportion of stroke measured at			
	(a) Cut-off	.248	.273	.281
	(b) Release	.980	.969	.968
	(c) Compression	.067	.067	.051
27.	Mean effective pressure in pounds per square inch, H. P. cylinder, 3 sets, lbs.	79.44	70.03	70.85
28.	Mean effective pressure in pounds per square inch, L. P. cylinder, 3 sets, lbs.	10.86	12.10	11.96
29.	Mean effective pressure in pounds per square inch, referred to H. P. cylinder, 3 sets, lbs.	68.31	76.11	76.23
30.	Steam accounted for in pounds per I. H. P. per hour:			
	(a) Near cut-off, H. P. cylinder	10.00	8.65	8.97
	(b) " release H. P. cylinder	10.29	9.16	9.27
	(c) " cut-off L. P. cylinder	8.07*	9.47	9.11
	(d) " release L. P. cylinder	8.49*	8.58	8.70
	Speed.			
31.	Average revolutions per minute	80.07	80.13	80.23
	Power.			
32.	Indicated horse-power developed by H. P. cylinder	303.46	272.92	273.17
33.	Indicated horse-power developed by L. P. cylinder	263.43	293.51	291.93
34.	Indicated horse-power developed by whole engine	566.89	566.43	565.1
	Results.			
35.	Steam consumed per I. H. P. per hour, lbs.:			
	(a) Including steam condensed in jackets and re-heater coil	11.293	11.406	11.220
	(b) By jackets and re-heater coil alone	0.0	1.541	1.158
	(c) By engine, exclusive of jackets and re-heater coil	11.293	9.865	10.062
36.	Percentage of total steam used by engine, accounted for by indicators, per cent.:			
	(a) Near cut-off H. P. cylinder	.886	.758	.800
	(b) " release, H. P. cylinder	.911	.804	.827
	(c) " cut-off, L. P. cylinder	.715	.830	.812
	(d) " release, L. P. cylinder	.752	.752	.775
37.	Percentage of steam used by engine, exclusive of that condensed in jackets and re-heater accounted for by indicators, per cent.:			
	(a) Near cut-off, H. P. cylinder	.886	.876	.891
	(b) " release, H.P. cylinder	.911	.929	.921
	(c) " cut-off, L. P. cylinder	.715	.960	.905
	(d) " release, L. P. cylinder	.752	.870	.865

*During the test, with jackets all shut off, the water collected in the receiver at the rate of 3.3" per hour. This represents 241 lbs. per hour, or .43 lbs. per I. H. P. perhour, or 3.7% of the total consumption.

off from the remaining boilers, and, in order to prevent unnecessary leakage of steam into this boiler, a banked fire was maintained in the furnace, and the pressure of steam held up to an average of 171 pounds. The indicators used on all the tests were of the "Star Improved" make, kindly furnished by the Star Brass Manufacturing Company, of Boston.

The data and results of the feed water test are given in Table No. 1, and those of the coal test in Table No. 2. Following these tables is a summary of the principal features and dimensions of the plant.

Table No. 2.—Data and Results of Coal Test of Plant, All the Steam Being Used Solely for Engine and Auxiliaries.

Kind of coal	Pocahontas
Total Quantities, Etc.	
1. Duration of test, hrs.	10.
2. Total weight of wet coal consumed, lbs.	6,759.
3. Percent. of moisture in coal, per cent.	3.1
4. Total wgt. of dry coal consumed, lbs.	6,549.0
5. Total ashes and refuse, lbs.	388.0
6. Percent. ashes and refuse to dry coal, per cent.	5.9
Hourly Quantities.	
7. Dry coal consumed per hour, lbs.	654.9
8. Dry coal consumed per hour per sq. ft. of grate surface, lbs.	9.86
9. Water evaporated per hour, as estimated, lbs.*	6,955.0
Pressures and Temperatures.	
10. Steam pressure at boilers, by gauge, corrected, lbs.	176.2
11. Steam pipe pressure near engine by engineroom gauge, corrected, lbs.	175.7
12. Pressure in receiver by engineroom gauge, corrected, lbs.	13.8
13. Vacuum in condenser by engineroom gauge, corrected, in.	27.1
14. Steam pressure in main pipe supplying auxiliaries, lbs.	92.9
15. Temperature of steam at throttle valve, degs.	395.0
16. Number of degrees of superheating at throttle valve, degs.	17.0
17. Temperature of steam supplied to low pressure, cylinder, degs.	287.0
18. Number of degrees of superheating in steam supplied to low pressure cylinder, degs.	44.0
19. Temperature of injection water, degs.	34.0
20. Temperature of water discharged by air pump, degs.	68.0
21. Temperature of water leaving Webster heater, and supplied to economizer, degs.	70.8
22. Temperature of water leaving economizer and supplied to boilers by main feed pump, degs.	181.5
23. Temperature of jacket water supplied to boilers, degs.	361.0
24. Temperature of escaping gases leaving boilers, degs.	540.0
25. Temperature of escaping gases entering economizer, degs.	448.0
26. Temperature of escaping gases leaving economizer, degs.	288.0

Indicator Diagrams.

	H. P. Cyl.	L. P. Cyl.
27. Mean effective pressure in lbs. per sq. in., average of all the diagrams, lbs. (Measurements taken from 3 sets of Sample Diagrams.)	59.14	12.48
28. Initial pressure above atmosphere, lbs.	172.0	13.6
29. Corresponding steam pipe pressure by engineroom gauge, corrected, lbs.	175.7	13.7
30. Pressure above zero in lbs. per sq. in.:		
(a) Cut-off	161.2	19.1
(b) Release	38.4	5.8
(c) Compression	44.4	2.9
31. Back pressure at mid-stroke in lbs. per sq. in., above or below atmosphere	+15.8	—13.5
32. Proportion of stroke measured at:		
(a) Cut-off, per cent.	.195	.303
(b) Release, per cent.	.958	.966
(c) Compression, per cent.	.083	.051
33. M. E. P. from 3 sample diagrams	58.76	12.78
34. M. E. P. referred to H. P. cylinder	58.76	80.4
35. Steam accounted for in lbs. per I. H. P. per hour:		
(a) Near cut-off	7.26	10.24
(b) Near release	8.01	9.54

Speed.	
36. Revolutions of engine per minute	80.43
37. Number of quadruple strokes of air pump per minute	27.00
Power.	
38. Indicated horse-power developed by H. P. cylinder	228.81
39. Indicated horse-power developed by L. P. cylinder	304.04
40. Indicated horse-power developed by whole engine	532.85
Results.	
41. Weight of dry coal consumed per I. H. P. per hour, lbs.	1.229
42. Feed water consumed per I. H. P. per hour, as estimated, lbs.	13.05
43. Water evaporated per pound of dry coal under actual conditions of temperature and pressure, as estimated, lbs.	10.62
44. Equivalent evaporation into dry steam from and at 212° per pound of dry coal, as estimated, lbs.	11.34
45. Equivalent evaporation from and at 212° per pound of combustible, as estimated, lbs.	12.05

*It is estimated that the work done by the steam which enters the cylinders from the main steam pipe is 474.7 I. H. P., and the consumption of steam (including that used in the jackets) is 474.7x11.406 = 5,414 lbs. per hour. The steam used by the air pump on a supplementary test, including leakage of plant, etc., is 1341. lbs. per hour. The steam used for jacket pump, for the steam pump at the Webster heater, and for the economizer engine, etc., estimated at 3%, is 200 lbs. These three items aggregate 6,955 lbs.

Principal Features and Dimensions of the Plant.

Three Manning Boilers	
Diameter, in.	67.
Length of tubes, ft.	15.
Number of tubes 2½-in. diameter	224.
Diameter of grate, ft.	6.5
Area of grate surface, one boiler, sq. ft.	32.2
Area of grate surface, two boilers, sq. ft.	66.4
Cooper Corliss Cross Compound Engine—	
Diameter, H. P. cylinder, in.	16-1/16
Diameter of piston rod, in.	3-¼
H. P. constant, one pound m. e. p., one revolution per minute	.0481
Clearance, per cent.	4.3
Diameter, L. P. cylinder, in.	40-1/16
Diameter of piston rod, in.	4-⅞
H. P. constant, one pound m. e. p., one revolution per minute	.303
Clearance, per cent.	5.0
Ratio of piston displacement, L. P. cylinder to H. P. cylinder	6.29 to 1
Economizer—	
Number of tubes	168.
Approximate area of heating surface, by catalogue, sq. ft.	2,016.
Re-heater—	
Inside diameter, ft.	4.3
Area of heating surface in coil	...
Height over all, ft.	5.
Worthington Duplex Air Pump—	
Diameter of steam cylinder, each, in.	10
Diameter of water cylinder, each, in.	22
Stroke of both, in.	15
Webster Heater Pump— 4½x3¾x4 inches.	
Jacket Pump— 4½x2¾x4 inches.	
Economizer Engine— 4x5 inches.	

The water supplied to the Webster heater is taken from the canal, and during cold weather has a temperature of about 40 degrees.

It is drawn from the heater by the 4½x3¾x4-inch pump, and discharged into the economizer under a pressure of about 80 pounds per square inch. The water leaving the economizer is in turn supplied to the triplex power pump which then forces it into the boilers. The exhaust steam from the Webster heater pump, the jacket pump and the economizer engine, all discharge into the Webster heater, and serve to heat the water before it is supplied to the economizer.

CONCLUSIONS.

It appears that the best results on the feed water tests were obtained when the cylinder jackets were shut off and the reheater coil alone was in use. This result was 11.22 pounds of steam per indicated horse power per hour, including that condensed in the reheater coil, no correction being made for the superheating at the throttle valve, which was 44 degrees.

When the jackets and reheater coil were both shut off, it appears that the feed water consumption was very nearly as low as the above, being 11.29 pounds per indicated horse power per hour, which goes to show that in the matter of steam consumption alone, the jacketing secured no material economy. The only advantage from the jackets in this case is that resulting from the slight economy due to returning to the boilers the jacket water, which has a temperature of 361 degrees, instead of feeding all of the water at 181.5 degrees, the temperature observed on the coal test, as also the mechanical advantage due to the extra power obtained under these circumstances from the low pressure cylinder.

The results of the coal test showed a consumption of 1.229 pounds of dry coal per indicated horse power per hour, this quantity covering not only that used by the engine itself, but also that used by all the auxiliaries concerned. This result is not quite as good as it would have been if the air pump had been in good condition. The writer's judgment is that the leakage of the air pump pistons caused an increase of the coal consumption amounting to between 3 and 4 per cent.

London's Water Consumption.

The water supply of London, England, is described in the 1901 report of the Local Government Board. The following data are taken from a summary of this part of the report as published in the "Journal of Gas Lighting." The total population supplied by the eight Metropolitan Water Companies on December 31 last was approximately 6,307,230, compared with 6,165,490 on the corresponding day in the previous year. The total average daily supply was 215,069,948 imperial gallons, representing a consumption of 34.49 imperial gallons per head, compared with 34.8 imperial gallons before. The sources of the supply were the Thames, the Lea, the springs in the valley of the latter river, and 39 wells in the chalk and sand formations. The volume of water delivered amounted to about 78,500,500,000 imperial gallons, 59 per cent. of which came from the Thames, 19 per cent. from the Lea, and 22 per cent. from springs and wells. Of the entire bulk of water coming down the Thames in August, 1901, 43.2 per cent. was withdrawn for the supply of London, whereas in April the quantity taken was only 5.6 per cent. With regard to the quality of the water supplied, the Thames and the Lea were generally favorable last year for the storage and filtration operations of the seven companies depending upon these sources, though, owing to floods in the early months of the year, the supplies of the Thames companies possessing the least storage showed considerable fluctuations in chemical quality during this period. Nevertheless, the river was in good condition for 311 days, and "exceptionally muddy and turbid" on 30 days only. Compared with the standard of 1,000—representing the mean amount of organic impurity in the Thames water delivered in 1868—the figures for the Thames and Lea respectively were 818 and 597, compared with 749 and 541 in the preceding twelve months. These figures show a slight inferiority in the year's supply, and it is pointed out that the organic matter present in the waters after undergoing the process of storage and filtration is to a relatively large extent of vegetable origin.

Sewage Farming appears to be a success with Mr. A. J. Dickinson, of Long Crendon, England, who stated at a recent meeting of the Association of Municipal and County Engineers that he had grown a crop of mangold wurzels of about 50 tons per acre, which would pay the whole cost of working, together with the interest on capital and repayment of loan.

Anchor Ice caused considerable trouble at the intake of the Detroit water-works last winter, according to the annual report of Engineer C. H. Hubbell. The supply is drawn from the Detroit River, and during the winter the usual protective covering of surface ice failed to form and twice the flow of water through all three intake pipes was entirely cut off by the accumulation of ice on the outer submerged cribs. In each case the difficulty lasted from about midnight to ten or eleven o'clock in the forenoon. During this period the only water entering the settling basin came through an emergency valve which had been built in the 72-inch intake pipe nearest the pier late in the fall. It was necessary to operate this valve at intervals of about twenty minutes in order to clear it of needle ice, which collected in large quantities. The supply procured in this manner, while not enough, was sufficient to keep the pumps running slowly and prevented the plant from shutting down altogether. The city was on short supply and considerable inconvenience was caused by the low pressure.

New Automatic Regulators for Septic Tanks and Contact Beds.

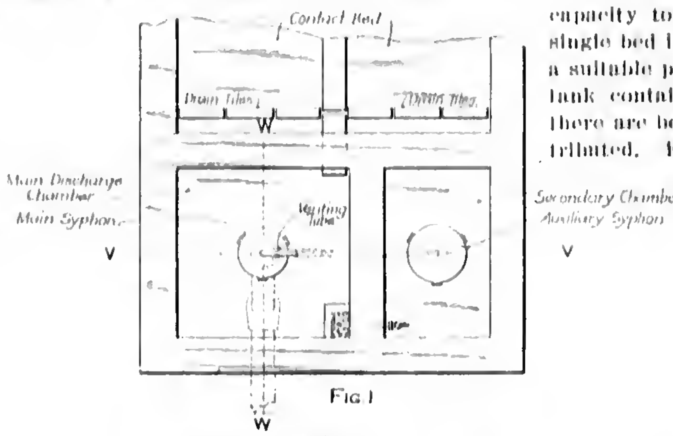
Two devices have recently been patented which deserve the careful consideration of those who have to deal with the regulation of septic tanks and contact beds. The first of these inventions, according to the letters patent, "relates to improvements in apparatus for intermittingly charging or discharging liquid tanks, and when employed for discharging tanks operates in such a manner as to permit the tank whose discharge is controlled thereby after being filled to remain filled for a certain determinate time before being emptied." It will be seen that this is particularly applicable to the conditions of a contact bed, allowing the bed to fill, stand full for any desired period, and then discharge automatically; but obviously the apparatus may be employed wherever it is desired to intermittently charge or discharge a tank of any description. The second invention "relates to an apparatus designed for intermittingly controlling the flow of liquid from a central tank or receptacle to a plurality of tanks or receptacles and so arranged that said plurality of receptacles may be filled or charged in predetermined rotative order from said main tank or receptacle." This invention was designed more especially for use in connection with a septic tank so as to receive the effluent from the tank and properly distribute it to contact or filter beds. The device for discharging the contact bed will be described first.

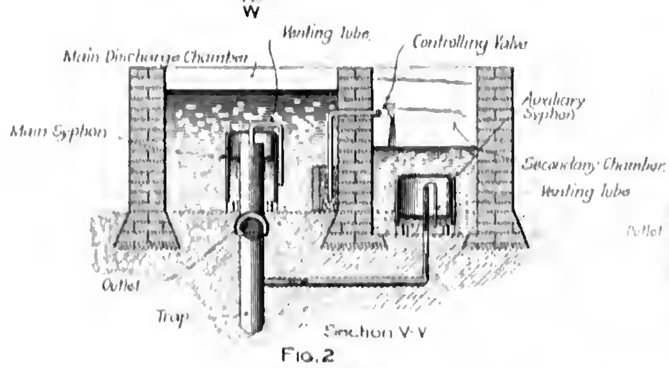
The accompanying illustrations show the general arrangement of the working parts, but some explanation is necessary for a full understanding of the operation of the apparatus. An ordinary drain pipe of convenient size connects the contact bed with a main discharge chamber, in which is located an automatic syphon. The longer leg of the syphon discharges into a U shaped trap connected to the outlet drain. A venting tube is provided, passing through the bell of the intake limb of the syphon and down into the discharge limb as shown.

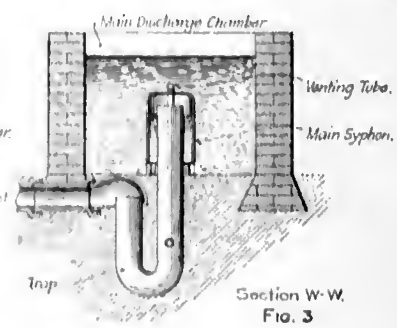
A short length of pipe with its inlet end protected by some filtering material, as shown in the cuts, connects the main discharge chamber with a secondary chamber, which chamber preferably has its bottom at a lower level than that of the other. This secondary chamber also contains a syphon. The bell or shorter leg of this syphon is made of greater diameter proportionately to the discharge limb than the bell of the main syphon. The lower end of the longer leg of the auxiliary syphon is extended and communicates with the longer end of the main discharge trap by means of a small pipe which enters the trap below the level of the discharge end of it. The venting tube of the secondary syphon has its shorter leg extending below the lower edge of the syphon bell. It is stated that this venting tube may be used in place of the one on the main syphon and vice versa.

A description of the action of the various parts follows. As the contact bed gradually fills with sewage the level of the liquid in the main discharge chamber also rises and at the same time the liquid rises in the bell or shorter leg of the syphon and compresses the air which is confined between it and the trap beyond. It is understood that when the contact bed and discharge chamber have become full the supply of liquid will be cut off, by automatic or other means, and the head due to this height of liquid will not be sufficient to cause the main discharge syphon to act. When the level of the liquid in the main chamber has reached the highest point of the pipe connecting it with the secondary chamber the latter will begin to slowly fill. As the connecting pipe is much smaller than the inlet pipe of the main chamber, and as the secondary chamber does not begin to fill till the other is nearly full, a much longer time is required to fill it than to fill the main one. The contact bed therefore remains full during the completion of the filling of the secondary chamber. The time required for filling the latter may be varied between wide limits by means of a valve or faucet on the connecting pipe.

As the liquid rises in the secondary chamber the air in the auxiliary syphon and the connecting pipe leading to the trap of the main syphon is compressed. This pressure continues until it is sufficient to overcome the pressure in the principal syphon, at which time the water which has been in the connecting pipe below the level of the trap outlet, is forced into the trap of the main syphon. When this happens the pressure in the auxiliary syphon is communicated to the principal syphon, and causes the water both in the trap and the bell of the main syphon to be depressed; the transmission of such pressure is continued until,







Device for Regulating Flow from Contact Beds.

combined with the pressure already existing in the longer leg of the principal syphon, it is sufficient to overcome the seal of the trap and start the main syphon in operation.

Thereafter the operation is like that of an ordinary syphon discharge, the syphon continuing its operation until the main chamber is emptied to the level of the mouth of the shorter leg of the syphon. Meanwhile the auxiliary syphon has been emptying its chamber. At the completion of the operation of both syphons the venting devices are brought into operation and the syphons completely vented, thus insuring a discharge at uniform intervals providing the inflow into the tank is uniform.

It will be noticed that just before the syphons begin to discharge, the level of the liquid in the shorter leg of the main syphon is lower than it was when the auxiliary syphon began to force the water out of the connecting pipe. This condition occurs because the pressure from the auxiliary syphon acts in both directions in the discharge limb of the main syphon. After the water in the trap has been depressed by the action of the main syphon below the level of the end of the connecting pipe, the pressure drives the water back a little way in the pipe toward the auxiliary syphon; but owing to the small size of the pipe and the consequent air friction, the air does not escape from the main syphon through the auxiliary one. A seal is therefore maintained in the connecting pipe which prevents the premature operation of the main syphon. Obviously the placing of the discharge end of this connecting pipe at a higher level than the end nearest the auxiliary syphon would accomplish the same result, even though a larger pipe be employed. The discharge leg of the auxiliary syphon will manifestly be made of such height above the connecting pipe that the column of water in it will give sufficient pressure to more than counterbalance the pressure produced in the main syphon by the head of water in the main discharge chamber.

Coming now to the other invention, that for discharging liquid from a septic tank into a series of contact beds for example, in regular order, it will be seen that the connections are necessarily somewhat more complicated than in the other invention, although the action is very similar.

A distributing or dosing tank of sufficient capacity to contain the desired charge for a single bed is connected with the septic tank by a suitable pipe or other connection. The dosing tank contains as many automatic syphons as there are beds to which the liquid is to be distributed. Four are shown in the illustration. The short leg of each syphon consists of a downwardly-opening bell, which may be supported on the upper edge of the longer leg. The longer leg of the syphon communicates with a trap leading to the outlet. In the distributing tank there is also a series of deep chambers or starting wells equal in number to the syphons. These chambers and their associated syphons will be referred to as Numbers 1 to 4 respectively as shown on the plan view. Within each of the wells is a downwardly-opening bell-shaped receptacle supported on short legs near the bottom.

Each syphon communicates with its associated starting well by a drain pipe passing through the top of the syphon. When any syphon begins to operate, the corresponding well is emptied through this drain pipe, as will be shown later. Freely connected with each chamber and below it, is a sub-chamber, into which the lower end of the drain pipe extends. The depth of this sub-chamber is made somewhat greater than the depth of the seal of the associated syphon, so as to insure a perfect seal at all times in the operation of the apparatus. Each of the bells in the starting wells communicates through a starting pipe with a syphon associated with another well of the series. Each of the starting pipes passes up through the open top of the well and thence laterally and downward toward the syphon with which it communicates, entering it below the seal-level as shown in the cuts, although that is stated not to be a necessity.

In the present instance the syphons and chambers are arranged in straight lines so that the starting pipe of chamber No. 4, which communicates with syphon No. 1, must pass from one end of the series to the other. They may, however, be arranged in circular series, in which case the starting pipes would all be of practically the same length.

In the usual working conditions, three of the starting wells are filled with liquid and one is empty, and all the extension chambers and the traps of all the syphons are filled. If it be assumed that the chambers No. 1, 2, and 3 be filled and chamber No. 4 be empty, the operation of the apparatus is as follows: The water entering the dosing tank from the septic tank fills the former to or above the tops of the starting wells. The traps at the discharge ends of the syphons are so proportioned with respect to the tank that the maximum head in the tank is not sufficient of itself to start the syphons into operation. When the dosing tank has been filled to the level of the tops of the starting wells the liquid begins to overflow into the empty well No. 4. The filling of this chamber causes the liquid to rise around the hollow bell in the chamber, and the pressure thus set up is communicated through the starting pipe to syphon No. 1, this pressure finally becoming great enough to overcome the seal in the trap and start syphon No. 1 into operation. This syphon continues in operation outwardly from the entrances to the main syphons. When the level of the liquid in the syphon trap has been depressed below the level of the entrance of the starting pipe, the pressure in the syphon acts to drive the liquid back into the vertical part of the pipe, so that the pipe must be proportioned so that this back pressure will produce a column of liquid in the vertical part of the pipe which will more than counterbalance the pressure in the syphon. When the starting well begins to fill, the air pressure in the hollow bell tends to overcome the pressure in the syphon and to force this column of liquid out of the starting pipe into the trap, and the continued pressure on the seal of the syphon trap finally forces the seal and starts the syphon.

It is desirable to provide vent pipes which communicate with the starting pipes just above the hollow bells and extend downwardly outside the bells. These vent pipes are provided to be sure that the bells and pipes are thoroughly vented after each operation of the associated syphon. The lower ends of these vent pipes determine the sealing levels of the several bells.

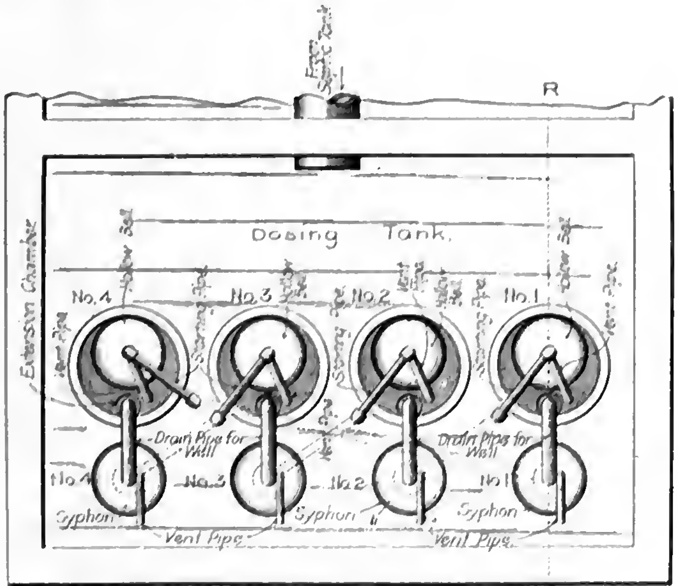


Fig 1

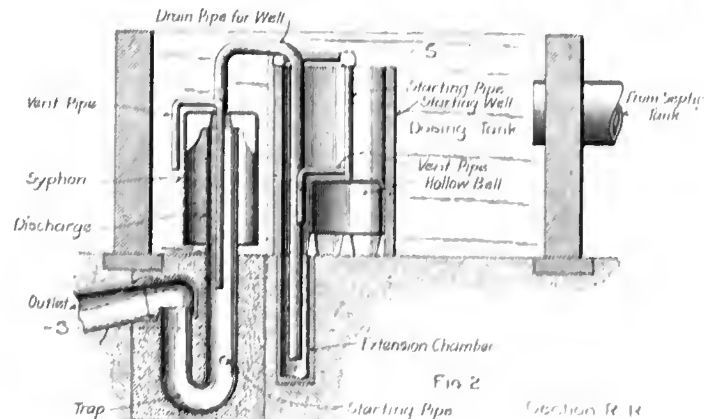


Fig 2

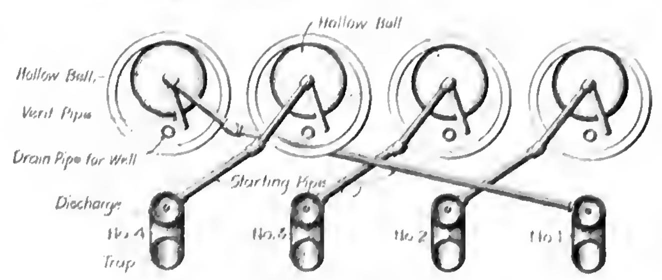


Fig. 3

Automatic Regulator for Discharging Septic Tank Effluent to Contact Beds.

until the whole dosing tank is emptied of its contents. At the same time a suction is produced in the drain pipe connecting this syphon with its associated well, so that No. 1 starting well is emptied through the drain pipe and the hollow bell in the chamber is freely vented.

After syphon No. 1 has stopped working, due to the emptying of the dosing tank, it is seen that No. 1 starting well is the only one empty, No. 4 having been filled by the overflowing liquid, and a similar round of operations will be gone through with in starting syphon No. 2. The reason that the wells which are already full do not cause the syphons with which they connect to operate, is that the hollow bell and starting pipe are also filled with liquid and can therefore communicate no air pressure to the traps of the syphons, as is the case when the empty well begins to fill.

Each of the small starting pipes is trapped at its entrance into the main syphon trap so as to prevent the escape of air from the syphon through the empty well. In the case shown in the illustrations these small pipes are trapped by merely laying them inclined downwardly and

It is stated that this invention may be used to advantage in connection with a double-trap syphon, by connecting the starting pipe to the blow-off trap. There being a less quantity of water to displace in order to force the seal, the starting chambers and bells may be made much smaller than in the previously described construction. Mr. S. W. Miller, of Chicago, of the Pacific Flush Tank Company, is the inventor of these devices.

The New England Water-Works Association will hold its next meeting in Boston on Wednesday, November 12. A paper on "Fuel and Its Economic Uses," will be presented by Prof. Ira N. Hollis, and a paper on "Waste Heat Engines" by Prof. Edward F. Miller. The election of officers will occur at this meeting. The following nominations have been made by the committee: President, Charles K. Walker, Manchester, N. H.; vice-presidents, V. C. Hastings, Concord, N. H.; George P. Wescott, Portland, Me.; Edwin C. Brooks, Cambridge, Mass.; E. W. Kent, Woonsocket, R. I.; H. N. Turner, St. Johnsbury, Vt.; J. C. Hammond, Jr., Rockville, Conn.; additional members of executive committee, P. Kieran, Fall River, Mass.; George A. Stacy, Marlboro, Mass.; H. G. Holden, Nashua, N. H.; secretary, Willard Kent, Narragansett Pier, R. I.; treasurer, L. M. Bancroft, Reading, Mass.; editor, Charles W. Sherman, Boston, Mass.; advertising agent, Robert J. Thomas, Lowell, Mass.; finance committee, E. J. Chadbourne, Wakefield, Mass.; W. F. Codd, Nantucket, Mass.; A. R. Hathaway, Springfield, Mass.

The Settling Basins at the St. Louis waterworks had deposited in them during the year ending April, 1902, 466,252 cubic yards of sediment, of which one-half was removed by manual labor at a cost of 1.017 cents per yard. Each of the six basins measures 672x400 feet. In his annual report, Commissioner Edward Flad describes the hydraulic dredge which was built for cleaning the basins while in regular use. A centrifugal pump, electrically driven, is mounted upon a barge, and is provided with a suction pipe which extends to the bottom of the basin and with a flexible floating discharge pipe which discharges over the side of the basin. The barge is 16x21 feet by 3 feet 9 inches deep and has a draft of about 26 inches. It is provided with a deck house, and is propelled across the basin by a hand winch operating on a stationary rope stretched for that purpose. The ultimate design contemplates a propelling arrangement electrically driven. The main pump is a 12-inch Morris centrifugal pump direct connected to a 90 horse-power motor. There is also a jet pump which furnishes a series of thirteen jets at the mouth of the suction pipe for dislodging the mud. This jet pump is a 4-inch Morris centrifugal pump, direct connected to a 20-horse-power motor. The suction pipe of the main pump is 12 inches in diameter and expands at its lower end into a flaring or fan-shaped mouth-piece, having an opening 10 feet wide and about 1½ inches high, and provided with rollers which rest on the concrete bottom. The floating discharge pipe consists of 21 sections, each 21½ feet long, connected by 3½ feet of rubber hose. The discharge pipe proper is 14 inches in diameter, and is supported by two floating air-tight pipes 12 inches in diameter, one on each side.

The Vitality of Sewage Bacteria in Soil and the Antagonism of Soil Bacteria to the Typhoid Bacillus.

A Review by G. C. Whipple.

The question of how long the bacillus of typhoid-fever is able to survive in various environments outside the body is one of great importance to sanitary engineers, and all data bearing upon the subject should receive serious consideration. Quite early in the history of bacteriology experiments were made to determine how long Bacillus typhi and its near relative, Bacillus coli communis, could exist in water and sewage, with the following general result: In ordinary drinking water which has been sterilized B. typhi does not multiply, but gradually loses its vitality until, after a period variously estimated from one to three months, it fails to respond to the usual tests and may be considered as dead. B. coli on the other hand does multiply if the amount of organic matter in the water is sufficient and may hold its vitality for nearly a year and perhaps for a longer period. The greater the amount of organic matter in the water, the longer will both germs survive provided the water be sterilized, but if it be not sterilized the antagonism of the ordinary water bacteria results sometimes in a speedy reduction in the number of B. typhi, and even in a material decrease of the more hardy B. coli.

During the last five years some extensive studies upon the viability of B. typhi in soils have been carried on by Dr. Sidney Martin for the Local Government Board of England, supplemented by studies of soil bacteria by his colleagues, Dr. A. C. Houston and Dr. E. Klein. These have been published as appendices to the annual reports of the Medical Officer to the Board since 1896-7. The thirtieth report of the Local Government Board for the year 1900-01, just issued, contains an interesting summary of the results as they stand to-day, together with detailed accounts of the latest experiments.

Dr. Martin's paper is on the "Nature of the Antagonism of the Soil to the Typhoid Bacillus." In summing up the results of his previous investigations he says: "First—In certain virgin soils, consisting chiefly of sand or peat, which have never been cultivated, the typhoid bacillus does not grow nor live under any condition of the soil, sterilized or unsterilized. Second—If these virgin soils are placed under cultivation, they become capable, when sterilized, of maintaining the typhoid bacillus for a certain limited period. Third—In cultivated soils, i. e., those containing organic matter, that have been sterilized, the bacillus lives for a prolonged period and spreads through the soil. If, however, the bacillus be added to a cultivated soil, sterilization of which has been omitted, the micro-organism cannot be obtained from such soil after twelve days or so."

The early experiments seemed to indicate that these results were due, not to any exhaustion of the nutritive quality of the soil as a medium owing to the rapid growth of the indigenous soil bacteria, but rather to a special antagonism of the chemical products of the soil-bacteria to the typhoid bacillus, and Dr. Martin set out to prove this by laboratory experiment. He first isolated from the soil a proteus-like bacterium, which he considered to be a typical form found in garden soil, and which he described under the name Bacillus ramificans. Three flasks were then prepared, each containing a three-quarter-inch layer of Chichester soil, moistened with distilled water and sterilized. To the first was added a few drops of a broth culture of the typhoid bacillus, to the second an equal amount of broth culture of B. ramificans, and to the third, equal amounts of broth cultures of both bacteria. At various intervals from 24 hours to 33 days, these soils were examined as to the relative number of bacteria in each. For 18 days the two species were present in the third flask in about equal numbers, but on the 26th day the B. ramificans greatly outnumbered the B. typhi, and on the 33d day no B. typhi could be found, while there was a copious growth of B. ramificans. Meanwhile both cultures incubated separately in the first two flasks were flourishing. The experiment was repeated with the same bacteria, using broth as a medium instead of moist soil. In this case the typhoid bacilli lived for 54 days, but disappeared before the 71st day.

In another experiment a 21-day-old broth culture of B. ramificans was filtered through a Chamberland filter, by which the bacteria were removed, the filtrate containing, however, the products of their growth. When this medium was subsequently inoculated with a culture of B. typhi, it was found that the bacillus died in less than fourteen days. This and other experiments fully described in the paper referred to demonstrated the existence of some chemical excretory product inimical to the life of the typhoid germ and produced abundantly by the common bacteria present in the soil.

To Dr. Martin's statement that the typhoid bacillus was destroyed in unsterilized cultivated soil in less than twelve days, bacteriologists naturally raise the point that only with the greatest difficulty can this bacillus be isolated from a mixed culture of bacteria such as would be found in the soil, and that the typhoid germ may have been present in his later cultures without being detected. His recent careful experiments seem to indicate, however, that his general conclusions above mentioned are substantially correct.

Recognizing the difficulty of separating the typhoid bacillus from mixed cultures Dr. Houston has approached the subject from another direction in a series of experiments described in a paper entitled the "Inoculation of Soil with Sewage." The object of his experiments was to ascertain whether certain easily recognized sewage microbes, such as B. coli, streptococci, and spores of B. enteritidis sporogenes, retained their vitality for any considerable length of time when sown broadcast on the soil.

A plot of ground, five feet square, upon which the soil was rather poor and which had received no fertilizer for six years, was treated at intervals with cesspool sewage, and samples of the surface soil were examined bacteriologically before treatment and again at regular intervals after treatment. The examinations included the determination of the total number of ærobic bacteria, the number of spores of ærobic bacteria, and tests for the presence of the above named species. On July 9, 1900, twelve gallons of sewage were applied. This sewage contained about two million bacteria per cubic centimeter and gave positive tests for B. coli, streptococci and B. enteritidis sporogenes. Two days after the application there was a decided increase in the number of bacteria in the soil, as many as 12 million per gram being found, but this was followed by a marked diminution, so that after 17 days the number was only about half a million. This decrease was accompanied by an increase in the ratio of spores to the total number of bacteria; in other words the vegetative forms decreased while the spores increased. Positive tests of B. coli were not obtained after the second day, but a form which agreed with the typical colon bacillus except that it did not produce indol persisted until the 24th day after the inoculation. Whether this form had been originally a typical B. coli and had gradually lost its power to produce indol, or whether it was a distinct variety and had been present all the time Dr. Houston was not able to determine. Streptococci did not persist beyond the second day, while the spores of B. enteritidis sporogenes persisted until the 24th day, when the experiment terminated. The same patch of soil was then watered bi-weekly in the same way from August 13 to September 22, after which samples were analyzed at intervals until December 13. The first sample taken after the application of sewage was stopped showed, as before, an increase in the number of bacteria to about 13 million per gram, but the number soon fell to about seven million per gram and remained constant at about that figure. A typical B. coli was isolated 31 days after the inoculation ceased, and for 80 days the degenerate form mentioned above could be easily observed. On the 80th day, though not on the intervening days, a true B. coli was found. Streptococci persisted only for two days, but the spores of B. enteritidis persisted until the experiment was discontinued. Dr. Houston's other experiments were made with London sewage applied to an urban soil, but the results did not differ materially from those already described. Dr. Houston's paper is voluminous in its detail, but in the light of American investigation his tests for the identification of B. coli seem entirely inadequate, but as he himself states, his errors are on the side of including among the members of the colon group forms which perhaps should not be so included. As the result of his investigation he concluded that "there was no indication that the addition of sewage to a soil leads to a marked or indeed to other than a temporary increase of the sewage microbes in general at the expense of the soil bacteria. On the contrary, the more hardy soil bacteria seemed to oust the more delicate sewage microbes in the struggle for existence." Dr. Houston's report is illustrated by many excellent photomicrographs of streptococci isolated from the soil.

Permits for Opening Streets to make connections with sewers are now issued by the Engineering Department in Grand Rapids, Mich., according to the latest report of City Engineer L. W. Anderson. This carries with it the inspection of all sewer connections within the street line and the replacing of all roadways and pavements. A uniform charge of $1 covers sewer permit and inspection. Heretofore the plumbers were given a permit at the office of the Board of Public Works, then secured a list of the locations from the engineering department, and made the connections where and in such manner as they saw fit. In the case of other permits, the actual cost of inspection is charged to and collected from the parties to whom the permit is issued.

The Reduction of Alumina to Metal is now progressing in America on what would have been regarded ten years ago as a stupendous scale. With 11,000 horse-power operating at Niagara Falls and 5,000 horse-power at Shawinigan Falls, in Quebec, America possesses 16,000 horse-power devoted to producing this metal. This will produce aluminum at the rate of 4,500 tons yearly, or a production twice as large as that of the rest of the world put together. Not only is this rate of production actually in force, but the same company has in contemplation the utilization of 12,000 horse-power additional at Massena, N. Y. The principal source of this production, according to a report by Professor Joseph W. Richards, chairman of the Committee on Metallurgy of the American Aluminum Association, recently abstracted in "The Iron Age," are the bauxite deposits of Arkansas and Georgia.

The Water Tower at Grand Rapids, Wis.

The water tower at Grand Rapids, Wis., consists of a covered steel tank, 26 feet in diameter with its top about 154 feet above the ground, supported on four columns resting on concrete foundation piers. These foundation piers are made of a 1:2:5 broken stone mixture, Portland cement being used. For the two upper courses of each pier four parts of broken stone were used instead of five. The concrete was mixed with a minimum of water, so as to make a moist, not wet, concrete. It was laid in 6-inch layers, and each foundation was completed in one continuous operation. In the upper courses special care was taken to secure a smooth surface, and to accomplish this, a 3-inch facing of mortar in the proportion of one of cement to two of sand was put in place together with the concrete. The anchor bolts for the tower posts were built into the foundations as the concrete was laid.

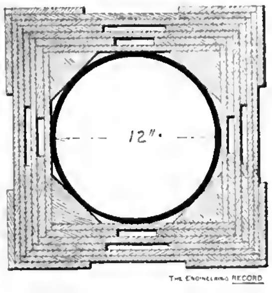
All the metal work in the tower, with the exception of the cast iron bolsters on the piers and other small details, is rolled steel, of medium grade, and made by the open-hearth process. The specifications stated that it should conform to the "Manufacturers' Standard Specifications for Structural Steel," as printed in the 1900 edition of the Carnegie Steel Company's handbook. The details of the four steel columns are shown in the accompanying illustrations. They are of the ordinary box column type with double lacing on the inside. The height of 116 feet up to the base of the tank is divided into four panels ranging from 34 to 25 feet each. At the bottom the posts are 48 feet apart center to center, and at the top 19 feet 9 inches. Access to the tank is gained by a series of bars 1¾x⅝ inch in section riveted at regular intervals to one of the columns.

The tank itself is 38 feet 3 inches high exclusive of the roof and the conical bottom, and is composed of eight rings of ¼-inch plates 5 feet wide, except the two bottom rings, in which the thickness of the metal varies from 5/16 to ¾ of an inch according to the location, whether close to one of the posts or not. The plates are riveted with lap joints, the four upper rings having only single lines of rivets. About 5 feet from the top a 5x3x⅜-inch angle is riveted around the outside of the tank to give it additional strength. The lowest ring of the tank, to which the conical bottom is attached, is composed of three thicknesses of plates, ¾-inch at the columns, then 9/16-inch, and midway between the columns the thickness is ⅝ of an inch. There are two 6x3½x⅜-inch angles riveted to the bottom of this ring, and these, reinforced with buttresses about 4½ feet high at each of the posts, rest directly on the tops of the latter. There is a single 6x3½x⅜-inch angle around the outside of the top of the lowest plates, connecting them to inside cover plates.

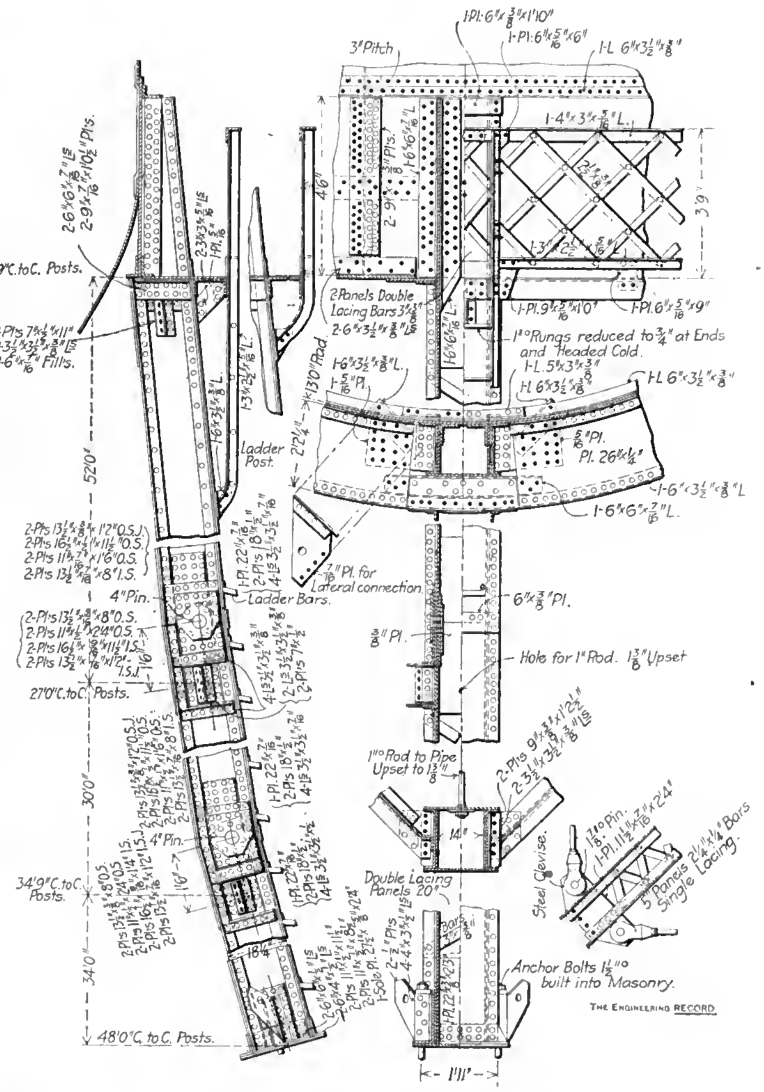
The conical bottom is simply riveted to the lowest ring of the tank proper about half way up, the top ring of the cone being bent to a 5-foot 8½-inch radius in order to make the connection. The cone has a vertical height of 16 feet, and is made in five rings, the upper one 5/16 of an inch thick and the others, ¼ of an inch. All the joints in the cone are double riveted. An iron ladder leads up the outside of the tank to a trap door in the roof.

The roof consists of a framework of steel covered with pine sheeting and tin. With the exception of a 1¼-inch vertical tie rod in the center, and the rafters, which are 4x5½-inch channels, the framework is composed almost entirely of 3½x3x¼-inch angle irons. The steel purlins of this same size have 2x2-inch pine strips bolted to them, to which the sheeting is nailed. The sheeting is of ¾-inch pine

THE WATER TOWER AT GRAND RAPIDS, WIS.



FROST PROTECTION.

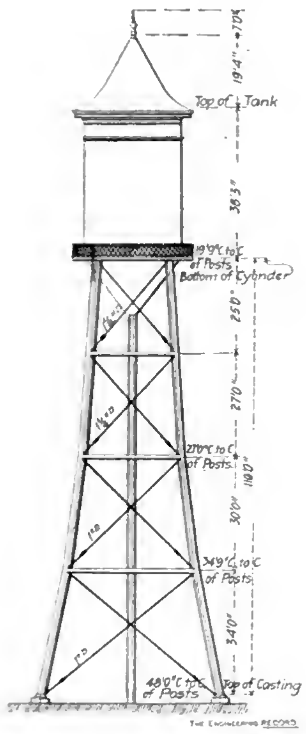


DETAILS OF COLUMNS AND CONNECTIONS.

boards, cut segmentally and put on radially. A single thickness of building paper was then tacked over these boards and the tin roof put on with soldered horizontal joints and double locked radial joints. The tin was painted on the under side before it was placed on the roof. Surmounting the roof is a copper finial, connected to the steel framework by three connections of No. 2 copper wire, making electrically perfect connection. The height of the top of this finial above the bases of the columns is 173 feet 7 inches. A galvanized iron cornice finished off the roof at the bottom.

The inlet pipe is 12 inches in diameter, and connected to the bottom of the tank by means of a flanged expansion joint with iron body and brass sleeve. The cast iron base elbow of this pipe is set in 7 feet of earth on a concrete footing 3 feet square and 18 inches thick. A frost protection is built around the inlet pipe from the under side of the tank to the surface of the ground, and supported on a brick foundation extending to the concrete footing.

This frost protection is of woodwork as shown in the accompanying illustration, square in cross-section, and made by placing four



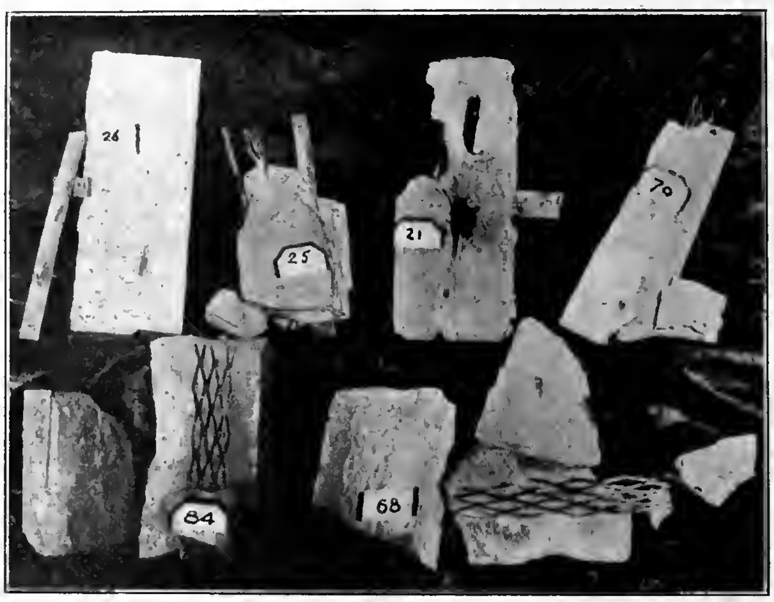
Elevation of Tower.

pieces of 4x4-inch lumber, halved diagonally, vertically against the pipe, and securing to these alternate layers of thin boards and building paper. There are first two thicknesses of boards and paper, and on the outside a double thickness of boards with paper between. These three courses are separated by ½-inch spaces made by ½x6-inch filling strips at the corners, and the vertical air spaces on each side are further divided by ½x6-inch fillers every 6 feet vertically, and fitting tightly against the corner pieces. All the corners are finished with ½x6-inch boards.

Before shipment to the work, all the steelwork of the tower was given a coat of boiled linseed oil, and after erection it was painted with two coats of graphite paint, the frost protection also receiving the same attention. The tank, however, was filled and tested for tightness before the final coat of paint was applied. The frost protection at the expansion joint and also at the ground was left open till after the final tests were made, in order to be sure that no leaks existed at those points. The engineers in charge of construction were Messrs. Loweth & Wolff of St. Paul.

Corrosion of Steel Frames of Buildings.

In the issue of The Engineering Record for September 20, 1902, there was published the results of an investigation by M. Breuillié on "The Durability of Steel in Concrete." Further information along this line is given in a recent report by Prof. Charles L. Norton, Massachusetts Institute of Technology, who is in charge of the laboratory of the Insurance Engineering Experiment Station, 31 Milk Street, Boston, of which Mr. Edward Atkinson is director. An abstract of the report is given below. The difficulty of cleaning the steel as done in the experimental work is so costly on the scale of practical building construction as to be prohibitive. It is true that structural steel is cleaned, but the result of the cleaning satisfies only a much less exacting definition of the term, clean, than that used in a laboratory. Protective coatings for steel are legion, and probably some of them would be effective if applied to the steel; but it has been the writer's common observation that the coating was put, to a large extent, upon rust, scale or foreign substances on the surface of the steel rather than upon the metal. The trouble is further increased by the fact that if the steel should be perfectly cleaned it would not remain cleaned long enough to be coated, by the usual commercial processes. Absolutely clean, bright steel will flash rust, when exposed to atmospheric moisture, almost as rapidly as powder will flash fire. It would seem then, that what the practical constructor needs to know is not alone, or so much, what happens to steel when cleaned and coated under laboratory conditions, but rather what befalls the steel as ordinarily manipulated in the operations at mill and shop and in building construction. The latter line of investigation, it is understood, the director of the Insurance Engineering Experiment Station hopes to undertake in the near future, and, in this undertaking, he invites engineers and architects to co-operate.



Steel Protected by Cement.

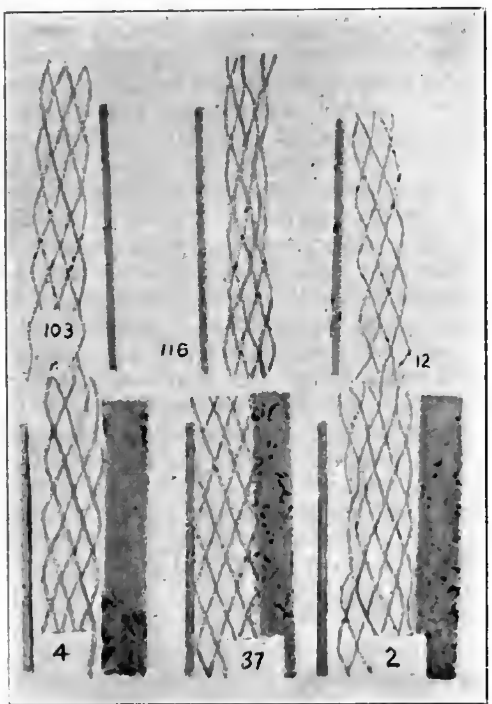
The problem of steel framing for a textile factory, bleachery or dyeworks, paper and pulp mill, and the protection of the metal from both heat and moisture, is a very much more difficult one than the construction of a department store or office building. The working of the fibers of cotton and wool requires a constant humidity at a rather high degree; the working of pulp and paper generate great volumes of vapor which must be guarded against.

The constantly increasing use of steel as a structural material in modern buildings has led to many questions as to its permanency. The examination of buildings ten to fifteen years old, when, during alterations, the steel framework has been exposed to view, reveals all stages and conditions of disintegration of the steel. So great has been the corrosion, even in this short time, in some cases, that a note of alarm has been sounded by some engineers most familiar with the subject. The use of steel beams and posts is of so recent date that no very exact deduction can be drawn as to the time required for a very serious or destructive loss of steel through corrosion; but surely, when a steel plate one-half inch in thickness loses more than one-eighth inch in five years, there arises a question as to the ability of the structure to last more than twenty-five years.

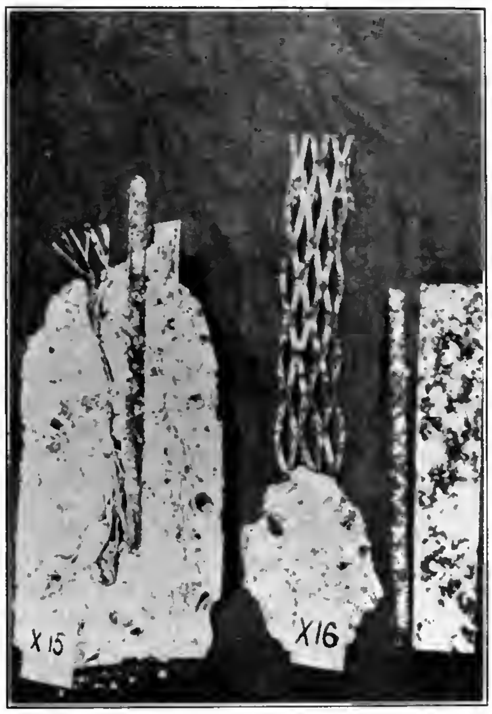
Some of the factors in the matter of corrosion of steel we know; others we do not know, and cannot until after a lapse of some years. There can be no question that moisture and carbon dioxide are the active agents in causing much of the rusting of steel. To what extent the two are relatively responsible and in what measure they need renewal, to keep up the process, is uncertain. It has been held that the formation of a coat of rust upon the surface of steel was the beginning of a progressive action whereby the rust, or iron oxide, acted as a continuous carrier of oxygen to the steel beneath. This process seems to require only moisture and atmospheric air containing carbon dioxide to start it, but as to the depth of penetration of the process, no assignable maximum in any given time is known. It is extremely probable that in a comparatively dry place the process is exceedingly slow.

There can, of course, be no question as to the ease of access to the steel, in many cases, of both moisture and carbon dioxide. When steel is bedded in the wall of the building, as is almost always the case, the changes in temperature from time to time, as well as the more or less constant difference in temperature between the two faces of the wall, tend to cause a condensation of moisture in the wall at different points. Further, the necessary carbon dioxide is most plentiful in the large cities, where the steel frame is most common. When the walls of the building are of brick or stone, moisture and carbon dioxide may enter at the joints and, to a greater or less extent, through the body of the stone or brick. Few stones are, however, porous to such an extent as to allow an appreciable penetration. Terra-cotta tile is of itself porous, and the existence of air passages tends to increase the condensation of moisture and its absorption by the terra-cotta and possible contact with the steel. Concrete, made of Portland cement with sand and either cinders or stone, would seem to offer more protection to the steel than any of the materials just mentioned; yet, we hear from time to time of the loss, by corrosion, of steel bedded in concrete.

It has been held by several engineers that the mere alkaline nature of Portland cement was a sufficient guarantee of its protecting steel from rusting. There is, of course, good chemical reasoning for this, the familiar use of strong alkaline solution in boilers to prevent the formation of scale being based upon the same principle. This would seem to settle the matter once and for all, were it not a fact that steel bedded in concrete has corroded very rapidly, while other steel in a different concrete of the same kind of cement stands without change for ten years or more. An examination of several cases where expanded metal had been embedded in concrete showed plainly that wherever the steel was exposed through cracking rusting began, even though the cracks were very fine. It would seem that the alkaline nature of the cement would be sufficient to prevent corrosive action occurring within a few hundredths of an inch on the moist surface of the steel, but such is not always the case. To study the matter systematically, two brands of American Portland cement (Alpha and Lehigh) were selected; two kinds of cinders, one from a sugar refinery, the other from Boston and Albany locomotives; a sharp, clean beach sand; and a hard, clean broken stone, the larger part being fragments of flint and trap rock. Concretes were made up in bricks about 3x3x8 inches, with the steel specimens near the center.



Steel Rusted at Voids in Concrete.



Steel Rusted by Contact with Cinders.

The following mixtures were tried at first: Neat cement; cement, one part, to three of sand; one cement to five broken stone; and one cement to seven cinders. All briquettes were made in duplicate with both cements. There were later made up briquettes of one part cement, two sand and five cinders, and of one cement, two sand and five crushed stone.

It was hoped to vary the density, the porosity and the nature of the contact with the steel, as well as the chemical composition of the concretes. The cements were tested chemically and physically and found good. The cinders, when washed down with a hose stream and dried, tested distinctly alkaline, and analysis revealed very small amounts of sulphur. The stone and sand were thoroughly washed and clean. The ingredients were mixed dry in every case and, when wet, thoroughly mixed and tamped until wet on top.

The cleaning of the steel was the most troublesome problem met with. It was necessary to scour the pieces, then pickle in hot dilute sulphuric acid, and finally dip into hot milk of lime. When cold, the lime was removed with a wire brush. This left the steel clean and bright, ready to be put into the test bricks. The specimens used were a mild steel rod 6 inches long and ¼ inch in diameter, a piece of soft sheet steel 6x1x1/32 inches and a strip of expanded metal 6x1 inches, all three pieces being put in each brick. Since time would not permit of exposing these specimens to natural conditions, they were enclosed in several large tin boxes, sealed tightly, and subjected, one-quarter of them to an atmosphere of steam, air and carbon dioxide, and a second quarter to air and steam, a third to air and carbon dioxide, and a fourth stood upon the table of the room, with no special care as to their temperature or dryness. Of the entire number, about one-half were set in water for one day, the rest for seven days, before sealing up.

At the end of three weeks the briquettes were carefully cut open and the steel examined and compared with specimens which had lain unprotected in each of the tin boxes. The neat cement specimen can be dismissed without discussion, for the protection was perfect. The steel was as bright as when put in. The unprotected pieces were found to consist of rather more rust than steel. The steel was wrapped about pieces of uralite, to serve as a means of identifying it by number, the stamped numbers being nearly obliterated by the rust. Of the remaining specimens, hardly one had escaped serious corrosion. The location of the rust spot was invariably coincident with either a void in the concrete or a badly rusted cinder. In the more porous mixtures, the steel was spotted with alternate bright and badly rusted areas, each clearly defined. In both the solid and the porous cinder concretes, many rust spots were found, except where the concrete had been mixed very wet, in which case the watery cement had coated nearly the whole of the steel, like a paint, and protected it. Some briquettes made later of finely ground cinders and cement, in varying proportions, when exposed to moisture and carbonic acid, showed how effectually the presence of cement prevented rusting, even in a highly porous mass—one cement to ten of cinder, provided there were no cracks or crevices or distinct voids.

From the examination of these several hundred briquettes there have been drawn several conclusions: First: Neat Portland cement, even in thin layers, is an effective preventive of rusting. Second: Concretes, to be effective in preventing rust, must be dense and without voids or cracks. They should be mixed quite wet where applied to the metal. Third: The corrosion found in cinder concrete is mainly due to the iron oxide, or rust, in the cinders and not to the sulphur. Fourth: Cinder concrete, if free from voids and well rammed when wet, is about as effective as stone concrete in protecting steel. Fifth: It is of the utmost importance that the steel be clean when bedded in concrete. Scraping, pickling, a sand blast and lime should be used, if necessary, to have the metal clean when built into a wall.

The Artesian Water Supply of Long Eaton, England.

Until about ten years ago the residents of Long Eaton, England, derived their water supply from individual wells, and as the population was rapidly increasing (being about 10,000 in 1893), and no sewerage facilities whatever were afforded until after the wells had become badly polluted, some other source of supply was a necessity. In the fall of 1888, a company was formed which, without consulting the local board, proposed to secure the monopoly of the water supply of the district from wells driven in the vicinity. Mr. George Hodson, M. Inst. C. E., who was retained by the local board to report upon this scheme, concluded after investigation that the proposed supply would be both insufficient in quantity and undesirable in quality, which opinion was concurred in later by other prominent engineers. The company ultimately abandoned all attempts to utilize its supply so far as Long Eaton was concerned. Meanwhile a careful physical and geological examination was made of the entire available district, comprising about 120 square miles. The progress of this investigation and a description of the works finally built were presented in a paper read by Mr. Hodson before the Incorporated Association of Municipal and County Engineers from which the following notes have been taken:

All possible sources of supply were investigated, and as soon as it became evident that an underground supply was all that was available, the question as to where the wells should be located became a vital one, specially difficult to decide on account of the geological conditions encountered. The water present in the gravel underlying the immediate neighborhood of the town, in addition to being nearly as badly polluted as that in any of the rivers flowing through the section, was limited in quantity because of impervious underground ridges that divided the gathering ground into small sections.

In order to satisfy some members of the local board that a suitable supply could not be obtained from the immediate vicinity of the town, a well was sunk to a depth of 165 feet through the gravel and the underlying marl. The yield of water obtained at this depth was insufficient to supply the pump for more than a few minutes at a time and analysis showed it to be a "nearly saturated solution of sulphate of lime."

Wells sunk in the vicinity of Weston, about two miles from the place finally selected, revealed various geological errors in the ordnance map of that district, but no satisfactory supply of water. Careful examination led to the belief that all the conditions for an artesian supply were present further west, and borings were made at the Stanton Barn site near the town of Melbourne. Here a layer of impervious sandstone was found to extend to a depth of 60 feet, and then to a depth of 190 feet the boring passed through shales and clays. At this depth the water began to overflow freely at the surface, and at 220 feet, after passing through a layer of hard sandstone, a fissure was struck which sent up the water with such force that the 2½-inch hole yielded 150,000 imperial gallons per day, and fragments of rock were thrown up into the air. When the pipes were carried up from the casing tubes the water rose 35 feet above the surface of the ground, and might have risen higher had it been worth while to make a water-tight joint. Analyses of the water both from the upper and lower rock proved it to be of very satisfactory quality, the deep water being slightly the harder.

The site of the well possesses all the features essential to the success of a water works system. It commands an ample collecting area, free from any danger of pollution so far as could be foreseen. It is in the direct dip of the strata and cannot be very well interfered with by rival works. It is close to a good public road, and within reach both of a railroad and a canal for the conveyance of coal. Moreover, it possesses the advantage that the nearest road for the pumping main passes close to the town of Melbourne and through the town of Castle Donington, where, within 300 yards of the direct route of the pipes, there is a suitable site for a reservoir 312 feet above the market place in Long Eaton.

The contract for building the works, although let to one firm, Messrs. Price & Shardlow, Nottingham, was divided into two parts, one for sinking and proving the yield of the well and the other for providing and laying all the mains, hydrants, etc., building the reservoir and pumping station, and providing and setting the machinery.

The main well, 11 feet in diameter, was begun a few yards distant from the overflowing test well. It was carried down 70 feet, so as to pass through the upper rock and 10 feet into the shale beneath. This last 10 feet was lined with 18 inches of brickwork and had a brick floor. Two main headings with numerous branches were driven from the well, commencing at the level of the base of the hard rock.

The contractor provided a temporary pumping plant capable of handling 60,000 imperial gallons per hour. It consisted of three Cornish boilers, supplying steam to a pair of No. 10 "aqua-thruster" pumps, together capable of pumping the required quantity. These pumps were slung from the square framing of the well in such a manner as to be easily raised or lowered, or withdrawn altogether whenever necessary. The winding engine was supplied with steam from the same boilers, and a Root blower was provided for ventilating the headings, being worked by an engine attached to a portable mortar mill. The boilers were set in brickwork, the bricks being subsequently used in the foundations for the permanent machinery.

The water pumped was measured by means of a weir and an automatic recording device. The quantity steadily increased with the progress of the headings, ultimately reaching 880,000 imperial gallons per day including the deep supply. The Root blower used for ventilation proved effective until the headings had been driven about 100 yards in each direction. After this distance had been reached considerable hindrance was caused by the delay in removing the fumes created in the blasting operations, and to facilitate the work the contractors found it to their interest to put down 6-inch borings from the surface to aid the blower. Each of these holes, owing to the heat from the steam used by the pumps in the well, became down-cast shafts, and not only rapidly cleared away the dynamite fumes, but also kept the headings cool and pleasant to work in. After the completion of the well these ventilation holes were made secure at the bottom by oak plugs and filled with Portland cement grout.

The headings were about 6 feet high and 5½ feet wide, this being found the most convenient size for two men to work comfortably at a face. They were given a gradient of 1 in 500, and as the work advanced, portions were widened out at intervals to serve as turn-outs for the cars. It was found necessary to extend the headings to a total length of 2,250 feet, much further than was expected, on account of the fissures in the rock being filled with finely divided clay, which considerably hindered the circulation of the underground water. This condition, which it was impossible to have foreseen, illustrates some of the uncertainties of an underground supply. However, it is considered probable that in a case like this the yield will increase rather than decrease with age due to the clay being washed out of the fissures to some extent.

The time occupied in driving the headings was 38 weeks and the average rate of progress varied from 30.16 to 16.3 feet, the mean being 26.93 feet per face per week. There were always two faces being driven at the same time, and three faces for a short period. Most of the holes were drilled with ordinary hand drills, but in the softer rock ratchet drilling machines were used. Gelignite was almost the only explosive used until the last few weeks, when it was replaced entirely by the more expensive gelatine dynamite, which is much more powerful in its action and gave better results, especially in the tougher rock. Generally three holes were put in a face and fired simultaneously.

During the time the headings were in progress, the original well was widened out to 10 inches diameter and was cased with steel tubes perforated where they passed through water-bearing beds. This well yielded 281,000 gallons of water, and a second, also 10 inches in diameter, was carried down to the bottom rock about 150 feet away. The well sinking proved that a fault of 10 feet throw existed between the original boring and the main well, and it was found that although the second boring yielded 135,000 gallons per day from the middle rock, that the source from the bottom rock was completely cut off and not a drop of water could be obtained from it.

The water from the deep wells is slightly harder than that from the headings and as the total quantity was much in excess of the demand, it was decided to reserve this supply for emergencies. A special valve was therefore provided, by which it could be regulated from the surface. The cast-iron base plate for this valve is 3 feet in diameter and is securely bolted to the rock at the level of the headings, the joint being made watertight by a sheet of gutta-percha. A guide tube is carried down from the surface to the headings, of sufficient diameter to allow the valve to be entirely withdrawn. The long valve rod is worked by a screw passing through the pedestal at the surface, having an indicator attached which shows the position of the valve. The valve proper is coned at the top and bottom, and constructed so that it descends freely upon its seat, being bushed with gunmetal on both faces and ground watertight.

Among the residents of Melbourne it was freely alleged that the supply met with was being drawn from the River Trent, instead of being water absorbed upon the higher ground, and to dispel this belief one of the ventilating holes was left open after the completion of the headings and before the permanent pumps were started. Although the deep well valves were kept closed, the water gradually rose until it overflowed from the hole and passed away into the Trent at a point 12 feet below its point of issue.

The machinery at the pumping station consists of four deep well pumps 14½ inches in diameter and four surface pumps, driven by spur gearing from two compound tandem surface condensing engines with 11½-inch high pressure cylinders, 20-inch low pressure cylinders and 32-inch stroke. The engines are supplied with steam by two Lancashire boilers 6 feet 3 inches in diameter and 20 feet long, with a working pressure of 105 pounds per square inch. When working together at normal speed the load is equivalent to 120 pump horse-power. The well pumps deliver the water through the surface condensers into tanks outside the engine house, from which it is drawn by the four 10-inch horizontal double acting pumps which force it to the reservoir. Each pair of well pumps and horizontal pumps is connected to the same crank in such a manner that the well pumps are doing their maximum duty while the force pumps are at the minimum, which arrangement results in very smooth running. The machinery is in duplicate in every part, and can be worked independently. Its contract capacity was 56,000 imperial gallons per hour, but it is stated that it will easily pump 60,000 gallons.

Municipal Ice-Making is leading to legal complications in Wolverhampton, England, according to "The Surveyor." It seems that a local ice merchant and the corporation, which conducts a cold storage and ice factory, are competing in their retail prices of ice to the public, and that the corporation has undercut the dealer's quotation for ice. The merchant has now appealed to the Local Government Board as to the legality of the corporation manufacturing ice for sale to the general public.

The Reconstruction of an Arched Culvert in Grand Rapids, Mich., is described substantially as follows in the 1901-2 report of City Engineer L. W. Anderson: The old culvert consisted of a semi-circular stone arch, 10-foot span, with an invert of 3-inch planking. The length of the arch was 65 feet, and it consisted of simply a 12-inch ring without backing. It had entirely broken away at one end and the planks were supported at the ends only, the ordinary flow of the stream passing under them. Concrete abutments were constructed under the arch down to rock, the planking being cut away a section at a time; the arch was backed up with concrete and the top plastered with Portland cement mortar; a 4-inch brick arch was built inside of the old arch to protect it from further disintegration.

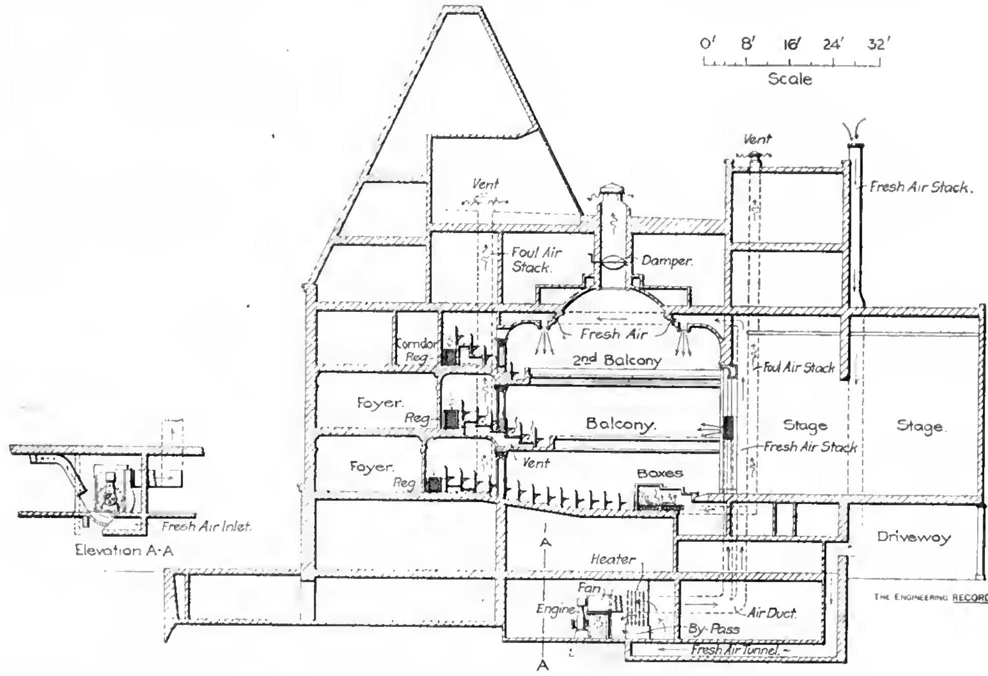
Power and Ventilation in the Bush Temple of Music, Chicago.

The heirs of the late William H. Bush, one of the pioneers of Chicago, have recently erected a large building of beautiful design on the corner of North Clark Street and Chicago Avenue, known as the Bush Temple of Music. The architecture is of the French Renaissance style with a French Gothic roof crowning the main pavilion. A view of the exterior is shown in an accompanying reproduction of the architect's perspective. The main feature of the building is its large, centrally located auditorium, rising through the second, third and fourth stories, around which are located various studios and offices. Most of the main floor and a part of the second are occupied by offices and salesrooms. The office portion of the fourth floor is given up entirely to the Railway Department of the Chicago Branch of the International Correspondence Schools and the basement contains a restaurant and barber shop. Above the auditorium are three smaller recital halls with adjoining parlors and retiring rooms.

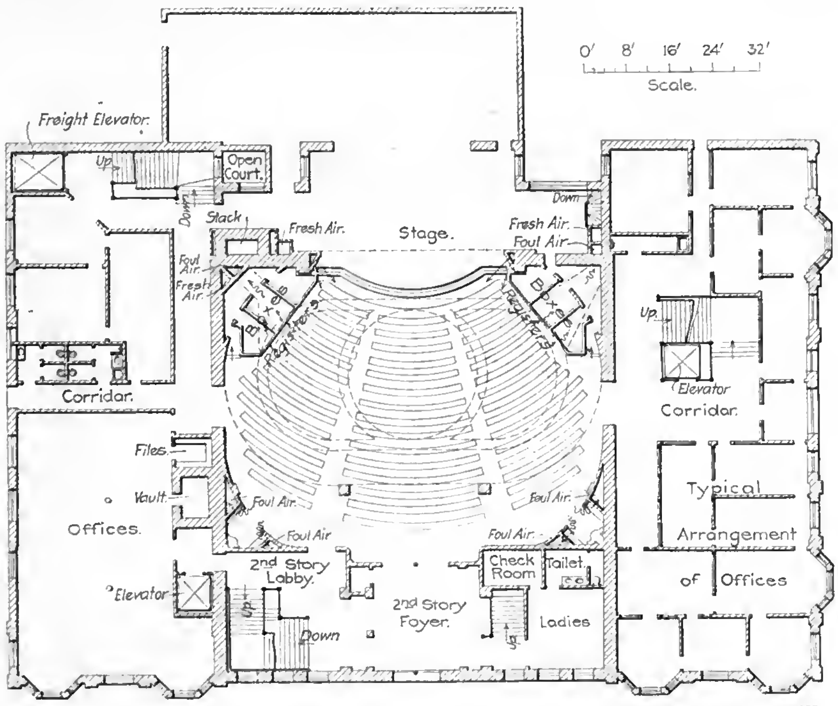
Bush Temple of Music, Chicago.

The mechanical plant, located at the west end of the basement, is very complete for a building of this size and is compactly and conveniently arranged as shown in the accompanying basement plan. The steam is generated by three Scotch marine boilers, 78 inches in diameter and 14 feet long having a rated capacity of 80 horse-power each. These supply the several engines and the heating system when necessary. The electricity for power and lighting purposes is supplied by two 60-kilowatt, 125-volt, direct-current, compound-wound generators of the Northern type, direct-connected to two 12x13-inch simple engines, made by the Ball Engine Company, of Erie, Pa. Of the other engines, two are for driving ventilating fans and one for compressing air. One of the uses to which the compressed air is put is to operate air-brake models for a 60-car freight train and a 5-car passenger train in the Correspondence School. All other machinery is motor driven; two motors, of the Northern type, run two Yeomans bilge pumps of a capacity of 400 gallons a minute and a 16-horse-power Holtzer-Cabot motor is belted to a Kroeschell ice machine, operated on the carbonic anhydride system and having a capacity of 6 tons of ice a day. This ice machine, besides supplying ice for the café in the basement, is also used to cool the distilled drinking water, which is pumped to all parts of the building. Three electric elevators of the Eaton & Prince make are installed, each operated by 20-horse-power motors. Two of these are for passengers and one is for freight. An organ in the auditorium is pumped by a 5-horse-power motor-driven fan and the keyboard controls the pipes electrically, the current being supplied by a two-cell storage battery.

There are two separate ventilating systems, one for the auditorium and one for the restaurant in the basement, each with its own plenum fan. The latter, as indicated in the basement plan, is a combination plenum and exhaust system, as the fresh air is forced into the room by a blast fan, which takes its air through tempering coils, and the vitiated air is removed by an exhaust fan at the base of a discharge shaft. The basement ventilation is equipped with an unusually large number of registers; there are 70 for delivering air, placed 7 feet above the floor level, and 37 for discharging it, placed 8 inches above the floor. The latter have an opening of 6x28 inches each and the velocity through them is about 280 feet per minute. This allows a change of air in the room once in every eight minutes. In all other respects it is the same in principle as the larger system for the auditorium ventilation.



Sectional Elevation of the Building.



Main Floor Plan of Auditorium.

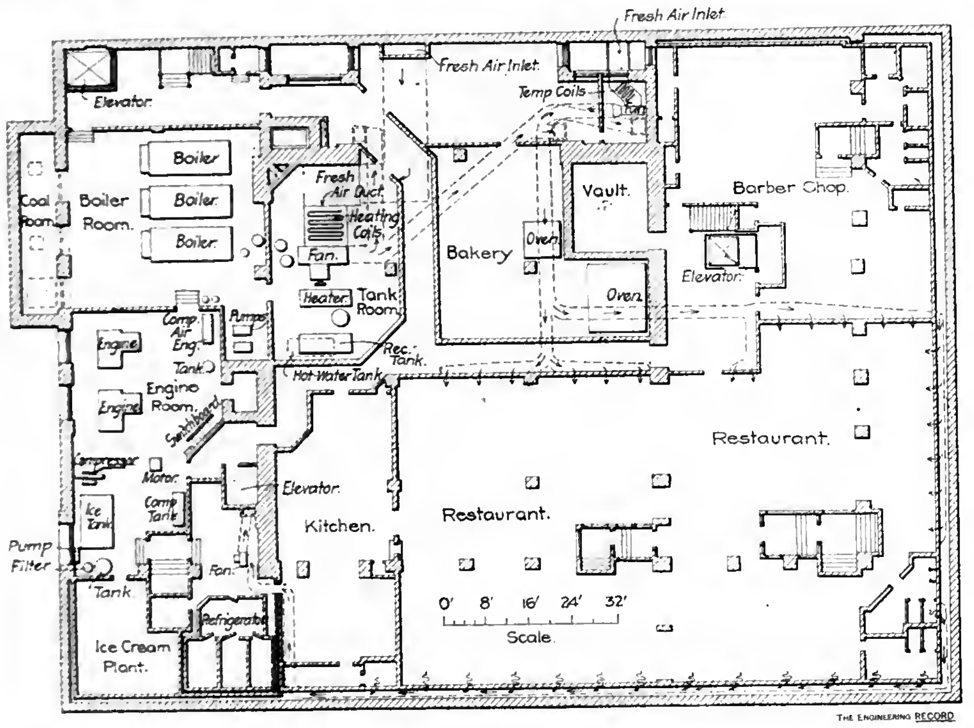
The ventilating and heating of the auditorium is, perhaps, the most interesting feature of the equipment. The heating and ventilating are combined by the use of the indirect system whereby warm fresh air is supplied to replace the foul air. The downward method of distribution in the hall is adopted. The objection frequently made against the downward system, on the ground that it is less effective than the upward system in keeping the air pure for the same volume replaced in a given time, was met by using a large amount of air and the designers say that the system has improved, instead of detracting from, the acoustic properties of the hall. For the sake of the acoustics of the hall, all draperies, upholsteries, and other non-resilient materials were avoided where possible, but incidentally, the assistance they would render by virtue of their properties of retaining warmth and excluding cold were lost. The air thus encounters hard surfaces almost entirely and this with many places of admitting cold air, such as several foyers and the proximity of an open-air balcony or promenade, made the problem of efficient heating somewhat difficult.

The fan and heating coils are located in the basement and the fresh air is drawn in through a horizontal underground tunnel which connects with a steel shaft dropping vertically on the outside of the building from a point above the roof. The fan is an 8-foot double discharge Buffalo Forge Company's steel plate fan, having a blast wheel 85 inches in diameter and driven by a vertical engine, of the same firm's make, direct-connected to the fan shaft. The air is taken through the usual heater coils of staggered pipes consisting of six two-row sections. Each section has its own steam and drip connections to cut out one or more sections in moderate weather and, of course, preventing an entire shut-down should one become disabled. The coils contain 5,000 feet of 1-inch pipe, equivalent to 1,670 square feet of surface, and are encased in an extra heavy steel plate housing, to give an absolutely tight connection from fan inlet to the outdoor air supply. The housing has doors which render the coils accessible for repairs or inspection. Below the coils there is a by-pass controlled by a damper, which may be opened wide in summer time to avoid retarding the air by the pipes in the coils when the latter are not in use, or may be partly opened in winter to regulate the temperature by a mixture. This temperature is usually maintained at from 130 degrees to 170 degrees as circumstances require.

ium. The foul air is removed through registers in the private boxes, under the seats of the balcony, in the rear of the gallery and the rear and sides of the main floor, and finally passes out through the roof by means of tile and galvanized iron stacks with siphon ventilators at their tops. The current through these stacks is dependent, largely, on the pressure of the fresh air driven into the auditorium by the fan, augmented by the chimney action of the flues. The accompanying transverse section of the building indicates the method of circulating the air through the theatre.

The architectural plans for the building were drawn up by Mr. J. E. O. Pridmore, of Chicago, and his chief draftsman, Mr. E. Charles Hemmings. The main body of the building is constructed of the Chicago Hydraulic Company's grey pressed brick and the decorative work was furnished by the Northwestern Terra Cotta Company. Messrs. Charles G. Armstrong & Company, of Chicago, were the consulting engineers for the mechanical and electrical work.

Cast-Iron Piles have been used on two highway and electric railway bridges 30 feet wide



PLAN OF THE BASEMENT.

At its maximum speed, the fan is depended on to discharge from 30,000 to 35,000 cubic feet of air per minute, which is sufficient to change the air in the auditorium once in every five minutes if desired, though once in twelve minutes is calculated to be often enough. The seating capacity being 1,000, this makes a provision of about 30 cubic feet per minute per person. From the fan the air is forced through galvanized flues to the horizontal loops over the auditorium ceiling, from which it is discharged through ornamental perforations in the ceiling, and to the two registers about midway up at either side of the proscenium. These registers are set at an angle with the stage wall so as to discharge the air away from the stage. The form of the ceiling loops is indicated by dotted lines on the plan of the theatre. It will be seen that there is a circular loop within a larger elliptical loop. These are fed from two risers, one at each end, by short, flat, flaring connections.

All bends in connections and distributing ducts are made with a large radius to permit an easy flow of air, and the branch pipes to the various flues have dampers to equalize the distribution of air in all parts of the auditor-

over the Weweantit River between Marion and Wareham, Mass. The teredo destroys oak piling within five years at this place, so grey-iron piles of a cruciform section were adopted. They are 10 inches in diameter, weigh 60 pounds per foot, and have 1-inch webs. One bridge is 82½ feet long, with four bents of four piles each, and the other is 108 feet long, with five bents. Each pile has a lower section 30 to 34 feet long and a 6-foot upper section; the two are connected by a cast-iron sleeve in which the parts are held firmly by lead poured in while molten. On top of the pile there is a hollow cap adjustable vertically about 2 inches and held by lead. Mr. C. H. Howes, resident engineer of the Massachusetts Highway Commission, who had charge of the work, states that great care was used in driving the piles to keep them perpendicular and in place, as well as to bring them to a fairly true grade. Blocks of 3-inch white oak about 15 inches square were used as a cushion between the pile top and the hammer, the number of blocks ranging between two and sixteen. Better results were obtained with a 2,200-pound hammer falling 12 to 15 feet than with a longer fall. The bridge was built by the Berlin Construction Company.

The New Works of the B. F. Sturtevant Company.

The new works of the B. F. Sturtevant Company, now nearing completion, at Hyde Park, Mass., present an excellent opportunity to study the factors that control in the location and design of the modern manufacturing plant. The present plant at Jamaica Plain, Mass., is limited in its opportunity for growth, and the fire which occurred last year forced an immediate solution of the question of removal. Aside from the general character of the lot itself, the principal factors considered in reaching a decision were proximity to raw materials, and to an abundance of skilled labor, adequate shipping facilities, ample water supply, and space for ready disposal of waste material. The best combination of advantages was presented by a lot of nearly 20 acres of land in the town of Hyde Park, Mass., 6 miles from the old plant. The lot selected has a frontage of about 1,300 feet upon the freight yard of the New York, New Haven & Hartford Railroad, at Readville Station, the distributing point for all freight passing over either the Midland or Providence divisions of that road. One side of the lot is bounded by Mother Brook and the adjacent shore is at a level of nearly 10 feet below that of the yard and buildings, thus providing sufficient space for dumping waste material for years to come.

As regards the buildings the individual and aggregate areas were determined on the basis of recommendations made by the heads of departments, and the plans started with the idea of providing a total floor space slightly more than double that of the present plant. The lay of the land and its available area being somewhat against a group of one-story buildings, and a simple calculation showing that the actual cost of the power expended in a single year for lifting the entire produce of the works through a distance of 20 feet figured only a little over one dollar, determined the company upon the building of multi-storied buildings. It is believed that the fixed charges on elevating machinery will be more than offset by a reduction in the horizontal distances otherwise necessary to be traversed.

One arrangement of the buildings studied provided for a group of buildings parallel to the railroad tracks with accommodation for switch tracks between the buildings, and for their entrance at the ends of the building with an opportunity for growth by extension in length, and this plan was adopted. The accompanying small plan shows by the shaded portions the opportunity for increase of size in each of the buildings.

The type of building finally selected consists of steel interior columns and main steel girders, with heavy brick walls, wood timbered floor and plank roofs. In the case of the one-story foundry, the roof is supported by steel trusses; in the other buildings open timbering with wooden columns in the upper floor is employed. The main floor in the machine shop is of tar concrete with spruce and maple flooring. The upper floors are carried upon wooden beams spanning the spaces between the steel girders, which follow a unit system of 20 feet on centers through the building. All roofs are of 3-inch plank with tar and gravel top.

The question of power was early decided to the extent that the entire plant would be electrically driven from a central power house; that the engines would run condensing; that the exhaust steam derived from engines under test, which is considerable, would be utilized for heating with a supplementary amount of live steam admitted at reduced pressure as might be required. The power house was placed sufficiently far from the ends of the buildings to permit sufficient extension of each, and near enough to the water supply to reduce to a minimum the expense of conveying and condensing other water.

The accompanying plan of the buildings will indicate the consideration given to the transfer of materials throughout the plant. The pattern building provides at one end a two-story portion 80 feet square for carpenters and flask makers on the first floor, and for pattern makers on the second floor. The rest of the building, which is devoted to pattern storage, is provided with intermediate floors making four in all separated from the other portion of the building by double fire walls and automatic fire closing doors. The close proximity of this building to the foundry facilitates rapid intercourse.

The foundry, 170x350 feet, is to be equipped with narrow-gauge railways bedded in concrete making runways between the moulding floors. Two craneways run lengthwise through the building the greater part of its length, and the tracks extend beneath the crosswise traveling crane in the cleaning room at the end of the building. The brass foundry is located in one corner, a wash room in the adjacent corner, a core room between the two; the latter has ample opportunity for growth towards the center of the building, while the foundry itself can be extended to practically double its length. Storage for supplies is provided upon one side adjacent to the railroad switch. From the bins thus provided, the iron and fuel charges will be carried directly to the charging floor.

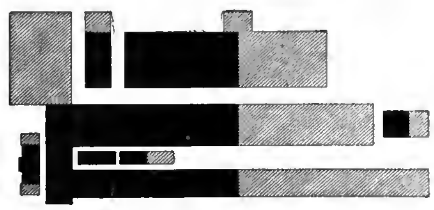
From the foundry the castings will pass to the rear of either the machine shop or the fan shop. The former is of the gallery type, 500 feet long, with wings 40 feet wide, and center runway of the same width for crane of 20 tons capacity. The lighting will be principally by a series of saw-toothed skylights running crosswise of the roof with glass facing due north. The crane will serve the entire floor and transport heavy castings from the machine tools to the erecting floor, where the completed engine or generator may be lifted upon a transfer car passing through the testing building. There it will be picked up by another 20-ton crane, which will drop it upon the testing plate and subsequently carry it forward to the steam railway track, which passes through the end of the building and provides space for the loading of two cars at one time. The upper floor of this building together with portions of the adjoining buildings is devoted to the electrical department and provided with individual small traveling cranes.

The building devoted to the manufacture of fans, heaters, etc., is 80 feet in width, of the same length as the machine shop, is three stories in height, of typical mill construction, provided with all conveniences for handling material and arranged so that shipment can be made from numerous points along one side, while supplies are brought in from the court between it and the machine shop.

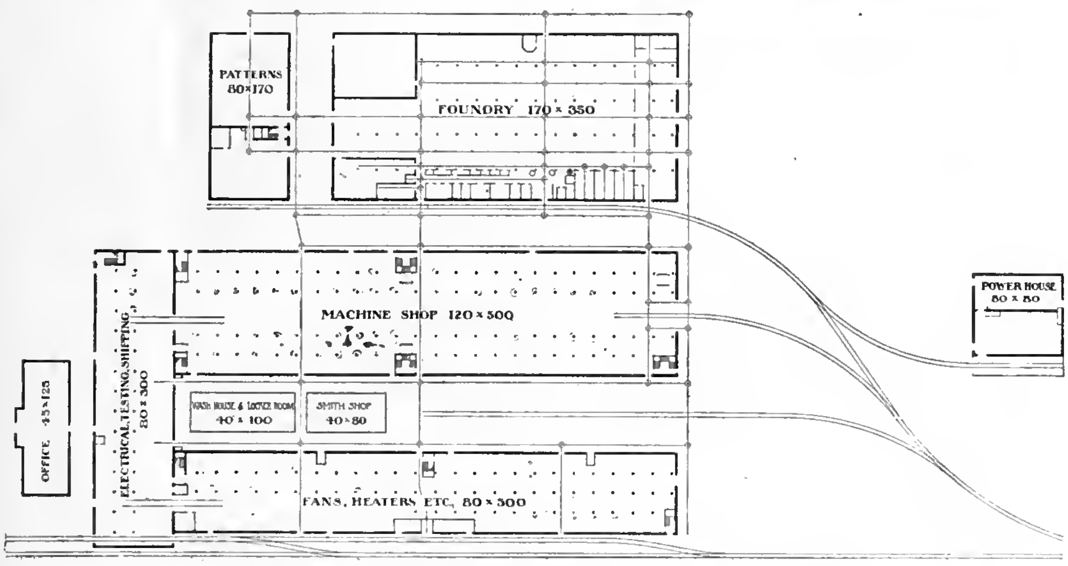
The smith shop, 40x80 feet, serves both buildings with equal facility, while the wash house and locker rooms measuring 40x100 feet, and three stories in height, is located as to reduce to a minimum the distance to be traversed by the individual workmen. The third floor will be used as a lunch room.

The standard first-floor height in the main building is 17 feet, that of the second and third stories is 15 feet. The windows are large and numerous.

The office building will contain the correspondence, designing and drafting offices, the superintendent's quarters, and the cost department, the advertising bureau and a printing office, which will be located in the basement. It will be three stories in height with a finished attic to provide additional drafting room space.



Possible Additions to the Plant.



New Plant of the B. F. Sturtevant Co., Hyde Park, Mass.

The equipment of this plant will be largely Sturtevant in its character. Beginning with the power plant, the mechanical draft apparatus, then engines and generators and the exhaust head will be of Sturtevant make. The building will be heated by the Sturtevant system, the shafting and individual machines driven by motors of the same make, the refuse from the wood-working machinery, the dust from the cleaning room of the foundry, the ventilation of the offices, toilet rooms, and wash house, and the removal of smoke from the smith shop will be accomplished by the Sturtevant exhaust fans, while Sturtevant blowers will be used for brass and iron foundry, forge shop blast and the like, and the firm's vent steam traps will be employed upon the steam dryers.

The Sault Ste. Marie Power Plant of the Consolidated Lake Superior Company, which has been under construction for four years, was started for the first time October 25. The plant cost about $4,000,000 and will develop 60,000 horse-power.

Association of Municipal Engineers of New York City.

On October 3 several engineers connected with various municipal departments of New York City held an informal meeting to discuss the advisability of organizing an association comprising all the engineers in the service of the city. The movement thus begun is said to be well received, and now another forward step is being taken. A circular letter has been issued by a sub-committee on organization, Messrs. M. L. Blum, chairman, A. N. White and M. H. Lewis, setting forth the purposes of the proposed society and giving every engineer connected with the city departments an opportunity to express his desire to join, by filling a printed form attached to the letter.

The aims and objects of the proposed society are stated to be as follows: To cover a scientific field not covered by any existing society. To bring municipal engineers together socially and professionally in order that the problems arising in their several departments may be freely and informally discussed, and that by this means each member may learn the functions of the various departments—what they accomplish and what they endeavor to accomplish, and assist in this accomplishment. To assist in systematizing and standardizing the information in the possession of all departments, establish uniformity in the keeping of engineering records, study the details of office practice, co-operate with the authorities so that duplication of work by the different departments may be avoided, and act in conjunction with other bodies in investigating various problems in municipal engineering. To establish a library of publications pertaining to municipal engineering, statutory laws affecting engineering, statistics as to durability and costs of engineering works, to keep on file plans and specifications of all municipal construction, and reports of other technical societies, and to publish information that may be of value to the engineering profession.

Believing that the service to the city and the interests of the engineers will be mutually conserved by a logical system of grades and promotions, it is proposed that the society make a study of the civil service systems of various countries and lend its efforts to the civil service authorities in establishing a comprehensive and efficient system in the municipality, a system under which ability and efficiency will receive due recognition. There is at present in the city a large body of engineers, about eight hundred in all, engaged on municipal work who have no common meeting ground and consequently are as widely separated as if divided into small parties scattered throughout the country, nevertheless these engineers have many interests in common which suffer through lack of united effort toward a given purpose.

It is believed that the engineers of the departments have missed many advantages because of the lack of a mutual interchange of information and unity of efforts to secure desired improvements. Although a large amount of interesting work is conducted by the engineers of the city, most of the men are acquainted only with the particular work with which they are immediately connected and so miss the educational advantages of a broader knowledge of the works of all departments.

There may be similar organizations to the one above proposed already in existence, but The Engineering Record does not know of any. In some places the necessity for such an association is met, at least in a measure, by the local society of engineers; but in some of the largest cities there may be fields for such movements which could be cultivated to advantage. The objects stated by the organizers of this New York association raise a question or two. Should not the engineers of the various departments of a city be so correlated as to avoid much duplication of work and materially aid one another in the collecting and recording of data? And why should not the engineers of the quasi-public corporations having tracks, pipes, ducts or other structures in the streets contribute their share in the matters of information and records? In some communities these ends are accomplished partly by the personal efforts of the city engineers, but in some municipalities there are large departments employing engineers who do not come under the control of the city engineer.

Diffusion of Light Through Windows.

An instructive report on the relative diffusing powers of various kinds of window glass has recently been issued by the Insurance Engineering Experiment Station, 31 Milk Street, Boston, of which Mr. Edward Atkinson is director. The report, from which the abstract below was prepared, was written by Prof. Charles L. Norton, of the Massachusetts Institute of Technology, who is in charge of the laboratory of the experiment station, and sets forth the results of extended investigations. Some observations by Mr. Atkinson have been added. The results of the tests on a score or more of different glasses may be stated briefly as follows:

We may increase the light in a room thirty feet or more deep to from three to fifteen times its present effect by using "Factory Ribbed" glass instead of plane glass in the upper sash. By using prisms we may, under certain conditions, increase the effective light to fifty times its present strength. The gain in effective light on substituting ribbed glass or prisms for plane glass is much greater when the sky-angle is small, as in the case of windows opening upon light shafts or narrow alleys. The increase in the strength of the light directly opposite a window in which ribbed glass or prisms have been substituted for plane glass is at times such as to light a desk or table fifty feet from the window better than one twenty feet from the window had previously been lighted.

Ground glass is of little value, except as a softening medium for bright sunlight. Its rapidly increasing opaqueness with moisture and dust makes it undesirable as a window glass. The common rough plate has very little action as a diffusing medium, giving no perceptible change in the effective light. "Ripple glass" has great value as a diffusing medium in small rooms with nearly open horizon. Of the ribbed glasses, the fine "Factory Ribbed," with twenty-one ribs to the inch, is distinctly the best, not in all probability because of the fineness, but because of the greater sharpness of the corrugation. The "Ribbed Wire" glass is about twenty per cent. less effective than the ordinary "Factory Ribbed" glass. The addition of a second corrugation upon the back of the plate giving the "Skylight" and "Washboard" glass is of no apparent value. The raised pattern imprinted upon one surface of the glass, as in the case of the "Maze," gives the widest diffusion, especially in bright sunlight. A raised figure, when worked upon the back of the "Ribbed" glass, renders it less offensive to the eye in bright sunlight, but less effective in deep rooms.

The exceeding brightness of all the specimens except the "Maze" and ground glass when in the bright sunlight, is such as to forbid their use where they are constantly in sight, unless they be provided with shades of thin white cloth. This practice of using a thin white shade is to be commended, as it gives a maximum of light when it is needed, in dull weather, when the shade need not be drawn, and yet keeps the eyes protected from a painful glare in bright sunlight. The white cloth shade cuts off about sixty per cent. of the light.

As the result of the test made in a room fifty feet by forty feet, we are able to draw the following conclusions:

First.—The conditions in a room less than fifteen feet deep are such that, except with a sky-angle of less than forty-five degrees, it is not advisable to alter the general course of the light by using a prismatic or ribbed glass. A nearly hemispherical diffusion, such as is given by the "Maze" or "Ripple," is ordinarily preferable.

Second.—When a room is from twenty feet to sixty feet deep, or even more, and has a sky-angle of sixty degrees or less, the ribbed and prismatic glass gives a very great gain in effective light. The gain in brilliancy is such as to make a basement with prism canopies as light as a second story without them, and the first story with ribbed glass should be distinctly brighter than the second story with plane glass. If the building which obscures the light from the sky at a window be increased two stories in height, it will be found possible to restore the light by the use of ribbed glass, and to even improve its earlier condition by a prism canopy. The assumption is here made that the obstructing building is at least thirty feet distant. Rooms with windows opening upon light shafts and narrow alleys with very limited sky, where the available light is now small, may have the light twenty feet back from the window increased ten or twenty times by using prisms; and, by using canopies of prisms, it is sometimes possible to strengthen the light from fifty to one hundred times.

"Ribbed" and "Maze" glass are of very great value in softening the light, especially in the case of such windows as are exposed to the direct sun, aside from their effectiveness in strengthening the light at distant points. With the "Maze" glass, the artist may have, in all weather and in all directions, what is in effect a much-desired "north light." The photographer may have in this way as well diffused a light as he now has with cloth screens or shades, with a much greater intensity. To be efficient in rooms of twenty feet deep or more, ribbed glass should be set with its ribs horizontal, and where the sunlight falls upon it, it should be provided with thin white shades. All inferences drawn from the test are made upon the assumption that the windows are to be reglazed with diffusing glasses only in the upper half, which is the common practice. If the lower sash is to be reglazed as well, a further increase of about twenty-five per cent. may be expected.

Considering both expense and efficiency, the following general suggestions are given:

Use "Maze" or "Ripple" glass in small rooms or offices not more than fifteen or twenty feet deep.

Use "Factory Ribbed" glass in rooms thirty to fifty feet deep, with sky-angles of sixty degrees or more.

Use prisms or "Factory Ribbed" glass, in sheets, in all vertical windows in rooms more than fifty to sixty feet deep, with sky-angle of less than forty-five degrees. With a sky-angle of less than thirty degrees, use prisms in canopies.

It must be borne in mind that one factor, which can be merely hinted at in this report, may be the one which decides the matter of the selection of any one glass, that is, the cost. At present prices we may assume that the "Factory Ribbed" glass costs but little more than ordinary double-thick plane glass. The cost of rolled prismatic glass is not yet established. The cost of the cast prismatic glass is of necessity much greater than of either of the others.

In the first cases in which "Factory Ribbed" glass was used, the ribs were placed horizontally, but the line of bright light thus deflected towards the eyes of the workman may become injurious, and, although the diffusion from horizontal lines is a little better and more effective, the plan of setting is now to place the ribs vertically.

The conclusions which may be deduced from the tests made by Professor Norton, with a window twelve inches square serving as the sole source of light in a large hall with dark ceiling, are:

First.—Windows of the customary height, but of one-third the width commonly adopted, when glazed with ribbed or suitable prismatic glass, will give on a bright day as much effective light as the full width of window glazed with plane glass; on a cloudy day or in a position where the light from the sky is derived from a limited area, even a greater ratio.

Second.—Windows of the type now common in mills, workshops or school rooms, fitted with plane glass, if reglazed in the upper half only with ribbed or prismatic glass, will yield on a bright day more than fifty per cent. excess of effective light, or on dark days a larger ratio. If reglazed down to but not including the lower panes (in which we advise plane glass), the increase in effective light will be much greater.

Third.—Whether or not the increase of effective light will be as great in a room now fully lighted by the customary number of windows of plane glass as in this hall lighted with a single twelve-inch window has not yet been determined, but it has been proved in mill practice that the light is much improved in quality and is rendered much more effective, both near to and far away from the windows.

It may be judicious in all cases to glaze the lower row of panes in factory, workshop and school house windows with plane glass, so that the unpleasant impression of not being able to look out may not be given. It has sometimes been suggested that some portion of each window should be of plane glass for hygienic reasons, upon the ground that "sunlight transmitted through plane glass has a greater hygienic value than that which is refracted through a denser medium." The roughened glass of various types is not a "denser" medium. The glass only diffuses or deflects the rays of light. The hygienic value of this diffusion in its effect upon the eye, when the plates are rightly adjusted, cannot be questioned. It has also been observed that the heat of the sun is diffused, as well as the light, making the warming of the room more uniform.

Wired glass is now cast with ribbed or corrugated surfaces for the diffusion of light. If such glass, set in metallic frames, is substituted for plain glass windows at points where there is danger of fire passing, safety will be well assured with improvement in the lighting. Insurance companies now accept such wired glass windows where they were previously obliged to ask that window spaces should be bricked up. In closing windows against fire, either the "Maze" or the ribbed wire glass may be adopted, assuring safety and at the same time improving the light within. Care should be exercised in setting thick wired glass in metal frames. The lower edge must, of course, bear directly on the frame. The sides and top should be fitted loosely, so that the differential expansion and contraction of glass and frame may not crack the glass.

A Hydrographic Survey is to be made of the principal rivers of Wisconsin to determine the possibilities for water supply and power development.

The Escalator.

A notable installation of moving stairways is now approaching completion in a large department store recently erected in New York City, opposite Herald Square, for Messrs. R. H. Macy & Company. It comprises four stairways serving five floors, each stairway guaranteed to carry 10,000 people per hour. The stairway is known as the Escalator, which is a copyrighted name derived by the inventor, Mr. Charles D. Seeberger, to define the device as a means for securing progression from one plane to another. While a considerable number of Escalators are already in operation in this country, the Macy Escalator plant is the largest yet built by the makers, the Otis Elevator Company.

View of the Escalator and Shunt.

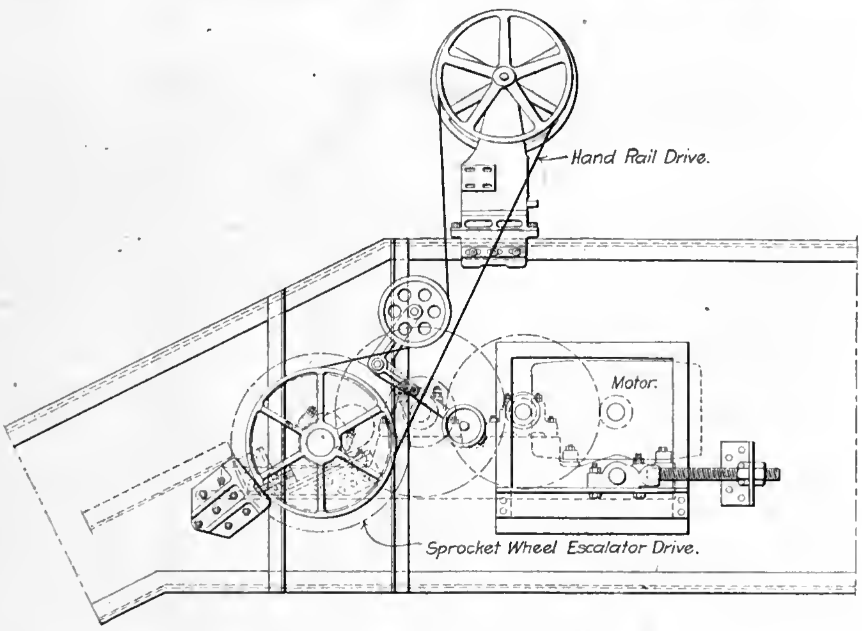
The Escalator consists of an endless series of steps connected together by a heavy sprocket chain which at the upper part of the machine engages with the driving sprocket wheel. Each step is essentially a four-wheel truck, bolted to an axle, which, in turn, is connected to the links of the driving chain. There are two wheels at each end of the truck moving on separate tracks which are so placed that the steps remain horizontal at all points of the ascent. At the landings at the top and bottom of the Escalator, the tracks, and therefore, the trucks, travel in the same plane, so that the steps there become a moving sidewalk making it easy to step on or off. A traveling handrail is provided at each side of the stairway, moving at the same speed as the steps.

Should a person fail for any reason to step off at the upper landing, a device called a shunt removes him from it. This consists of a box-like affair, triangular in plan, with the apex pointing against the direction of the moving platform. In the lower part, set in a vertical position, are two belts running backward from the apex in opposite directions, diagonally across the landing, brushing the person from the side of the platform on which he happens to be. The shunt is generally placed about 10 feet from the top of the Escalator, as indicated in the accompanying reproduction of a photograph of the top of the first stairway.

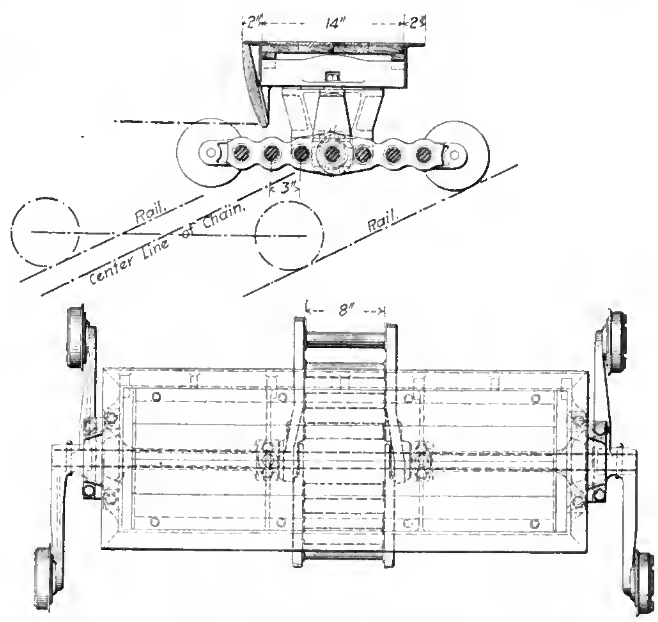
In the accompanying drawings are shown the general construction of the unit of the system, that is, the truck, and the arrangement of the drive, which is obtained by means of an electric motor with speed reduction through spur gearing. The Escalator is supported by a steel frame carried by the structure of the building itself, and rises upward at an angle of about 26 or 27 degrees with the horizontal. One hundred trucks were required, so that it can readily be appreciated that not only must the parts be interchangeable and constructed of durable material, but considerable care is required to obtain practically noiseless operation.

All parts of the running gear are made of crucible cast steel and the axles and link pins of cold-drawn steel. The parts are made to micrometer measurements, bolts being made to fill holes exactly without clearance, so that when erected no adjustment is necessary. The risers of the steps, which are 8 inches in a vertical distance, are formed with a curved surface, as shown, and are finished to the required convexity by automatic machinery designed for the purpose. So closely does the tread of each step remain against the riser of that next above it, during both the inclined travel and the assumption of the horizontal position, that a piece of paper can hardly be forced in the space between. In fact, the aperture is barely visible.

The links of the sprocket chain are made of two 18-inch cast-steel shrouds, with 1½-inch steel pins between them, at 3 inches between centers. The ends of the links are bushed with phosphor bronze, in which graphite is inlaid, thus providing lubrication to the bearing surfaces. In the interest of noiseless operation, the tracks are made up of wood and steel, with a layer of rubber between the tracks and the



Location of the Escalator Drive.



One of the Units, or Steps.

structural iron-work. Raw-hide pinions are used in the gearing and the wheels on which the steps run are deadened with a lead filling. The wheels are provided with graphite lubrication. For driving the Escalator, including the hand-rail, a 25-horse-power motor is installed, running at about 600 revolutions per minute. This speed is reduced by three sets of spur gearing to between 10 and 11 revolutions at the sprocket wheel, which drives the chain at 100 linear feet per minute, a speed that has been found satisfactory. It is stated that this speed will be increased when the public becomes accustomed to it.

The first Escalator in public service was installed in one of the buildings at the Paris Exposition of 1900. Since then Escalators have been placed in the Siegel-Cooper stores in New York and Chicago, in the Simpson Crawford Company's store in New York, Gimbel Brothers' store in Philadelphia and at the Twenty-third Street station of the Sixth Avenue Elevated Railroad in New York. In most of these the worm and wheel type of speed reduction has been employed. One of the most promising future installations will be made for one of the New York rapid transit railroad stations where an Escalator known as Duplex type will be built to carry passengers both up and down, the two flights being in the same plane.

Personal and Obituary Notes.

Mr. P. L. Reed has been appointed civil engineer in the U. S. Navy.

Mr. Edward A. Bond has been re-elected engineer and surveyor of New York State.

Frederick C. Waite, at one time city engineer of Leavenworth, Kan., was found dead in his rooms in that city October 27.

Messrs. Millard F. Tompkins and Henry G. Colvin have been elected directors of the O'Rourke Engineering Construction Company, of New York.

Mr. S. H. Neely, of the supervising architect's office, Treasury Department, Washington, has been detailed to supervise the construction of the United States legation building at Pekin, China.

Major Smith S. Leach, Corps of Engineers, U. S. A., and Lieut. George M. Hoffman, Corps of Engineers, have been appointed members of a board to study the water supply question at Fort Leavenworth, Kan.

Mr. William H. Wiley, of the well-known firm of publishers of scientific books, John Wiley & Sons, New York, and since 1884 treasurer of the American Society of Mechanical Engineers, has been elected to Congress from the Eighth District of New Jersey.

A dinner was held in New York November 10 by some 150 prominent architects to celebrate the twenty-first anniversary of the establishment of the School of Architecture of Columbia University and to honor its founder, Prof. William R. Ware.

Charles H. Miller, for many years consulting landscape engineer of the Fairmount Park, Philadelphia, died November 2 at his home in Mount Air, Pa., aged 73 years. He was made chief of the Bureau of Horticulture at the Centennial Exhibition in 1876.

Mr. Wm. Paul Gerhard gave a lecture before the students of the Massachusetts Institute of Technology, on November 1, on "The Sanitary Engineering Work of Large Modern Buildings," the lecture being illustrated by drawings and lantern slides.

Messrs. Kern Dodge and Charles Day, of the firm of Dodge & Day, Philadelphia, modernizing engineers, have returned from an extensive trip through the middle West, where they visited many of the principal machine shops and foundries gathering data on shop efficiency and factory methods.

Mr. A. S. Cheever, M. Am. Soc. C. E., has been appointed superintendent of the Fitchburg Division of the Boston & Maine Railroad, succeeding Mr. F. O. Melcher, M. Am. Soc. C. E., who resigned to become superintendent of the Illinois Division of the Chicago, Rock Island & Pacific Railway.

Mr. C. W. Bradshaw, superintendent of the Ohio & Northern division of the Louisville & Nashville Railroad, has been appointed superintendent of the Atlanta, Knoxville & Northern Railroad, and will be succeeded at Russellville, Ky., by Mr. Samuel Calloway, assistant superintendent at Birmingham, Ala.

President Palmer C. Ricketts, of the Rensselaer Polytechnic Institute, Prof. William H. Burr, of Columbia University, and Mr. Henry W. Hodge, of Boller & Hodge, New York, have been appointed a special commission to pass upon the relative merits of the revised and original plans of the Department of Bridges of New York for the Blackwell's Island bridge.

Mr. R. E. Newton, Assoc. M. Am. Soc. C. E., is now interested in the Newton Engineering Co., of Milwaukee, Wis., recently incorporated, which is equipping a shop for structural steel-work. He was at one time in the employ of the Keystone Bridge Works, and of the Wisconsin Bridge & Iron Co., and for several years was structural engineer of the Boston & Montana Mining Co.

William Forsyth, a former surveyor of the District of Columbia, died in Washington, November 4. He was born near Dublin, Ireland, in 1820, received his early engineering training in Europe and came to American in 1850, settling the following year in Washington. He had much to do with the planning and construction of street and sewer work in Washington, and did not retire from his official position until 1897.

Mr. Arthur E. Horton, who has been in the engineering department of the Metropolitan Park Commission of the Commonwealth of Massachusetts since that commission was first organized, has opened offices in the Tremont Building, Boston, as manager of the American Bureau of Information, National Industries, to engage in consulting work in preliminary and topographical surveys, adjusting boundaries, special map work, etc., for civil, mechanical and mining engineers and landscape architects.

Mr. L. E. Chapin, M. Am. Soc. C. E., and Mr. Morris Knowles, Assoc. M. Am. Soc. C. E., have formed a co-partnership for the practice of general and consulting engineering, with offices in the Frick Building, Pittsburg, and in the Central Savings Bank Building, Canton, O. For eight years Mr. Chapin was city engineer of Canton, and for the past eleven years has been in private practice. During the last five years Mr. Knowles has been engaged in water-supply investigation for Pittsburg, Philadelphia and New York City, and is still connected with the Pittsburg filtration work.

The following candidates for different grades of membership in the American Society of Civil Engineers were announced elected November 5: Member: U. B. Hough, mechanical engineer, Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho. Associate members: H. J. Chambers, with Milliken Bros., New York City; F. R. Davis, resident engineer, Buffalo, Rochester & Pittsburg Ry., Juneau, Pa.; L. H. Davis, chief assistant engineer, Lake Superior Power Co., Sault Ste. Marie, Ont.; A. B. Diehr, U. S. Dredge Epsilon, Memphis, Tenn.; W. H. Ham, engineer, New York Expanded Metal Co., New York; W. D. Hubbard, superintendent of water-works and sewers, Concord, Mass.; J. J. Pemoff, assistant engineer, Department of Docks & Ferries, New York; J. J. Walker, engineering department, American Bridge Co., New York. Juniors: G. J. Davis, Jr., Washington, D. C.; G. T. Paraschos, Constantinople, Turkey; E. M. Rhett, U. S. Engineer School of Application, Washington; F. M. Weaver, Philadelphia; Eduardo Ortiz, Mexico City, Mexico.

The Efficiency of Meters in keeping down the water consumption is commented on as follows in the annual report of the Board of Water Commissioners of Detroit: Sixty premises on which meters still remained, but where the owners were paying by estimated rates, were placed back on the meter roll on account of their large consumption, and it is astonishing how quickly the consumption on such places drops back to the normal quantity when they are obliged to pay by meter instead of estimated rates. They seem to think it no crime to waste public property, but when they have to meet the cost individually, it is immediately reduced to the minimum amount.

The Apportionment of Water Power at Ogdensburg, N. Y., became such a complicated matter in 1872 that the Supreme Court was called upon to settle the conflicting claims. The Oswegatchie River is dammed there by a timber structure, first built in 1796, and the water is delivered to mills through an open canal, except in the case of the municipal water-works. The power is partitioned into 26 first-class privileges and 75 of the second-class, and 62 of these, including all of the first-class, are in use. The method of apportionment, according to the U. S. Geological Survey, involves a system of weirs with movable crests, one at the entrance to each penstock. The head is never allowed to go below 8 feet. During low-water, excessive draft is prevented by raising the weirs. The crests of the weirs for second-class privileges are kept 1½ feet above those for first-class. A standard form of weir with a crest 4 feet long is used for all privileges.

The Action of Distilled Water upon lead was the subject of a report by Dr. Frank Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council, who has been investigating the subject and communicated the results to the members of the British Association at their recent meeting in Belfast, as stated in a recent issue of the "Journal of Gas Lighting." As the outcome of his experiments, he came to the conclusion that dissolved oxygen is the cause of the action of distilled water upon lead; the subsequent action of carbonic acid leading to the production of hydroxycarbonate. As it has been suggested that the action of water upon lead is indirectly due to the presence of bacteria, Dr. Clowes, in the course of his experiments, frequently exposed water sterilized by long boiling to lead which had been fused in a flask sterilized by steam in the presence of air which had passed through cotton wool. The oxidizing action occurred freely in all such experiments, presumably in the absence of bacteria and their products. The action of distilled water, or of soft waters generally, upon lead may be considerably reduced by dissolving various substances in the water. Sulphuric acid, or a sulphate, was found to be most efficient for this purpose; carbonic acid and carbonates proved less so; and lime water still less—in fact, it even promoted the action when it was used in larger proportion.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Peabody, Mass.—Engrs. Snow & Barbour, of Boston, write that C. E. Trumbull & Co., of Boston, have been awarded the contract for constructing 3,000,000 gal. masonry distributing reservoir at the Peabody water works. Price, $36,285.

Salem, Mass.—In regard to the proposition to establish a filtration plant for the Wenham Lake and Longham portion of the city water supply, City Clk. J. Clifford Entwish writes that nothing definite has yet been decided, the matter being in the hands of the Salem Water Bd. of which Frank F. Newell is Chmn.

Walnutport, Pa.—The Blue Ridge Water Supply Co. has been incorporated with a capital of $5,000.

Altoona, Pa.—The Water Comrs. have recommended the purchase of a site in Oakton for the proposed new reservoir for the city, which is to have an elevation of 1,460 ft. above the sea.

Tonawanda, N. Y.—The Municipal Bd. has awarded to the Holly Mfg. Co., of Lockport, the contract for an 8,000,000 gal. pumping engine, for $26,500.

New Castle, Pa.—State Chemist Aschman, of Pittsburg, in a recent report declares the water supply of this city to be impure and not desirable for drinking purposes. A Com. of 6 physicians (of which Dr. W. E. Zerner, Pres. of Lawrence Co. Med. Society, is a member) has been appointed to report upon various plans suggested to secure a pure water supply.

McKees Rocks, Pa.—Press reports state that the Pittsburg & Lake Erie R. R. will shortly let contracts for two water plants to be erected at McKees Rocks at a cost of $25,000 each. There will be two reservoirs with a capacity of 500,000 gallons each. Two pumps will supply the tanks, each having a capacity of 1,000 gallons a minute.

Northampton, Pa.—The Northampton Water Co. has been incorporated with a capital of $1,000. Incorporators: Alvin F. Newhart, Wm. F. Benninger and Benj. W. Roth, of Walnutport, and others.

Vineland, N. J.—The United Water & Light Co., principal office 613 Landis Ave., Vineland, has been incorporated to construct and operate water works, etc. Capital, $200,000. Incorporators: John B. Reynolds, Arthur A. Holbrook and Harry E. Sweeney.

Wilmington, Del.—The Texas Rice Irrigation Co. has been incorporated in Wilmington by Albert Barnes, J. G. Gray and S. S. Adams, of Wilmington. Capital, $500,000.

Meadville, Pa.—City Engr. W. A. Doane writes contracts have been let for drilling further test wells at 72 cts. per ft.

Baltimore, Md.—The ordinance authorizing the issue of city stock to the amount of $1,000,000 to improve the water supply was indorsed by the voters at the election held Nov. 4. The Water Bd. has decided, according to local press reports, to expend next year a portion of this loan as follows: For an additional storage reservoir, $350,000; for improving the upper service in district east of Jones Falls, $70,000, and for Southwestern Annex, $225,000.

Hammonton, N. J.—This town voted at the special election to issue $15,000 additional bonds to complete the water works.

Hillsville, Pa.—According to local press reports it is proposed to construct water works for this place. Geo. W. Johnson, of New Castle, and Delos Ferrell, of Hillsville, are said to be interested.

Oneida, N. Y.—It is stated that bids are wanted Nov. 11 for a 4-in. water main extension on North and Phillip Sts. J. F. Connor, City Clk.

Lancaster, Pa.—The Water Com. has directed the Water Supt. to lay mains on portions of Washington St. and College Ave.

At the recent election it was voted to borrow $145,000 to improve the water supply.

Ft. McRee, Fla.—The following bids were opened Oct. 28 by Capt. W. E. Cole, Q. M., at Ft. Barrancas, Fla., for water and sewer systems complete at Ft. McRee: T. W. Nicol & Co., Mobile, Ala., $14,998; Frank Sutter, Pensacola, Fla., $14,055; C. H. Turner, Pensacola, Fla., $15,775; Geo. H. Crafts, Atlanta, Ga., $14,945; Henry Monk, Pensacola, Fla., $12,250. Other bids received at the same time were as follows: H. T. Sinnott, Nashville, $4,492 for tank and tower; J. R. Keller, Pensacola, $7,836 for tank and tower and $3,800 for pump and boiler.

Richmond, Va.—The Com. on Finance & Water has appointed a sub-committee, of which Mr. Gorden is Chmn., to investigate the different plans suggested for raising necessary money for the construction of a settling and coagulating basin to cost $350,000, also a plan for raising money with which to construct a stand pipe for Lee Dist.

Portsmouth, Va.—The Portsmouth, Berkley & Suffolk Water Co. is asking, through its Gen. Mgr., Geo. H. Hornung, for bids for a 5,000,000 gal. pumping engine, with boilers, for the new pumping plant to be shortly erected at Lake Kilby, the designs of which are now under preparation.

Bristol, Va.—Bids are wanted Nov. 22 for $25,000 water bonds. E. E. Jones, Chmn. of Finance Com.

Gillett, Wis.—Local press reports state that it is proposed to construct water works.

Detroit, Minn.—Press reports state that estimates of cost are being prepared for a system of water works.

Odell, Ill.—An ordinance is said to have been passed that the users of city water must install meters before Jan.

Albia, Ia.—The citizens are reported to have voted a franchise for a water system.

Coulterville, Ill.—According to press reports the Illinois Central R. R. Co. will expend $38,000 in a water system at Coulterville on the St. Louis division. A reservoir covering 20 acres of ground and holding 60,000,000 gal. is now in course of construction, and a pumping plant with a capacity of 31,000 gal. per hour will bring water from the reservoir to a 100,000 gal. tank. W. J. Hanrahan, Ch. Engr. of R. R. Co., Chicago, Ill.

Goodhue, Minn.—The Village Council is considering plans for a new water works system.

Des Moines, Ia.—Local press reports state that the Water Co. will lay a new 24-in. feed main through the factory district between 6th Ave. and 11th St. and south of the railroad tracks.

Westbrook, Minn.—Engr. in Charge M. B. Haynes, of Mankato, Minn., writes that the contract for furnishing all material and completing a water works plant in Westbrook has been awarded to W. D. Lovell, Des Moines, for $6,934. The work includes approximately 1,806 ft. 6-in. mains, 535 ft. 8-in. mains, 7 hydrants, 4 valves and pumping station and an 80-ft. tower of steel with wooden tank. Other bids received Oct. 30 were from Fairbanks, Morse & Co., St. Paul, at $8,994, and from E. T. Webster, Dubuque, Ia., for $8,421.

Columbus, O.—C. E. Perkins, Ch. Engr. of Pub. Wks., writes that the contract for constructing a 2-span steel truss aqueduct, timber trunk, having a total length of 106 ft., to be built 1 mile south of St. Mary's on the Miami and Erie Canal, crossing St. Mary's River, has been awarded to the King Bridge Co., Cleveland, O., for $4,760.

Duluth, Minn.—Bids are wanted Nov. 24 for the purchase of $140,000 bonds issued by this city for the purchase of the West Duluth water plant. H. W. Cheadle, City Clk.

Youngstown, O.—Last week the item in reference to the report of Consulting Engrs. O. H. Jewell and Walter Wagner on the proposed filtration plant for this city, through error appeared under Xenia, O., instead of Youngstown, O.

West Milton, O.—Bids will be received Dec. 1 by John Coate, Village Clk., for constructing water works.

St. Cloud, Minn.—The Water Works Co. is said to have made a proposition to the city to sell the plant or will install a filtering plant if the city will make certain concessions.

East Grand Forks, Minn.—There is talk of laying further water mains for fire protection.

Dexter, Minn.—Bonds are reported to have been voted for a system of water works.

Jewell Junction, Ia.—Bonds for $7,000 are stated to have been voted for the construction of a system of water works.

Wheeling, W. Va.—The Water Bd. is considering the construction of an auxiliary main leading from the water works to the reservoir. Probable cost is said to be $75,000.

East Dundee, Ill.—Bids are wanted Dec. 1 for the construction of a stand pipe, engine and pump, as advertised in The Engineering Record.

Bloomington, Ill.—The sum of $5,000 is reported to have been appropriated for experimental purposes for the proposed improvement of the water supply. Elmer Folsom, City Engr.; J. F. Hulva, Chmn.

Wooster, O.—Consulting Engr. L. E. Chapin, of Canton, is quoted in local papers as having stated that it will cost from $100,000 to $125,000 to secure a good and adequate water supply for this city.

Newton, Ia.—Local press reports state that this place is making an effort to secure a waterworks system.

Marshfield, Wis.—The Common Council has asked for an appraisement of the water works and electric light plant, according to the term of the franchise.

Clinton, Ia.—The citizens of this place are said to be in favor of the construction of water works.

Lawrenceburg, Ky.—The proposition to issue $20,000 bonds for water works and an electric light plant, carried at the recent election.

Tuscaloosa, Ala.—The Tuscaloosa Water Works Co. is said to be preparing to extend the water mains from the Central College through West End, Deer Park and Southside.

Gunter, Tex.—The Gunter Water Works Co. has been incorporated with a capital of $3,000. Incorporators: J. Gunter, John Hardie and others.

Williston, N. D.—The Council is stated to have granted a franchise to ex-Mayor Johnson for the construction of water works and an electric light plant.

Snyder, Colo.—Local press reports state that Surveyor Baker and D. A. Camfield, of the South Platte Reservoir Co., are locating a site for a proposed storage reservoir to be constructed in the vicinity of Snyder, at a probable cost of $100,000.

Boise, Idaho.—Preliminary plans for the reservoir, with a capacity of 10,000 acre ft., to be built by the New York Canal Extension Co., have been filed with the state engineer. Application is made for 670 acres of state land, under the provision of the act of the last legislature, granting state land for reservoir purposes.

San Diego, Cal.—In a recent report to the Common Council City Engr. G. A. D'Hemecourt estimates the cost of building 2 dams in the city park at $14,060 for the lower dam and $13,730 for the upper dam; the estimated cost of constructing a conduit in B St. is placed at $50,440 for a structure of expanded metal concrete having an area of 16½ sq. ft. at the inlet and an area of 33.6 sq. ft. at the outlet.

Walla Walla, Wash.—The City Officials are investigating the gravity water system of Seattle with a view to installing a similar system at Walla Walla.

Seattle, Wash.—The City Engr. has estimated the cost of 22d Ave. water main at $20,928, and Galer St. at $32,500.

Lincoln, Neb.—According to press reports Wm. Frank and others propose the construction of an irrigation system in Scott's Bluff County, to cost $500,000. The ditch will be 150 miles long.

Carlsbad, N. Mex.—Local papers state that the Pecos Improvement Co., F. G. Tracy, Pres. and Gen. Mgr., proposes to construct a concrete flume in place of the wooden one that spans the Pecos River at Carlsbad, and conducts the water of the main irrigation canal; the flume will be 600 ft. long, with 4 steel and concrete piers. Estimated cost, $40,000.

Steamboat Springs, Colo.—Chas. Brown, of Parachute, Colo., and associates are said to have asked the Town Bd. for a franchise to construct water works.

Pueblo, Colo.—The Trus. of the North Side water works have ordered estimates and specifications prepared for a stand pipe, having a capacity of 1,000,000 gal., to be placed near Fairmount Park.

San Luis Potosi, Mex.—Local press reports state that this city is to have a complete system of water works, and a dam holding 400,000 cu. meters of water will be constructed at a cost of $68,000.

Hamilton, Ont.—Mgr. Barrow is said to be in favor of the construction of a storage reservoir for the city's water supply.

SEWERAGE AND SEWAGE DISPOSAL.

Van Buren, Me.—Local press reports state that a sewerage system is about to be put in.

Athol, Mass.—At a town meeting held Oct. 31 it was voted to borrow $20,000 for the construction of an extension to the sewer system, also construct sewers in portions of Main, Leonard and other streets and appropriating $8,000 for same.

Boston, Mass.—Bids will be received Nov. 12 by Jas. Donovan, Supt. of Streets, for sewerage works in portions of Tileston Ave.

York, Pa.—An ordinance providing for a loan of $400,000 for the construction of a sewerage system and disposal plant has passed first reading in the Common Council.

McKeesport, Pa.—Mayor Black has vetoed the ordinance providing for the construction of a $75,000 sewer in the 8th Ward.

Fulton, N. Y.—The State Supt. of Pub. Wks. has granted permission to the Bd. of Pub. Wks. of this city to lay 3 drain sewers running from E. 1st St. and discharging into Oswego Canal.

Wilkesbarre, Pa.—The Councils are considering the proposition to secure a loan of $380,000 for necessary improvements. According to a statement submitted by the City Engr. the required expenditure includes the following: Street Dept., $156,313, it being proposed to replace all cobblestones in the city streets with vitrified brick pavement; for retaining wall on N. Main St., $3,500; for sewers, $126,282; for engine house, $36,000; police station, $30,000 and public baths and crematory, $27,000.

Doylestown, Pa.—Boro. Clk. Jas. Flack writes that John C. Swartley, of Doylestown, is the Engr. in charge of proposed improvements to the sewerage system.

Buffalo, N. Y.—Ass't Engr. Hoffman, of the Dept. of Pub. Wks., writes that the following bids were opened Oct. 31 for the construction of 3,844 ft. of 48-in. to 27-in. brick sewer in Mumford St., with 13 manholes; trench to average 13 ft. in depth and be excavated in loam and gravel: John Mumm, 176 Best St., $14,900; McKeown & Johnson, $15,555; Miller, Franklin & Ritzman, $15,600; Jas. McElroy, $16,847; Dark & Co., $16,953; Beaser Bros., $17,112.

Allentown, Pa.—An ordinance before the Common Council provides for issue of $500,000 bonds for the purpose of installing a house sewerage system and disposal plant.

South Bethlehem, Pa.—Boro. Secy. Thos. Ganey writes that work will be started next spring on the sewerage system which it is proposed to construct at a cost of $100,000. R. K. Neumyer, Engr. in Charge.

Philadelphia, Pa.—The Councils Com. on Surveys has approved the schedule of appropriations needed by the Bureau of Surveys next year; the principal items are: $500,000 for Passyunk Ave. bridge over the Schuylkill; $216,616 for widening Delaware Ave., north of Vine St.; $100,000 for Cohocksink relief sewer; $250,000 for branch sewers; $500,000 for main sewers, and $500,000 for new bridges.

Newburgh, N. Y.—The Common Council has passed a resolution providing for the construction of Haines Crossroad sewer and two other sewers at a cost of $4,850.

Bradley Beach, N. J.—At the recent election it was voted to install a system of sewerage, and issue bonds for same to the amount of $23,800.

Anglesea, N. J.—Bids will be received Nov. 18 by Augustus Hilton, Mayor, for furnishing material for laying about 5½ miles of 8, 10 and 12-in. sewer pipe and constructing manholes and appurtenances. Wm. H. Boardman, Engr.

Brooklyn, N. Y.—Bids will be received by J. Edw. Swanstrom, Boro. Pres., Nov. 19, for furnishing material for alteration of sewers necessitated by Atlantic Ave. improvement subway in Franklin Ave. and other streets. Engineer's estimate is as follows: 2,035 lin. ft. 54-in. brick sewer, 17 manholes, 18,000 ft., B. M., foundation planking, 285,000 ft., B. M., sheeting and bracing, etc.

Oneida, N. Y.—City Engr. Vedder has been instructed to prepare plans and specifications for a sewer in Stone St.

Lancaster, Pa.—At the recent election it was voted to borrow $250,000 to extend and improve the sewer system.

Ft. McRee, Fla.—See "Water."

Ionia, Mich.—Bids will be received Nov. 11 by Marvin E. Kenyon, Co. Drain Comr., for cleaning and constructing a certain drain known and designated as Carbaugh and East Libhart Creek drain, located in Sebiwa, Orange and Portland Townships.

Mason City, Ia.—Bids will be received Nov. 18 by the Bd. of Trus. of the Iowa Odd Fellows and Orphans Home for constructing an 8 and 10-in. tile sewer about 4,425 ft. long. J. W. Marshall, Secy. of Bd., Storm Lake.

Atlantic, Ia.—Local press reports state that plans have been received from the Iowa Engineering Co., of Clinton, for the new sewerage system, which provide for 13 miles of 20-in. to 8-in. pipe sewers, 19 8-in. flush tanks, 12 5-in. flush tanks, 139 manholes and 12 drop manholes. The estimated cost is $42,516, of which $5,000 is for a sewage disposal tank.

St. Paul, Minn.—City Engr. Rundlett is said to be in favor of an expenditure next year of $120,000 for new main sewers.

Dixon, Ill.—According to press reports bids are wanted Dec. 7 for the construction of sewers in several streets. F. A. Truman, Pres.

Youngstown, O.—Local press reports state that new bids will probably be asked by the City Comrs. for the construction of Ingils St. sewer. C. E. Cross, City Clk.

Toledo, O.—Bids are wanted Nov. 17 for the construction of 8, 10 and 12-in. circular pipe sewers in 11th St. and certain alleys. Chas. H. Nauts, City Clk.

Bushnell, Ill.—Citizens are said to be agitating the matter of issuing bonds for a sewerage system.

Duluth, Minn.—The City Engr. has been instructed to make estimates for the construction of a trunk sewer from Grand Ave. to the Bay, following the line of Polk St. Ravine.

Delray, Mich.—The Council has decided to put in 2 sewers. Plans for sewers are said to be in the hands of ex-City Engr. R. H. McCormick, of Detroit.

Rock Island, Ill.—The City Council is reported to have voted for sewer extensions to cost $100,000.

Clinton, Ia.—The City Council has passed over the Mayor's veto a resolution instructing the City Engr. to prepare plans, specifications and estimates for a complete sewerage system for this city.

Paulding, O.—Bids will be received Nov. 25 by the Village Council for furnishing material and constructing a 12-in. sewer, including inlets and manholes, in portions of Cherry St. E. A. Ream, Village Clk.

Norwood, O.—Engr. J. A. Stewart, of Norwood, is reported to have drafted a plan for a sewerage system to start at Evanston, carrying off the sewage of the suburbs of Cincinnati in that vicinity through Norwood and drain, in addition, Hyde Park, Oakley, Pleasant Ridge, Kennedy Heights, Silverton and Madisonville. Probable cost about $200,000.

Peoria, Ill.—Local press reports state that ordinances are about to be introduced in the City Council for the following sewers: for Dist. No. 1, estimated cost $33,000; for districts in North Peoria, estimated cost $87,000, and for Persimmon St. sewer system, estimated cost $19,000.

Bisbee, Ariz.—Press reports state that a company of Tucson capitalists has asked for a franchise to construct a sewer system in Bisbee.

BRIDGES.

Boston, Mass.—The contract for the steel superstructure for sections A and B of the new Broadway bridge has been awarded to the Boston Bridge Works for $112,874.

The contract for building six masonry piers for the Atlantic Ave. bridge to South Boston has been awarded to W. H. Ellis, of this city, and the Mayor has approved the same. His bid was $69,700.

Wilmington, Del.—Press reports state that the Levy Court Comrs. propose to build a new bridge in place of Morrison's bridge over the Christiana.

Pittsburg, Pa.—It is reported that the Pennsylvania R. R. contemplates raising the 30th St. bridge, crossing Allegheny River at Herrs Island, the island end to be raised 20 ft., while the city end remains as at present. W. H. Brown, Ch. Engr., Philadelphia.

New York, N. Y.—Mayor Low has approved the ordinances appropriating $2,920,000 for work on Bridge No. 3, and $1,627,000 for work on the Blackwell's Island Bridge.

Reading, Pa.—The Co. Comrs. are reported to be considering the construction of another bridge across the Schuylkill River at Reading.

Oneida, N. Y.—It is stated that bids are wanted Nov. 11 for constructing a Portland cement concrete culvert over Higinbotham Brook, at Main St. J. F. Connor, City Clk.

McKeesport, Pa.—Mayor R. J. Black is stated to have signed the ordinance providing for the construction of a steel bridge at Versailles Ave.

Philadelphia, Pa.—See "Sewerage and Sewage Disposal."

Petersburg, Va.—Local press reports state that the Va. Passenger & Power Co. proposes either to make improvements to the Free bridge over James River for the electric railway from Petersburg to Richmond, or to build a new bridge.

Chicago, Ill.—Bids are wanted by the Drainage Bd., Sanitary Dist. of Chicago, until Nov. 19 for the purchase of $1,500,000 worth of bonds for the construction of bascule bridges and the widening of the river.

Wapakoneta, O.—Bids are wanted Nov. 28 for constructing a steel leg bridge across Auglaize River 2 miles north of Buckland, said bridge to consist of 1 span 156 ft. in length with 14 ft. roadway; also for constructing a steel leg bridge across Auglaize River 4 miles northeast of Wapakoneta, consisting of 1 span 124 ft. long, with 14 ft. roadway. W. H. Meyer, Co. Aud.

Traverse City, Mich.—At a recent meeting of the Council Engr. Blomshield, of W. Bay City, presented an estimate on a double arch concrete bridge with abutments to cost $16,500. Estimated cost of steel bridge $21,600.

Youngstown, O.—Local press reports state that the city and county propose to build jointly a viaduct about ⅓ of a mile in length to extend from Manning St. to Midland Ave. in the West End.

Delaware, O.—Local press reports state that the Columbus, Sandusky & Hocking R. R. will probably build a steel bridge over its crossing at North Sandusky St. F. R. Barrett, Engr. Maintenance of Way, Detroit, Mich.

Grand Rapids, Mich.—The contract for constructing piers and abutments for Wealthy Ave. bridge is stated to have been awarded to Jos. Higgins, of Grand Rapids, for $23,175.

Joliet, Ill.—The Joliet Bridge & Iron Co. is stated to have secured the contract for constructing the Red Mill bridge for $12,542.

Columbus, O.—The following bids were opened Oct. 30 by the Bd. of Pub. Wks., Julian Griggs, Ch. Engr., for the construction of sanitary sewers:

Bidders and Addresses.	Brick sewers. 4,602 ft. 2-ring, 36", 13 ft. cut.	4,509 ft. 1½-ring, 27", 13 ft. cut.	2,157 ft. 1½-ring 24", 14 ft. cut.	Pipe sewers. 2,705 ft. 20" 13 ft. cut.	2,133 ft. 18", 9½ ft. cut.	2,380 ft. 15", 6 ft. cut.	1,424 ft. 12", 12 ft. cut.	2,047 ft. 10", 8 ft. cut.	4,748 ft. 8", 9 ft. cut.	156 manholes.	3 interceptors.	1,285 ft. paving relaid.	Total.
J. B. Sheets & Co., Pittsb'h.	$3.85	$2.45	$2.40	$1.35	$0.98	$0.65	$0.75	$0.49	$0.49	$33	$140	$0.40	$51,840
John E. King, Tiffin, O....	3.92	2.86	2.50	1.46	1.00	.80	.85	.75	.63	34	150	.50	56,608
Lee & Casey, Pittsburgh, Pa	4.00	2.70	2.40	1.56	1.05	.77	.88	.63	.60	43	150	.20	57,012
N. B. Abbott, Columbus, O..	4.00	2.90	2.50	1.60	1.05	.80	.85	.69	.60	35	150	.50	57,348
W. H. Luchtenberg & Co. "	5.00	3.60	2.75	1.70	1.35	1.20	1.15	1.00	.95	35	165	.75	70,863
A. G. Pugh, Columbus, "	4.73	3.75	3.57	1.76	1.08	1.30	1.12	1.03	.94	40	110	.35	72,862

Kansas City, Mo.—Plans have been prepared for sewers in Sewer Dist. No. 211, which call for 25,000 ft. of pipe and 5,000 ft. of brick sewers, 101 manholes, 62 catch basins and 5 flush tanks. Total cost, $60,000. R. W. Waddell, City Engr.

Bessemer, Ala.—City Engr. Wm. J. Parkes writes that the time for receiving bids for the Second Ave. Dist. storm sewers has been postponed to Nov. 18; the proposed sewers will range in size from 18 to 42-in., and the estimated cost is $7,500.

Oak Cliff, Tex.—The City Council has granted the Citizens Sewerage Co. a 25-year franchise, for the construction of a sewer system. Incorporators: Ben. W. Smith, E. G. Patton and W. L. Addison.

Central Covington, Ky.—This town has voted $30,000 bonds for sewerage.

Marshalltown, Ia.—City Engr. Wm. Bremner writes that preliminary steps have been taken by the City Council for the construction of a viaduct about 1,500 ft. long, with approaches over the railroad track; nothing will be done, however, until the matter is acted upon by the State R. R. Comrs.

Grand Rapids, Minn.—See "Railroads."

Springfield, O.—City Engr. W. H. Sieverling writes it is proposed to build a combined roadway and electric railway bridge; style, truss or through girder; span, 130 ft.; width, 40 ft; material, medium steel.

Waukesha, Wis.—A section of the Barstow St. bridge, about 35 ft. in length, is reported to have collapsed. A new bridge will probably be constructed.

Niles, Mich.—The South Bend & Southern Michigan Ry. Co. expects soon to contract for a steel viaduct and bridge over the Michigan Central Ry. at Niles; length, about 220 ft. The main span, of about 90 ft., to be plate girder or riveted truss, end spans of rolled beams. W. S. Kinnear, Ch. Engr., Michigan Central, at Detroit, Mich.

Steubenville, O.—Secy. Jas. G. Mitchell, of Rochester, Pa., writes that the Steubenville Bridge Co. proposes to construct a bridge across Ohio River at Steubenville. Engr. in Charge, E. K. Morse, Pittsburg, Pa.

Saginaw, Mich.—Bids will be received by County Road Comr. Herman H. Eymer until Nov. 26 for the construction of the town line bridge across Cass River, to cost about $15,000.

Knoxville, Tenn.—Local press reports state that the Louisville & Nashville R. R. Co. (R. Montfort, Ch. Engr., Louisville, Ky.) is willing to enter into conference with the City and the Knoxville Traction Co. (Jas. Link, Ch. Engr., Knoxville) looking to the joint construction of a viaduct over the yards of the road at Clinch Ave.

Memphis, Tenn.—It is stated that plans have been completed for a $10,000 steel bridge to be constructed at Bway., near Elmwood, for the Southern Ry. (D. W. Lum, Engr. of Bridges, Washington, D. C.), the Frisco (C. D. Purdon, Ch. Engr., St. Louis, Mo.), and the Nashville, Chattanooga & St. Louis R. R. (Hunter McDonald, Ch. Engr., Nashville).

Tacoma, Wash.—A Council Com. is reported to be investigating the question of constructing a bridge across Puyallup River at St. Paul Ave. and a roadway across the flats on piles.

Milwaukee, Ore.—Preliminary surveys are stated to have been completed for a bridge for the Southern Pacific Ry. Co. across Willamette River, a short distance south of Milwaukee. R. Koehler, Mgr., Portland.

Chippewa, Ont.—Engr. in Charge Geo. Ross, of Welland, Ont., writes that the contract for building the superstructure of a steel bridge across Welland River at Montrose, 4 miles from Chippewa, has been awarded to the Hamilton Bridge Wks. Co., of Hamilton, Ont., for $8,117; the contract for the substructure was awarded to Jos. Battle, of Thorold, Ont., total, $10,998.

PAVING AND ROADMAKING.

Boston, Mass.—Bids will be received Nov. 17 by Jas. Donovan, Supt. of Streets, for constructing Columbia road between Buttonwood St. and N. Y., N. H. and H. R. R. bridge; also on the same date for constructing Columbia road between I and Q Sts.

Wilkesbarre, Pa.—See "Sewerage and Sewage Disposal."

Washington, D. C.—The schedule of the Engr. Dept. of street improvements to be undertaken next year in accordance with the request of the Commissioners in their estimates to Congress, includes $110,000 for paving in northwest section; $152,000 for grading, regulating and paving in northeast section; 76,800 for paving in southeast section; $66,700 for paving in southwest section and $41,000 for paving in Georgetown section.

Brooklyn, N. Y.—Bids are wanted Nov. 19 for furnishing material and labor required for the construction of cement concrete sidewalks in various streets; the Engineer's estimate places the total number of sq. ft. at 41,406. J. Edw. Swanstrom, Boro. Pres.

Buffalo, N. Y.—Bids are wanted Nov. 14 for repaving Niagara, 17th and S. Division Sts. and Willow Pl. Francis G. Ward, Comr. of Pub. Wks.

A correspondent writes that the following bids were received for paving Hamburgh Turnpike, from Buffalo River to the City Ship Canal, 36 ft. wide, 9,410 sq. yds.: Asphalt—German Rock Asphalt & Cement Co., $33,000; Barber Asphalt Paving Co., $28,042; Warner-Quinlan Asphalt Co., $33,230; Eastern Const. Co., $31,000; H. P. Burgard, $28,000. Brick—H. P. Burgard, $32,000; Barber Asphalt Paving Co., $30,488; F. V. E. Bardol, $32,000. Medina Sandstone—H. P. Burgard, $37,000; F. V. E. Bardol, $35,000; Wm. H. Kinch, $33,000; Barber Asphalt Paving Co., $41,216.

Hoboken, N. J.—Bids are wanted Nov. 26 for improving 6th and Madison Sts. and Willow Ave. by regulating grade, resetting curbs, relaying crosswalks and repaving roadway with present Belgian blocks. Jas. H. Londrigan, Acting City Clk.

Syracuse, N. Y.—The City Council has approved plans and specifications prepared by the City Engr. for paving Grape St. from E. Genesee to E. Kennedy Sts. with sheet asphalt or brick. The Council has adopted an ordinance providing the amount of money, to be raised to pay for the paving of Butternut St. with brick, be fixed at $67,000.

Silver Lake, N. Y.—Bids are wanted at the office of the Richmond County Park Comrs. until Nov. 17 for constructing road in Silver Lake Park, as advertised in The Engineering Record.

Washington, D. C.—Morris Hacker, Supt. of County Roads has reported to the Comrs. that to macadamize Nichols Ave. southward from St. Elizabeth's would cost $18,000.

Belleville, N. J.—The Bd. of Freeholders has received from Engr. Ralph Earle, of Jersey City, a report which places the estimated cost of improving Belleville Turnpike, for a distance of about 3 miles, at $55,025.

Pittsburg, Pa.—Local papers quote Dir. J. Guy McCandless as having stated that he will recommend appropriations for a large amount of paving for next year. Among the streets to be recommended will be Forbes St. and 5th Ave. to be repaved with asphalt.

Norwood Park, Ill.—In the County Court Judge Lovett has confirmed the special assessment rolls for the paving of a large number of the principal streets in Norwood Park at a cost of $75,000.

Springfield, Ill.—The contract for paving Allen St., over 1 mile long and 36 ft. wide, with sandstone curb, is stated to have been awarded to J. F. Bretz & Son, their bid being $1.38 per sq. yd. from 7th to 2d Sts., and $1.44½ per sq. yd. from 2d to Walnut Sts.; curbing, 54 cts. per lin. ft.

Toledo, O.—The lowest bids received for paving Clark St. were from Garrigan Bros. at $8,010 for vitrified block with $200 extra for concrete, and from C. H. Burchinals at $11,320 for asphalt block.

Bids are wanted by City Clk. Chas. H. Nauts until Nov. 17 for improving John and Machen Sts., Linwood Ave. and Dove Lane, by paving with either vitrified block or asphalt block on a foundation of concrete or a foundation of sand or broken stone. Bids are also wanted until Dec. 1 for the improvement of Detroit Ave. with a block pavement on a foundation of concrete, sand or broken stone.

Cincinnati, O.—City Engr. Stanley has been instructed by the Bd. of Pub. Service to prepare plans and specifications for the improvement of Hackberry St. from the end of the present improvement to Holloway, by paving with brick, and to improve Park Ave., from Foraker to Chapel, by paving with asphalt.

Hamilton, O.—A petition is being circulated asking the Bd. of Control to take necessary steps to have South Front St. paved.

Logan, O.—Bonds will be sold and a contract let early in the spring for 18,000 sq. yds. of vitrified brick paving. Engrs., Sieverling & Bauer, of Springfield, O.

Indianapolis, Ind.—The Bd. of Pub. Wks. has adopted a resolution for the paving of a portion of 20th St. with asphalt. Estimated cost, $22,850.

Keokuk, Ia.—The City Council has authorized City Engr. J. Ross Robertson to ask for bids until Nov. 27 for paving 4 streets and 1 alley, requiring about 4,500 sq. yds. of brick paving and 1,860 ft. of stone curbing. Bids to be received by Rice H. Bell, Clk. of Council.

Dallas, Tex.—Local press reports state that the Consolidated Street Ry. Co. will repave Main St. between its rails, at an expenditure of $67,000.

Topeka, Kan.—Property owners have petitioned for a 90-ft. brick pavement on Kansas Ave. from 10th to 13th Sts., with Allen County or Colorado stone curbing.

Pratt City, Ala.—Bids are wanted for paving and curbing certain sidewalks on 5 streets. J. E. Seay, Chmn. St. Com.

Ft. Worth, Tex.—Bids are wanted Nov. 21 for 25,000 sq. yds. of sheet asphalt and vitrified brick paving for Houston St. John B. Hawley, City Engr.

New Orleans, La.—Local press reports state that bids will be received by the City Comptroller for the repair of all asphalt streets in this city, for the care of which the city is responsible. City Engr. Hardee estimates that there are about 130,000 sq. yds. of asphalt pavement which will henceforth have to be maintained by the city.

Latonia, Ky.—This town has voted bonds to the amount of $30,000 for street improvements.

San Jose, Cal.—A project is under consideration for the construction of a county road to connect Santa Clara and San Joaquin Valleys by way of Mount Hamilton. E. P. Newhall, Surveyor of Stanislaus Co. (Modesto, C. H.), is said to be interested.

San Francisco, Cal.—The Street Com. of the Bd. of Supervisors has approved plans to repave Spear St. with asphalt block at an estimated cost of $11,200.

Redondo Beach, Cal.—Venable & Cleghorn are reported to have received contracts amounting to $46,000 for grading, graveling, guttering and curbing in this city.

POWER PLANTS, GAS AND ELECTRICITY.

South Norwalk, Conn.—The citizens are stated to have voted to appropriate $15,000 to enlarge the municipal electric light plant.

Hartford, Conn.—Mayor I. A. Sullivan is reported to be in favor of municipal ownership of the gas plant.

Mahanoy, Pa.—The Boro. Council is stated to have granted a franchise to the Mahanoy City Light, Heat & Power Co.

Camillus, N. Y.—A press report states that arrangements are being made to install an electric light plant in the knife factory. Lights will be furnished to the village from this plant.

Baltimore, Md.—At the election held Nov. 4 an ordinance authorizing the issue of city stock to the amount of $1,000,000, to extend the subway system for underground wires, was indorsed by a vote of the people.

Utica, N. Y.—T. E. McGarr, Secy. State Comn. in Lunacy, Albany, writes that the contract for rewiring and fixtures at Utica State Hospital has been awarded to F. L. Frost, of Albany, for $4,889.

Middletown, N. Y.—Bids are wanted Nov. 19 for electric wiring and fixtures for Pavilions Nos. 1 and 2 at the Middletown State Hospital, as advertised in The Engineering Record.

Altamont, N. Y.—The Altamont Illuminating Co., of Altamont, has been incorporated, to supply gas and electricity in Guilderland, Knox and Altamont; capital, $5,000. Directors: E. G. Crannell, Emmett Wynderse, Eugene Sand and others, all of Altamont.

Ft. Monroe, Va.—See "Government Work."

Vincennes, Ind.—The City Council is stated to have granted a 25-year franchise to the Vincennes Electric Light & Power Co.

Alton, Ill.—It is reported that the Alton Ry., Gas & Electric Co. is planning to lay 15 miles of additional gas mains within the next few months, and to extend the present mains to Upper Alton and North Alton. J. F. Porter, Pres., Alton.

Marshfield, Wis.—See "Water."

Akron, O.—John Lamparter and Ellsworth R. Bathrick are stated to have petitioned the City Comrs. for a franchise for a steam heating plant.

Rockford, Ill.—The Council has granted J. A. Walker and Fred K. Houston, representing the Central Heat & Power Co., a franchise for an electric light plant.

Barnesville, Minn.—The citizens are stated to have voted to issue $7,000 bonds to erect a power house and install new machinery for the village electric plant.

Chisholm, Minn.—Bids were opened Oct. 31 for an electric light plant, to be located at Chisholm, from plans of Prof. John J. Flather, of Minneapolis, for John Costin, of Virginia, Minn. Bids for building were rejected, but W. I. Gray & Co. received the contract for machinery, boilers and electrical work at $8,253.

Lawrenceburg, Ky.—See "Water."

Chattanooga, Tenn.—The Chattanooga Light & Power Co. has secured the contract for lighting the city for a term of two years.

Temple, Tex.—J. T. Smither and F. E. Merrill, of Temple, are stated to have petitioned the City Council for a franchise for a steam heating plant.

Covington, Ky.—Bids are wanted Nov. 13 for lighting the streets, alleys, public places and public buildings of the entire city with improved lights for a term of 2 years. Theo. Van Hoene, City Clk.

Hattiesburg, Miss.—A charter is reported to have been granted to the Hattiesburg Light & Power Co., with a capital of $30,000. M., R. H. and H. A. Hemphill are the incorporators.

Carrington, N. D.—The Western Electric Co., of Jamestown, N. D., is stated to have secured a franchise for an electric light plant.

Sterling, Colo.—O. P. Sells, of Pueblo, is stated to have secured a franchise for lighting the city by electricity for 20 years.

Davenport, Wash.—D. M. Glasgow, of the Davenport Machinery Co., writes that bids have been asked for the construction of an electric light plant. V. Schreder, Davenport, Engr. in Charge.

Williston, N. D.—See "Water."

Halifax, N. S.—Adam Weber's Sons, Park Row Bldg., New York City, have secured the contract for constructing a coal gas plant at Halifax for the Halifax Tram Co.

ELECTRIC RAILWAYS.

Clinton, Mass.—The R. R. Comrs. are stated to have granted new locations in Clinton to the Worcester Consolidated St. Ry. Co. W. W. McKee, Ch. Engr., Worcester.

Derby, Conn.—F. H. Fagan & Co., of Derby, are stated to have secured the contract for constructing the foundations for the new power plant of the C. R. & L. Co. to be built on Riverdale Ave.; contract reported to be about $65,000.

Jamestown, N. Y.—The City Council is stated to have granted a franchise to the Warren & Jamestown St. Ry. Co.

Batavia, N. Y.—The Highway Comrs. of Batavia are reported to have granted the Union Traction Co., which proposes constructing a railway from Olcott to Batavia, by the way of Medina, a franchise on the old Lewiston Road to the village line of Batavia.

Souderton, Pa.—A charter has been granted to the Souderton, Skippack & Fairview Electric Ry. Co., with a capital of $100,000. E. S. Moser, A. G. Reiff and Wm. M. Anders are among the incorporators. The line is to extend from Souderton to Trooper, a distance of 16 miles.

Oyster Bay, L. I., N. Y.—The citizens of the Town of Oyster Bay are stated to have voted Nov. 4 to grant a right of way for a trolley line over the main highways from the steamboat landing to the railroad station, and then on to the dividing line between the towns of Oyster Bay and North Hempstead, where the proposed road will connect with the trolley, to be built in that town so as to provide a cross-island trolley road from the Sound to the Great South Bay.

Syracuse, N. Y.—The Syracuse, Lakeside & Baldwinsville Ry. Co. and the Syracuse & Suburban Ry. Co. are stated to have petitioned the Council for franchises for a system of electric roads to extend over the entire city.

Lynchburg, Va.—The Lynchburg Traction & Light Co. is reported to have awarded to the General Electric Co., of Schenectady, N. Y., the contract for equipping the plant which it proposes to establish at Rensens, on the James River. The amount involved is reported to be $60,000.

Rome, Ga.—The City Ry. Co. is stated to have decided to extend the line to Lindale, a distance of 6 miles. A power plant will also be constructed. J. B. Marvin, Mgr., Rome.

Piqua, O.—The City Council is stated to have granted a franchise to the Springfield, Piqua & Sidney Traction Co.

Vermilion, O.—It is reported that plans have been prepared for a power house to be erected here for the Lake Shore Ry. Co. F. J. Stout, Gen. Supt., Toledo.

Abingdon, Ill.—The City Council is stated to have granted a franchise to the Peoples Traction Co.

Quincy, Ill.—Bracey, Howard & Co. are stated to have secured the contract for constructing a line from Quincy to Beardstown, for the Quincy & Southeastern Electric Ry. Co.

Manitowoc, Wis.—The City Council is stated to have granted a franchise to the Manitowoc & Northern Traction Co.

Vincennes, Ind.—The City Council is stated to have granted the Southern Traction Co. (Smiley N. Chambers, Pres., Indianapolis) a 50-year franchise. The company will operate an interurban line between Vincennes and Jasper, via Petersburg, a total distance of 44 miles.

Sheboygan Falls, Wis.—The Sheboygan Light, Power & Ry. Co. has petitioned the City Council for a franchise for an electric railway. Geo. B. Mattoon, Pres., Sheboygan.

Warsaw, Ind.—The Winona & Warsaw Ry. Co. has been incorporated, with a capital of $50,000, to construct an electric line between Warsaw and the Winona Assembly grounds. Directors: J. E. Beyer, S. C. Dickey and others.

Columbus, Ind.—The Indiana Central Electric Ry. Co. is reported to have been organized, to construct an electric railway to Brownsville and French Lick. Directors: M. O. Reeves, Columbus; John B. Burrell, Brownstown, and John P. Masters, Seymour.

Brainerd, Minn.—W. K. Swartz is reported interested in the construction of a street railway.

Lexington, Ky.—The business men of Lexington and North Middletown are reported interested in the construction of an electric railway between these cities. A. Smith Bowman, of Lexington, and Charlton Low, of North Middletown, are among those interested.

New Orleans, La.—It is stated that the New Orleans Rys. Co. will expend about $50,000 in improvements.

Houston, Tex.—Major C. C. Waller and associates have petitioned the Council for a franchise on Walker Ave. and Main St. for an electric line which they propose constructing from Houston to Galveston.

Oak Cliff, Tex.—The Northern Texas Traction Co. has petitioned the City Council for a franchise to construct a line from 1st St. to Washington Ave.

Opelika, Ala.—It is reported that a company is being formed with a capital of $200,000 to purchase the electric plant of the Alabama Light & Power Co. at Opelika and build an electric freight and passenger line from there to Auburn, a distance of about 7½ miles.

Cleveland, Tenn.—The Cleveland & Ducktown Electric Ry. Co. has been incorporated to construct an electric railway between Cleveland and Ducktown. Incorporators: C. A. Lyerly, C. E. James and others.

St. Louis, Mo.—J. D. Houseman, Mgr. of the St. Louis, St. Charles & Western R. R. Co., is stated to have secured a franchise from the Co. Comrs. at Clayton, making it possible for him to consolidate all the street railways in St. Louis County, and also to build connections, crossroads and extensions.

Leonard, Tex.—A meeting is reported to have been held here Oct. 28, with J. A. Thomas as Chmn., to consider the question of constructing an electric railway from Bonham, via Gober, Bailey, Leonard and Pike, to Blue Ridge.

Omaha, Neb.—The Co. Comrs. have granted Wm Hayden a franchise for an electric railway through Douglas Co.

Portland, Ore.—Winters, Parsons & Boomer, of Butte, Mont., are stated to have secured a contract to construct a 20-mile electric railway out of Portland, Ore.

Denver, Colo.—The Denver Tramway Co. (E. E. Sommers, Engr.) is about to build a brick power house at Wager and Platt Sts.; cost $40,000.

San Jose, Cal.—The City Council is stated to have granted F. F. Granger a franchise for an electric railway between San Jose and Congress Springs, a distance of 12½ miles.

Berkeley, Cal.—The Town Trus. are stated to have granted the Oakland Transit Co. a franchise to extend its line out College Ave. to the entrance of the University grounds. W. F. Kelly, Mgr., Oakland.

RAILROADS.

Buffalo, N. Y.—The N. Y. Central & Hudson River R. R. Co. is reported to be preparing plans for improving the Ohio St. docks and erecting new freight sheds at a cost of about $90,000. It is also proposed to erect a foot path 900 ft. in length across the freight yards at East Buffalo. J. P. Bradford, Div. Supt., Buffalo.

A press report states that the Lake Erie & Detroit River Ry. will be extended from St. Thomas to Buffalo, a distance of about 120 miles. Owen McKay, Ch. Engr., Walkerville, Ont.

New Castle, Pa.—A corps of engineers is reported to be surveying for a belt line to be constructed here for the Pennsylvania R. R., the Baltimore & Ohio R. R. and the Pittsburg & Lake Erie R. R.

Hobbs, Md.—A preliminary survey is stated to have been completed for an extension of the Queen Anne's R. R. from a point near Hobbs Station, Md., to Chincoteague, Va., a distance of 120 miles. Probable cost of construction is $2,500,000. J. W. Troxel, Ch. Engr., Queenstown, Md.

Lancaster, Pa.—The Pennsylvania R. R. Co. is reported to be making a survey for a new section of railroad in Lancaster County. It will connect the main line, at Gap, with the Columbia and Port Deposit R. R. at Shenk's Ferry. It will run through Salisbury, Paradise, Strasburg, Pequea, Martic and Conestoga Townships. W. H. Brown, Ch. Engr., Philadelphia.

Martin's Creek, Pa.—The Lehigh & New England R. R. Co. (W. H. Young, Ch. Engr., Pen Argyl, Pa.) is reported to be surveying for a line from Martin's Creek to Bangor and Pen Argyl, to connect with the Northampton R. R. at Martin's Creek.

Pennington Gap, Va.—The Louisville & Nashville R. R. Co. is reported to have a corps of engineers surveying a route from the main line at Pennington Gap, Va., through the coal regions of Virginia into the Kentucky mountains. R. Montfort, Ch. Engr., Louisville, Ky.

Farmville, Va.—The citizens of Prince Edward County are stated to have voted a subscription of $57,000 to aid in the construction of the Farmville & James River Valley Ry.

Grand Rapids, Minn.—The International Bridge & Terminal Co. has been incorporated to build and operate railways in Itasca County, and a bridge across the Rainy River into Canada; capital, $50,000. Incorporators: Washington Gray, A. A. Avery and others, all of Minneapolis.

Jackson, Ky.—Capt. C. J. Little, Pres. Lost Creek Coal Co., Lost Creek, Ky., is reported interested in the construction of a railroad from Jackson to Lost Creek, a distance of about 25 miles.

Dlo, Miss.—J. T. Jones, Prudential Bldg., Buffalo, N. Y., Pres. Gulf & Ship Island R. R., is reported interested in the construction of a railroad from Dlo or Mendenhall to Bluntville and Columbia.

Santa Fe, N. M.—The Eastern Ry. of New Mexico is reported to have filed incorporation papers Oct. 30 for the Atchison, Topeka & Santa Fe cut-off from Texico, near the New Mexico boundary, to Rio Puerco, in Valencia County. It will go through Abo pass and will cross the Rio Grande at Belen. It will be 265 miles long and will be the connecting link for a direct east and west line from Kansas City to Los Angeles. W. B. Story, Jr., Ch. Engr., Topeka, Kan.

Funk, Neb.—The Nebraska Pacific Ry. Co. has been incorporated with a capital of $1,000,000 to build a railroad commencing at Omaha, through the following counties: Douglas, Sarpy, Lancaster, Saunders, Butler, Seward, York, Polk, Hamilton, Hall, Clay, Adams, Kearney, Phelps and Gosper. Incorporators: Oley Erickson, Emmett L. Clark and others. Principal office to be at Funk.

Oakland, Cal.—The City Council is reported to have voted to grant a franchise to the San Francisco Terminal Ry. & Ferry Co. to operate a steam railroad through East Oakland and 3d St. to the Oakland harbor front.

Kalama, Wash.—The Coal Creek R. R. Co., of Portland, Ore., is reported incorporated, with a capital of $60,000, by W. H. Moody, Albert Bettington and J. P. McInerny to build a railroad commencing at a point in Cowlitz County, Wash., and running north through Cowlitz, Wahkiakum, Lewis, Pacific, Thurston, Chehalis, Mason, Jefferson and Clallam Counties.

Winnipeg, Man.—C. E. Hamilton, of St. Paul, Minn., on behalf of an American syndicate, is reported to have applied to the Manitoba Government for the incorporation of a company to build railways in the Canadian North-West.

PUBLIC BUILDINGS.

Boston, Mass.—The Congregation of Adath Israel is reported to have decided to erect a new temple. Jacob Hellborn, Chmn. Bldg. Com.

Pittsburg, Pa.—Bids are wanted Nov. 17 for the construction of shelter houses and houses of public comfort in Schenley Park and Highland Park. J. Guy McCandless, Dir. Dept. of Pub. Wks.

Harrisburg, Pa.—Geo. I. Lovatt, 424 Walnut St., Philadelphia, is reported to have been commissioned by the Bldg. Com. of St. Patrick's Cathedral, Harrisburg, to prepare plans and specifications for an edifice, to be erected on W. State St., to cost about $100,000. The church will be constructed of stone and will measure 120x150 ft.

Paterson, N. J.—The plans of Brite & Bacon, 111 5th Ave., New York, N. Y., are stated to have been accepted for the public library to be erected on Bway. and Auburn Sts., to cost about $150,000.

New York, N. Y.—The Armory Bd. is stated to have approved the plans of Hunt & Hunt, 28 E. 21st St., for the 69th Regt. Armory to be erected on 25th St. and Lexington Ave., to cost about $600,000.

Architects York & Sawyer, 156 5th Ave., are stated to have filed plans for the new granite building for the New York Historical Society to be erected on 76th St. and Central Park West. The cost of the whole building planned, including wings, is estimated at about $1,000,000. The central part, now to be erected, will cost about $450,000. Frank Tilford, Chmn. Bldg. Com.

Brooklyn, N. Y.—The Armory Bd. is stated to have selected 5 architects to make plans in competition for the proposed armory for the Second Battalion of Naval Reserves at 55th St., Brooklyn. The cost of the building is to be about $250,000. Plans to be submitted on Dec. 20.

Wilkesbarre, Pa.—See "Sewerage and Sewage Disposal."

Marietta, O.—The Bldg. Com. of St. Mary's R. C. Church is stated to have recommended the plans of Fughman & Uhlrick, of Cleveland, for an edifice to cost $50,000.

Bond Hill, O.—The Trus. of St. Aloysius Orphan Asylum in Bond Hill are reported to have decided to build a new chapel on the grounds of the institution, to cost about $20,000.

La Crosse, Wis.—Contracts for La Crosse County Court House have been awarded as follows: General construction to Peter Nelson, of La Crosse, for $121-847; plumbing to Thill & Lapitz, of La Crosse, at $1,230; heating to Fetter Baker Niebuhr Co., of La Crosse, at $6,786.

Bryan, O.—W. H. Buehrer, Deputy Aud., writes that on Nov. 3 Williams Co. Comrs. awarded the contract for hot water heating in the court house to Pressler & Pfeiffer, of Toledo, for $6,203.

Marion, Ind.—It is stated that bids are wanted Nov. 25 for erecting a $125,000 jail and jailer's residence. Richards, McCarthy & Bulford, Archts., Columbus, O.

Hendricks, Minn.—Bids are wanted Nov. 14 for erecting a village hall, lockup and engine house. John Eggen, Village Recorder.

Cleveland, O.—Bids are wanted Nov. 15 for furnishing and installing a steam heating system in the engine house at Kirkland St. Pumping Station. Chas. P. Salen, Dir. of Pub. Wks.

Winfield, Kan.—The plans of H. M. Hadley, of Topeka, are stated to have been accepted for a Carnegie Library, to cost $15,000.

Winnsboro, La.—Col. Stevens, of Alexandria, is stated to have prepared plans for a $20,000 court house for Franklin County.

Mississippi City, Miss.—The Superv. of Harrion Co. are stated to have selected the plans of Andrew J. Bryan & Co., of Jackson, for a $40,000 court house.

North Yakima, Wash.—The Congregation of St. Joseph's R. C. Church is stated to have decided to erect a new edifice of brick and stone, to cost $20,000.

Colorado Springs, Colo.—The contract for the wiring and electric fixtures for the new county court house is stated to have been awarded to Doss Bros., of Denver, for $5,500.

San Francisco, Cal.—The congregation of Emanu-El is stated to have decided to erect a new temple on Sutter St. and Van Ness Ave., to cost about $250,000.

BUSINESS BUILDINGS.

Greenfield, Mass.—A 5-story brick and brownstone addition 50x112 ft. is to be built to the American House. Drawings will be ready for estimates about Nov. 15. Architect, B. H. Seabury, of Springfield.

Arverne, L. I., N. Y.—It is stated that Alice Barrett will erect a hotel on Gaston Ave. and the ocean front, to cost about $35,000.

Auburn, N. Y.—The Auburn & Syracuse Electric Ry. Co. is stated to have decided to erect some new buildings here, for the storage of cars, etc.

Buffalo, N. Y.—Robt. J. Reidpath, Mutual Life Bldg., is the architect for a 3-story brick building to be erected on Main St. at Erie R. R. crossing for the Wright Taper Roller-bearing Co. Cost, $30,000.

Sharon, Pa.—The opera house owned by Jas. O. and L. S. Morgan is stated to have been destroyed by fire Oct. 30th. It will probably be rebuilt at once.

Atlanta, Ga.—The Southern Ry. Co. is stated to have decided to erect a $600,000 depot on Mitchell St. and Madison Ave. W. A. Vaughan, Div. Supt., Atlanta.

Charlotte, N. C.—Press reports state that F. P. Milburn, of Columbia, S. C., will prepare plans and specifications for a new hotel, to cost $100,000.

Milwaukee, Wis.—It is stated that the Schlitz Brewing Co. will erect a bottling house, to cost about $100,000.

Ft. Dodge, Ia.—W. J. Zitterell, of Webster, is stated to have secured the contract for erecting a freight depot for the Chicago Great Western R. R. for $25,000.

Winton, Minn.—The Union Iron Works, of Minneapolis, are stated to have secured the contract for erecting a saw mill at Winton for the St. Croix Lumber Co., for $50,000.

Waukegan, Ill.—John J. Flanders, Masonic Temple, Chicago, is stated to have completed plans for a 3-story store, office and flat building to be erected here for Clarence and Fred. Murray, to cost $40,000.

Chicago, Ill.—It is stated that a 7-story printing house covering 100x75 ft. is to be erected at 102-110 West Jackson Boule. for Mrs. Fannie E. Farrar, at a cost of $80,000.

The Standard Office Co. is reported incorporated, to erect an office building on Jackson and Michigan Boulevards, to cost about $2,000,000. E. P. Ripley, Pres. Santa Fe Ry., and Architect D. H. Burnham, Rookery Bldg., are reported to be among the incorporators.

Detroit, Mich.—Albert Kahn, Union Trust Bldg., is stated to have prepared plans for a $15,000 club house for the Detroit Racquet & Curling Club.

Columbus, O.—Frank Packard, Hayden Bldg., is reported to be preparing plans for a building for The Public Service Co., to be located at Mound and 17th Sts. The structure is 100x100 ft., to be of brick 1 story high, and have a smoke stack 180 ft. high. The contract for the foundation has been let. The new concern is to furnish heat and light to the public.

Bowling Green, O.—The Ohio Central Ry. Co. is stated to have decided to erect an $18,000 depot. Clifford Buxton, Ch. Engr., Toledo.

Crawfordsville, Ind.—The Wm. P. Jungclaus Co., of Indianapolis, is stated to have secured the contract for erecting the Big Four depot, for about $15,500.

Louisville, Ky.—The Sunnybrook Distillery Co. has taken out a building permit to erect a 5-story warehouse on 27th St. and Bway., to cost about $70,000.

Kansas City, Mo.—A. Van Brunt, 716 Delaware St., is the architect for a $30,000 brick store to be built at 9th St. and Bway. for B. Adler.

A. R. Meyer is about to erect a $35,000 brick store on Grand Ave. between 11th and 12th Sts.

Shepard & Farrar, Bank of Com. Bldg., are the architects for a brick store to be built for Baker & Lockwood at 3d and Oak Sts. Cost, $75,000.

Redlands, Cal.—L. Behymer, of Los Angeles, is reported to be organizing a company with a capital of $25,000, to build an opera house in Redlands.

Havre, Mont.—Architect Bell is stated to have prepared plans for a brick business building for O. G. Skylstead and the Stringfellow Drug Co.; probable cost, $20,000.

Winnipeg, Man.—Jas. Cadham is stated to be preparing plans for a warehouse to be erected on McDermot Ave. and King St. for Stobart, Sons & Co.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Cortlandt and Church Sts, 15-story br and stone office bldg; c, $500,000; o, New York Telephone Co; a, C L W Eidlitz; m, Chas T Wills; cr, Walt & Sinclair.

335 to 347 E 20th St; 3 6-story br and stone flats and stores; c, total, $90,000; o, Feller Sherufsky; a, Sass & Smallheiser.

43d St and 7th Ave, 4-story br and stone theater; c, $200,000; o, E C Potter; a, V Hugo Koehler.

322 and 324 W 48th St, 5-story br stable; c, $25,000; o, Mrs Ella Smith; a, M V B Ferdon.

DWELLINGS.

Boston, Mass.—The following plans have been filed with the Building Comr.: Block of six 4-story stone and brick residences, to be erected on Bay State Road, Back Bay, for Geo. Wheatland, 24 Congress St. Builders, Vaughan & Warren; architect, S. D. Kelley, 209 Washington St.; estimated cost, $120,000.

Four apartment houses, 4 stories each, brick and limestone; estimated cost, $150,000. Owner, E. A. Bangs; builder, Joseph Green; architect, D. H. Woodbury, 53 State St.

New York, N. Y.—McKim, Meade & White, 160 5th Ave., are stated to be preparing plans for a residence for Jas. Stillman to be erected on 72d St. and 5th Ave., to cost about $1,000,000.

Toledo, O.—Walter Hudson, Law Bldg., is stated to be preparing plans for a 3-story flat to be erected for John Coleman on 15th and Wisconsin Sts., to cost $12,000.

Chicago, Ill.—Milo D. Matteson will erect three 3-story apartment houses at 159-165 Lake View Ave. at a total cost of $75,000.

S. M. Seator, Reaper Blk., is stated to have prepared plans for a 3-story apartment house, to be erected on So. Park Ave. and 60th St., to cost about $100,000.

Evanston, Ill.—F. C. Letts will erect a residence on Ridge Ave. and Dempster St. to cost about $25,000.

Frank R. Kirkham will erect an apartment house on Davis St. and Oak Ave., at a cost of $30,000.

Detroit, Mich.—Chas. W. Koehler, 54 Buhl Blk., is stated to have completed plans for a 2-story brick apartment house of 9 flats for Chas. Holtz, to be erected at Grummond Ave. and Hamilton Boule., to cost $15,000.

St. Louis, Mo.—A building permit has been issued to H. Elliott, Jr., to erect a 2-story brick and stone residence at 5355 Kingsbury Boule. at a cost of $38,000.

Oakland, Cal.—W. G. Henshaw and A. W. Pattani are stated to have decided to erect a 7-story brick apartment house on Bush and Leavenworth Sts., to cost about $150,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Bway and 80th St, 10-story br and stone flat; c, $200,000; o, Wm C Dewey; a, John H Duncan.

Walton and Burnside Aves, 4 2-story br dwells; c, total, $24,000; o, Herman Hunnecke; a, J J Vreeland.

BROOKLYN.

Prospect Park West and President St, 6-story br apartment bldg, c, $200,000; o, Carl J Zimmerman; a, S O Schwartz.

SCHOOLS.

Charlemont, Mass.—H. W. Burrington and G. E. Bemis are members of the Bldg. Com. appointed to buy land and build a school house.

Boston, Mass.—Bids will be received Nov. 11 by the Schoolhouse Comn. for plumbing, masonry, carpentry and other work. R. Clipston Sturgis, Chmn.

Brooklyn, N. Y.—Bids are wanted by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., New York City, until Nov. 17, for the general construction of, addition to, and alterations in School 123, Boro. of Brooklyn; amount of security required, $75,000.

Castle Shannon, Pa.—Snee Bros., of Knoxville, are stated to have secured the contract for erecting a brick and stone school for $28,000.

Sparrows Point, Md.—Danl. Harding, of Towson, is stated to have secured the contract for erecting a school here for $26,772.

South Orange, N. J.—Wm. Devogel, of Passaic, is stated to have secured the contract for erecting the Maplewood School for $21,260, and N. S. Kellogg the contract for heating same for about $2,700.

New York, N. Y.—The Bd. of Trus. of the City College is stated to have adopted the final plans for the new buildings. Architect, Geo. B. Post, 33 E. 17th St. The Bd. of Estimate has already granted $600,000 of the $2,100,000 required.

Philadelphia, Pa.—John Wanamaker has purchased property on Broad and Christian Sts. and will erect on the site a building for Bethany College, to cost about $300,000.

Saginaw, Mich.—A $150,000 manual training school has been donated to this city by W. R. Burt. Architect not yet selected.

Cedar Falls, Ia.—The Trus. of the State Normal School are stated to have decided to erect a gymnasium next year, to cost about $50,000.

Marlin, Tex.—H. Galbraith, of Milford, is stated to have secured the contract for erecting a school here for $23,200.

Wahoo, Neb.—The directors of the Luther Academy are reported to have decided to erect a new school, at a cost of $18,000. Architect Plym, Brownell Bldg., Lincoln, is stated to have been selected to prepare the plans.

Salt Lake City, Utah.—Supt of Bldgs. Pinney is stated to be preparing plans for a school for the 18th Ward, to cost about $100,000.

Fresno, Cal.—The plans of the McDougall Bros., Voormum Blk., are stated to have been accepted for a 10-room brick school, to cost about $40,000.

Denver, Colo.—E. Philip Varian, Taber Bldg., is the architect for a brick and stone school to be built in South Denver, at a cost of $25,000, for the State School for Children.

STREET CLEANING AND GARBAGE DISPOSAL.

New Haven, Conn.—The following bids are reported to have been opened Oct. 28 by the Bd. of Health for the collection of garbage: Eastern district, R. D. Daley, $4,000; E. A. Hemingway, $4,250. Western district, Jos. Lawrence, $3,700; A. N. Farnham, $4,600.

New York, N. Y.—The only bid received Nov. 7 for the removal of snow and ice in Manhattan Boro. was that of the Century Const. Co., 21 Park Row, at 39 cts. per cu. yd. Bid rejected, and the contract is to be readvertised.

Rochester, N. Y.—The present contract for the collection of garbage expires the first of the year and bids will probably soon be asked for a new contract.

Milwaukee, Wis.—M. D. Newald, of this city, in a recent communication to the Common Council, has made a proposal to take over the garbage disposal plant on Jones Island, pay the city $6,000 a year rental and collect the garbage of the city for $77,500.

Kansas City, Mo.—City Physician Langsdale has been authorized by the Special Council Com. to receive bids for the collection and disposal of garbage in a sanitary manner by a heat process.

GOVERNMENT WORK.

Ft. McKinley, Me.—Capt. A. W. Yates, Q. M., U. S. A., Portland, Me., writes that contracts for work at Ft. McKinley have been awarded as follows: (bids opened Oct. 20): Construction to Chas. King & Co., of Boston, Mass., at $34,500 for Barracks 146; $19,600 for Officers' Quarters 142A; and $12,200 for Officers' Quarters 120C; total, $66,300. Plumbing to M. C. Hutchinson, of Portland, Me., at $3,945, $1,324 and $1,295 for the three buildings, respectively; total, $6,564. Heating to Arthur H. Moulton, Portland, Me., at $2,585, $1,125 and $725, respectively; total, $4,435. Electric wiring to Jas. Wilkinson & Co., of Boston, at $422, $327 and $248, respectively; total, $997.

Boston, Mass.—Bids are wanted at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., Mordecai T. Endicott, Ch. of Bureau, until Nov. 22 for constructing an extension of Pier No. 1 and doing necessary dredging at Boston Navy Yard, estimated cost, $53,000; until Nov. 29, for rebuilding machine shop No. 2, building No. 42, Boston Navy Yard, estimated cost, $91,000, and until Dec. 6 for constructing a brick and steel smithery building, Boston Navy Yard, estimated cost, $139,000.

Boston, Mass.—The following bids were opened Oct. 30 by Lieut.-Col. W. S. Stanton, Corps of Engrs., U. S. A., for dredging 35 ft. channels in Boston Harbor—*a*, in Broad Sound; *b*, in Upper Harbor: Carkin, Stickney & Cram, Detroit, Mich., *a* 40c. cu. yd.; *b*, 20c. cu. yd. G. H. Breymann & Bros., Toledo, O. (Divisions 3 and 4 only), *a*, 39c. cu. yd.; *b*, 20c. cu. yd. New England Dredging Co. and Eastern Dredging Co., Boston, *a*, 39.9c. cu. yd.; *b*, 23.7c to 26.7c. for different divisions. Bay State Dredging Co., Boston, Mass. (Division 4 only), *a*, 44c. cu. yd.; *b*, 25.5c. cu. yd. Morris & Cumings Dredging Co., New York (Divisions 2, 3 and 4 only), *a*, 40c. cu. yd.; *b*, 23.5c. cu. yd. The appropriation for this work is said to be $2,600,000.

New York, N. Y.—Bids are wanted at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., Mordecai T. Endicott, Ch. of Bureau, until Nov. 15 for removing from 90,000 to 140,000 cu. yds. of material from the waters of the New York Navy Yard.

Plattsburg Barracks, N. Y.—Bids will be received here Nov. 30 for constructing roads and gutters. Address Quartermaster.

Philadelphia, Pa.—Bids are wanted at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Nov. 29 for removing 500,000 cu. yds. of material from the waters of the Navy Yard, League Island, Pa.

Dover, N. J.—Bids are wanted at the U. S. Powder Depot until Nov. 22 for constructing loading house, also pump and boiler house; bids are also wanted until Nov. 28 for constructing brick and steel buildings as follows: magazine 50x150 ft.; storehouse 50x200 ft.; one building 30x75 ft. and one building 30x42 ft. O. B. Mitcham, Ord. Dept., Comdg.

Tompkinsville, N. Y.—Bids are wanted by Maj. Wm. T. Rossell, Corps of Engrs., U. S. A., at Tompkinsville until Nov. 18 for furnishing riprap stone for protection of Hog Island Shoal Light Station, R. I.

Washington, D. C.—Bids are wanted at the U. S. Engineer Office, Washington, until Dec. 3 for dredging in Rappahannock River, Milford Haven and Carters Creek, Va., and until Dec. 6 for dredging in Breton Bay, Md., and Lower Machodoc Creek, Va., as advertised in The Engineering Record.

New York, N. Y.—The lowest bid received at the Treasury Dept., Washington, D. C., on Nov. 5 for the mezzanine floor extension, Mail St. End, Registry Division, U. S. Court House and Post Office, New York, was from Kelly & Kelley, of New York City, at $13,796.

Ft. McRee, Fla.—Bids are wanted Nov. 19 by Capt. W. E. Cole, Q. M., at Ft. Barrancas, Fla., for constructing, plumbing and electric wiring, 2 single sets N. C. O. Quarters, at Ft. McRee.

Ft. McRee, Fla.—See "Water."

Norfolk, Va.—Bids are wanted Nov. 29 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., Mordecai T. Endicott, Ch. of Bureau, for constructing a brick and steel storehouse for equipment at the Norfolk Navy Yard; estimated cost, $68,000.

Ft. Monroe, Va.—Bids are wanted at the U. S. Engineer Office, Norfolk, Va., until Dec. 4 for furnishing generator, engine, switchboard, boiler and chloride accumulator elements for an electric plant at Ft. Monroe, as advertised in The Engineering Record.

Ft. Myer, Va.—Bids are wanted Nov. 22 for constructing Officers' Quarters, as advertised in The Engineering Record.

Indianapolis, Ind.—The contract for mechanical and electrical equipment for the U. S. Court House and Post Office is stated to have been awarded to Jas. McWilliams & Co., of Louisville, for $111,028.

Grand Rapids, Mich.—The following bids were opened Oct. 29 by Capt. Chas. Keller, Corps of Engrs., U. S. A., for extending the South pier at Manistee, Mich.: T. J. Bennett & Co., Muskegon, Mich., $13,038; Robt. Millen & Co., Muskegon, $13,754; Burk, Smith & Nelson, Muskegon, $14,455; Wm. Brownrigg, Manistee, Mich., $14,819.

Chicago, Ill.—The following bids were opened Oct. 29 by Lieut.-Col. O. H. Ernst, Corps of Engrs., U. S. A., for (*a*) dredging and (*b*) rock excavation, in Calumet River, Ill.: Saml. I. Dixon, Milwaukee, Wis., *a*, 25.8 cts. per cu. yd.; *b*, $8.40 per cu. yd. Fitz Simons & Connell Co., Chicago, *a*, 24.5 cts.; *b*, $5.90. Lydon & Drews Co., Chicago, *a*, 30 cts.; *b*, $6.00. Hausler & Lutz Towing & Dock Co., Chicago, *a*, 22.5 cts.; *b*, $5.50.

Ft. Lincoln, N. D.—Bids are wanted Dec. 1 for erecting a hospital. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Los Angeles, Cal.—Capt. Edgar Jadwin, Corps of Engrs., U. S. A., writes that contracts for dredging in Wilmington and San Diego Harbors, Cal. (bids opened Oct. 25) have been awarded as follows: To Raymond A. Perry, of Oakland, Cal., Division A which calls for the dredging of a channel at the entrance to Wilmington Harbor, Cal. (Inner Harbor at San Petro), to a depth of 20 ft. below low water, from near the outer ends of jetties to about 600 ft. north of Deadman's Island (amount available, $60,000), at 50 cts. per cu. yd., also Division B, which calls for dredging within Wilmington Harbor north of Division A, to a depth of 18 ft. at low water along principal wharfs and depth of not less than 14 ft. in approach to wharf (amount available, $40,000), at 16 cts. per cu. yd. To A. A. Polhamus, of San Diego, Division C, which calls for dredging in the ship channel across the ocean bar outside of entrance to San Diego Harbor, to a depth of 26 ft. at low water (amount available, $35,000), at 28.5 cts. per cu. yd.

Bids are wanted Nov. 26 by Capt. Edgar Jadwin, Corps of Engrs., U. S. A., at Los Angeles, for completing the jetty work at San Diego Harbor, Cal. A copy of the specifications for this work may be seen at the office of The Engineering Record.

Ft. Huachuca, Ariz.—Bids are wanted until Nov. 29 by Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, Colo., for constructing 2 lavatories at Ft. Huachuca.

Ft. Lawton, Wash.—According to local press reports the following bids were received at the U. S. Engr. Office, Seattle, for the construction of 7 buildings, including plumbing, steam heating and gas piping at Ft. Lawton: F. A. Pattus, of California, $100,852; $300 less if California slate is used. W. R. Nichols, Tacoma, $110,000; Bringham & Hoska, Seattle, $117,107; Wm. Peacock, of San Francisco, $135,665, if California slate is used. Separate bids for steam heating were also received as follows: S. E. Brown, of Seattle, $10,929; Washington Steam Heating Co., $11,222; Seattle Heat & Plumbing Co., $12,555. New bids for this work have been asked and will be opened Nov. 13.

Columbus, O.—The following bids were opened Oct. 21 by Maj. Dan C. Kingman, Corps of Engrs., U. S. A., for constructing breakwaters, the extension and reconstruction of parts of east and west piers at Conneaut Harbor, O.; alternate bids were received on East Breakwater, the bids on timber crib breakwater, pier-heads, timber crib and concrete piers, being the same in each case.:

Comparative cost of entire work with changes in type of East Breakwater.	L. P. & J. A. Smith Co., Cleveland, O.	Buffalo Dredging Co., Buffalo, N. Y.	Hughes Bros. & Bangs, Syracuse, N. Y.	Geo. W. Carter's Sons' Co., Buffalo, N. Y.	Standard Cont'g Co., Cleveland, O.	Hausler & Lutz Towing & Dock Co., Chicago, Ill.	Donnelly Contr'g Co., Buffalo, N.Y.
If East Breakwater Is Constructed of Rubble Mound.							
Timber crib breakwater..........	$28,320	$30,063	$28,150	$25,760	$31,115	$31,799	$25,485
Two pier-heads (50 ft. sq.)......	37,621	42,786	37,542	40,760	44,925	45,573	33,534
One rubble mound breakwater...	171,380	230,800	168,410	147,750	219,050	206,250	146,790
Timber crib and concrete piers...	240,200	274,264	243,953	341,637	319,579	302,128	232,427
Totals	$477,521	$577,913	$478,055	$555,907	$614,669	$585,750	$438,236
If East Breakwater Is Constructed of Rubble Mound, Type "B."							
One rubble mo'nd br'kw'r, Type "B"	167,740	215,000	166,540	139,300	217,050	212,650	147,190
Totals	$473,881	$562,113	$476,185	$547,457	$612,669	$592,150	$438,636
If East Breakwater Is Constructed with Timber Cribs and Concrete.							
One timber crib and con. br'kwater	187,284	187,025	191,305	203,890	228,330	230,091	169,725
Totals	$493,425	$534,138	$500,950	$612,047	$623,949	$609,591	$461,171

Wheeling, W. Va.—The following bids were opened Oct. 30 by Capt. W. E. Craighill, Corps of Engrs., U. S. A., for building lockwalls and guide walls for Dam No. 18, Ohio River, about 4 miles above Parkersburg, W. Va.:

Items and Quantities.	Henry P. Burgard, Buffalo, N. Y.	Robt. A. Cummings, Pittsburg, Pa.	Evansville Con. Co., Pittsburg, Pa.	Sheridan-Kirk Con. Co., Madison, Ind.	Aetna Const. Co., Wheeling, W. Va.
Grubbing and clearing 4 acres...........	$125.00	$50.00	$25.00	$75.00	$250.00
Hemlock timber, 310 M ft. B. M..........	30.00	40.00	40.00	40.00	45.00
Sheet piling, 63 M ft. B. M.............	40.00	60.00	45.00	100.00	60.00
Round timber, 41,000 lin. ft............	.15	.30	.25	.15	.25
Round piling, 1,300 lin. ft.............	.20	.50	.30	.45	.50
Common filling, 84,000 cu. yds..........	.40	.50	.27	.50	.60
Puddling, 3,800 cu. yds.................	1.50	2.50	2.00	2.00	2.00
Stone filling, 6,250 cu. yds............	1.50	3.50	1.50	2.50	3.00
Common excavation, 48,400 cu. yds.......	.50	.60	.25	.40	.50
Rock excavation, 5,010 cu. yds..........	1.00	3.00	2.50	3.00	1.00
Concrete, 23,100 cu. yds................	4.50	5.00	4.00	5.00	5.50
Oak timber, 21 M ft. B. M...............	30.00	60.00	50.00	80.00	60.00
Paving, 4,900 cu. yds...................	2.50	4.00	3.50	6.00	5.00
Curbing, 70 cu. yds.....................	8.00	6.00	7.00	11.00	12.00
Bolt holes, 1,400 lin. ft...............	.15	.50	.50	.35	.40
Iron and steel, 211,800 lbs.............	.06	.05	.05½	.06	.06
Vitrified pipe, 8-in., 800 lin. ft......	.50	.20	.35	.50	.60
Vitrified pipe, 12-in., 150 lin. ft.....	.70	.30	.50	.75	1.00
Galvanized iron pipe, 3-in., 4,000 lin. ft...	.30	.75	.60	.50	.75
Galvanized iron pipe, 2-in., 1,050 lin. ft...	.25	.60	.40	.40	.55
Galvanized iron pipe, 1½-in., 100 lin. ft....	.20	.50	.40	.30	.35
Highway, 2,800 sq. yds..................	1.25	1.00	.50	1.00	2.00
Total	$232,410	$301,530	$218,309	$291,660	$312,350

Shreveport, La.—Capt. Chas. L. Potter, Corps of Engrs., U. S. A., Vicksburg, Miss., writes that the contract for constructing dikes, etc., in Red River at Shreveport (bids opened Nov. 1) has been awarded to Hunter & Frey, 3 Monroe St., Memphis, Tenn., as follows: 29,000 lin. ft. of piles, 28 cts. per ft.; 15,000 ft., B. M., lumber, $40 per 1,000 ft.; 1,750 lbs. spikes, 6 cts. per lb.; 750 bolts with nuts and washers, 80 cts. each; 24,000 lin. ft. galvanized steel wire strand, 2 cts. per ft.; 1,500 cords brush fascines, $4.25 per cord; 750 stakes, 20 cts. each; 26,000 cottonseed sacks, $150 per 1,000; 400 lbs. staples, 8 cts. per lb. Total, $20,362. The only other bid received was from Grigsby Const. Co., at a total of $35,588.

Ft. D. A. Russell, Wyo.—Bids are wanted Dec. 1 for erecting a pump-house. Address Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, Colo.

Cheyenne, Wyo.—The following bids were opened Nov. 4, at the Treasury Dept., Washington, D. C., for a conduit and electric wiring system for the U. S. Public Bldg. at Cheyenne: Arthur Frantzen, Chicago, $3,940; Riddle & London, St. Paul, $2,967; Cheyenne Light, Fuel & Power Co., Cheyenne, $4,081.

MISCELLANEOUS.

Cohoes, N. Y.—Bids are wanted Nov. 15 for the purchase of $54,179 public improvement bonds. Miller Hay, City Chamberlain.

Baltimore, Md.—The Bd. of Estimates has passed the budget of the Park Bd. for 1903, allowing that department $351,168. This includes provision for establishing 35 new electric arc lights in Druid Hill Park.

New York, N. Y.—The following bids were opened Nov. 3 by Comr. of Docks McDougall Hawkes for about 279,500 cu. yds. of dredging on the North River, between W. 21st St. and W. 23d St.: International Contracting Co., 42 cts. per cu. yd; Morris & Cumings Dredging Co., 40 cts. per cu. yd.; R. G. Packard Co., 27½ cts. per cu. yd. (awarded).

Baltimore, Md.—Bids are wanted Nov. 12 for wharf repairs. Address Thos. G. Hayes, Pres. Bd. of Awards.

Philadelphia, Pa.—The chief engineer of the city is said to be preparing plans and specifications for the extension of the 26-ft. channel in Schuylkill River, under the appropriation of $400,000 provided in the recent Loan bill. A survey is also in progress upon Schooner Ledge to determine the amount of rock to be removed at that locality to give a 30-ft. channel.

Newark, N. J.—The proposition to issue $1,000,000 bonds for the Essex County Park Comn. is reported to have carried at the recent election.

Augusta, Ga.—At a recent meeting of representative business men and property owners a resolution was passed asking the City Council to build a levee for protection from high water.

Terre Haute, Ind.—The directors of the Honey Creek Dyke & Ditch Co. have filed a petition with the County Comrs. for the issue of $17,000 bonds to defray the expenses of proposed improvement. Frank Rigney, Chas. H. Bentley and others are directors of the company.

Superior, Wis.—Surveyors are said to be at work laying out a site for the third ore dock to be erected by the Great Northern railroad in this city. The dock will be located on Allouez Bay, east of the present docks.

St. Louis, Mo.—Ch. Engr. of Louisiana Purchase Exposition Richard H. Phillips, writes that the following bids were received for construction of Cascades, which are located north of the Main Art Building: Heman Cons. Co., St. Louis, $103,437; J. J. Lynch, $181,065; R. W. Morrison Cons. Co., $148,636; Shutt Improvement Co., $104,119; Rich Cons. Co., $135,791.

St. Louis, Mo.—The franchise granting the Missouri & Meramec Water Co. permission to construct a canal between the Missouri River at Centaur and the Meramec at the Highlands has been approved by the County Court at Clayton. Cortez A. Kitchen, Vice-Pres., is quoted as having stated that it is the intention of the Co. to increase its capital stock to $10,000,000 and push the work to completion.

Vicksburg, Miss.—The Fifth Louisiana Levee Comrs. are reported to have decided to extend the levee in the lower end of Concordia Parish, and will let out 300,000 yds. of levee work at that place.

Chattanooga, Tenn.—An ordinance establishing a park in South Chattanooga has been passed by the Lower Bd. of the Council.

Port Angeles, Wash.—Application has been made to the Council by C. A. Griggs, Frank Miller and Wm. K. Clark for a franchise to construct and maintain a dock at the foot of Oak St. The applicants are trustees of a company organized with a capital of $10,000 to build said dock.

NEW INDUSTRIAL PLANTS.

The Clinton Knitting Co., Syracuse, N. Y., is putting up a 4-story, 50x236-ft. brick factory building. The power plant will include a 150-H.-P. boiler and a 125-H. P. engine.

T. D. Kemp, Marion, Ala., is interested in an effort to establish a $25,000 or $30,000 plant for spinning yarn at that place.

The Ground Hog Plow & Foundry Co., Clarksville, Tenn., has bought the plant of Drane & Co., founders and machinists, and will enlarge same.

George Lueders & Co., 218 Pearl St., New York, whose chemical factory at South Elizabeth, N. J., was recently burned, expect to rebuild, probably on a larger scale.

The Alabama Portland Cement Co., Ltd., Demopolis, Ala., will build 60x100 and 40x90 ft. extensions and other smaller additions of structural steel. The addition to the steam plant will be 500 H.-P.

The Whatcom Falls Mill Co., Whatcom, Wash., will erect a saw mill, shingle mill, sash and door factory and wood-working plant, and is in the market for machinery.

Schloss Bros. & Co., Baltimore, Md., will erect a 7-story and basement building to have not less than 20,000 sq. ft. to the floor, and will be in the market for two 80-H.-P. boilers, two 75-H.-P. engines, dynamos, electric light plant and machinery for handling, cutting and making clothing.

One of the elevators of Geo. Bullen & Co., 332 Illinois St., Chicago, maltsters, containing about 50,000 bu. of barley, was destroyed by fire, entailing a loss of about $25,000 on barley and about $30,000 on the elevator.

The Hale & Kilburn Mfg. Co., 48 North 6th St., Philadelphia, expects, within 30 days, to invite bids for a new plant having about 200,000 sq. ft. floor space, exclusive of dry kilns and lumber storage. The company expects to install engines of about 350 H.-P., and the plant will be electrically driven, the engines being direct connected. Lockwood, Greene & Co., Boston, Engrs.

BUSINESS NOTES.

The S. Wilks Mfg. Co., 53-55 So. Clinton St., Chicago, maker of water heaters, steam generators and steel tanks, will erect a 200x150-ft. factory, partly two stories, which it expects to occupy about Jan. 1. All contracts have been let.

The Vincent Valve Co., Sandusky, O., is erecting a 42x100-ft. brass foundry and extending the iron foundry so as to give 2,000 sq. ft. additional working space. No additional power will be required.

The F. D. Cummer & Son Co., Cleveland, has just sold one of its Cummer semi-portable asphalt paving plants to The Marion County Construction Co., of Indianapolis.

The Ball Engine Co., Erie, Pa., reports the following among recent orders for engines: Cedar Rapids, Ia., Electric Light & Power Co.; Miehl Printing Press Mfg. Co., Chicago, a 300-H.-P. engine; Stromberg, Neb., Electric Light, Heat & Power Co.; Williams Coal Co., McHenry, Ky.

F. G. Street, 36 LaSalle St., Chicago, Ill., has been appointed sole agent for Northern Illinois, Indiana, Michigan, Minnesota, Wisconsin, North and South Dakota and Kansas, for the Scaife and We-Fu-Go water-softening and purifying systems, manufactured by Wm. B. Scaife & Sons Co., Pittsburg, Pa.

The New England Structural Co., of Boston, is furnishing the steel framework for the Monadnock Mills, at Bennington, Vt. Dean and Main, Engrs.

The American Blower Co., Detroit, Mich, reports recently booking a large number of orders for heating apparatus, including plants for the Lackawanna Steel Co.'s roll shop at Buffalo, N. Y.; Pittsburg, Pa., Valve Foundry Cons. Co.; Fox Typewriter Co., Grand Rapids, Mich., and the National Malleable Castings Co., Sharon, Pa., also the entire drying apparatus for the new starch factory of Piel Bros., Indianapolis, Ind.

The Sherwin-Williams Paint Co., of Cleveland, O., is equipping all its works for electric power distribution, having recently purchased for the Cleveland works three alternating-current generators of 150-Kw., 120-Kw. and 75-Kw. capacity, respectively, and about 500 H.-P. in induction motors, which will be used to drive all paint and varnish making machinery. It has also equipped the Newark, N. J., works with one 75-Kw. alternating-current engine-type generator and a number of motors and is about to install a duplicate plant at the same works. At Pullman, Ill., it is putting in a 120-Kw. alternating-current generator and one of 100-Kw., and about 200 H.-P. in induction motors. The electrical apparatus for the several plants is being furnished by the Westinghouse Electric & Mfg. Co.

Recent sales of Renold silent chain by the Link-Belt Engineering Co. include: Nine line shaft drives from motors for the new works of the Patton Paint Co., Newark, N. J.; eight drives from motors to line shafts and elevators in the new model plant which the Crompton & Knowles Loom Works are erecting in Philadelphia; and eight 60-H.-P. drives for induced-draft blowers in the new Waterside Station of the New York Edison Co. There are now sixty-one Renold silent chains in use in the new building of R. H. Macy & Co., varying in capacity from 1 to 90 H.-P.

The Pittsburgh Gage & Supply Co., Pittsburgh, Pa., reports the following among recent orders: 150-H.-P. boiler for the Lincoln Fire Brick Co., Bolivar, Pa.; 150-H.-P. boiler for the American Porcelain Co., New Brighton, Pa.; 150-H.-P. boiler for the Keystone Mining Co., Leadville, Colo., and one 35-H.-P. automatic engine for the Clearfield, Pa., Steam Laundry Co.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Nov. 10.	Bonds, Sterling, Colo	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Nov. 11.	Oneida, N. Y.	Nov. 8
Nov. 12.	Penngrove, N. J.	Nov. 1
Nov. 15.	Ft. Columbia, Wash.	Nov. 1
Nov. 26.	Newport, R. I.	Oct. 25
Dec. 1.	West Milton, O.	Nov. 8
Dec. 1.	East Dundee, Ill.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec 1.	**Pumps, Seguin, Tex.**	**July 26**
Dec. 20.	Pumping engines, Louisville, Ky.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 8.	
	SEWERAGE AND SEWAGE DISPOSAL.	
Nov. 11.	Ionia, Mich.	Nov. 8
Nov. 11.	Oneida, N. Y.	Oct. 25
Nov. 12.	Boston, Mass.	Nov. 8
Nov. 12.	Brooklyn, N. Y.	Nov. 1
Nov. 12.	Cincinnati, O.	Nov. 1
Nov. 15.	Ft. Columbia, Wash.	Nov. 1
Nov. 15.	Washington, D. C.	Oct. 25
	Adv., Eng. Record, Oct. 25.	
Nov. 15.	Akron, O.	Oct. 25
Nov. 17.	Toledo, O.	Nov. 8
Nov. 18.	Anglesea, N. J.	Nov. 8
Nov. 18.	Bessemer, Ala.	Nov. 8
Nov. 18.	Mason City, Ia.	Nov. 8
Nov. 19.	Brooklyn, N. Y.	Nov. 8
Nov. 20.	Canal Dover, O.	Nov. 1
Nov. 25.	Paulding, O.	Nov. 8
Nov. 26.	Cincinnati, O.	Nov. 1
Dec. 7.	Dixon, Ill.	Nov. 8
Dec. 15.	**Montevideo, Uruguay**	**Sept. 13**
	BRIDGES.	
Nov. 11.	Oneida, N. Y.	Nov. 8
Nov. 12.	Oskaloosa, Ia.	Nov. 1
Nov. 13.	Oberlin, Kan.	Nov. 1
Nov. 13.	Shreveport, La.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 8.	
Nov. 14.	Paulding, O.	Oct. 25
Dec. 17.	Chicago, Ill.	Nov. 1
Nov. 18.	Harrisburg, Pa.	Nov. 1
Nov. 20.	Doylestown, Pa.	Nov. 1
Nov. 26.	Saginaw, Mich.	Nov. 8
Nov. 28.	Wapakoneta, O.	Nov. 8
Dec. 1.	**Bigtimber, Mont.**	**Sept. 27**
	PAVING AND ROADMAKING.	
Nov. 12.	Cohoes, N. Y.	Nov. 1
Nov. 12.	Cincinnati, O.	Oct. 18
Nov. 14.	Buffalo, N. Y.	Nov. 8
Nov. 15.	Akron, O.	Oct. 25
Nov. 17.	Toledo, O.	Nov. 8
Nov. 17.	Silver Lake, N. Y.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Nov. 17.	Boston, Mass.	Nov. 8
Nov. 17.	Cincinnati, O.	Nov. 1
Nov. 19.	Brooklyn, N. Y.	Nov. 8
Nov. 21.	Ft. Worth, Tex.	Nov. 8
Nov. 26.	Hoboken, N. J.	Nov. 8
Nov. 27.	Keokuk, Ia.	Nov. 8
Dec. 1.	Toledo, O.	Nov. 8
Dec. 1.	Delphi, Ind.	Oct. 25
Dec. 11.	Guthrie, Okla. Ter.	Nov. 1
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	
— —	Pratt City, Ala	Nov. 8
	POWER, GAS AND ELECTRICITY.	
Nov. 12.	Penngrove, N. J.	Nov. 1
Nov. 13.	Covington, Ky.	Nov. 8
Nov. 14.	Eng., Dynamo, etc., Minneapolis, Minn.	Nov. 1
Nov. 15.	Abilene, Tex.	Nov. 1
Nov. 15.	Baton Rouge, La.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 8.	
Nov. 15	**Norfolk, Va.**	**Sept. 13**
Nov. 18.	Superior, Wis.	Oct. 25
Nov. 18.	Washington, D. C.	Oct. 25
Nov. 19.	Elec. wiring, hosp., Middletown, N. Y.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 4.	Ft. Monroe, Va.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Jan. 15.	Rome, Ga.	Oct. 11
Mar. 5.	Franchise, Manila, P. I.	Nov. 1
	GOVERNMENT WORK.	
Nov. 10.	Ft. Ethan Allen, Vt.	Oct. 18
	Adv., Eng. Record, Oct. 18 to Nov. 8.	
Nov. 10.	La Purchase Expo. Bldgs., St. Louis, Mo.	Oct. 11
	Adv., Eng. Record, Oct. 11, 18.	
Nov. 10.	(Lemon Creek) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	Newport, R. I.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	(Raritan Bay) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	(Woodbridge Creek) New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 10.	Removal of ledge, New York, N. Y.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 1.	
Nov. 12.	Mobile, Ala.	Oct. 18
	Adv., Eng. Record, Oct. 18 to Nov. 8.	
Nov. 12.	Sewer, Salem, Ore.	Oct. 18
Nov. 12.	Denver, Colo.	Oct. 4
	Adv., Eng. Record, Oct. 4, 11.	
Nov. 12.	Charleston, S. C.	Oct. 4
	Adv., Eng. Record, Oct. 4 to 18, Nov. 8.	
Nov. 13.	Ft. Lawton, Wash.	Nov. 8
Nov. 13.	Dredging, New York, N. Y.	Oct. 18
	Adv., Eng. Record, Oct. 18 to Nov. 8.	
Nov. 15.	Dredging, New York, N. Y.	Nov. 8
Nov. 15.	Oilhouse (Ft. Greble), Newport, R. I.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Nov. 15.	Ft. Columbia, Wash.	Nov. 1
Nov. 15.	Washington, D. C.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 8.	
Nov. 17.	U. S. Post Office shed, Buffalo, N. Y.	Oct. 18.
	Adv., Eng. Record, Oct. 18, 25.	
Nov. 18.	Tompkinsville, N. Y.	Nov. 8
Nov. 18.	Washington, D. C.	Oct. 25
Nov. 19.	Ft. McRee, Fla.	Nov. 8
Nov. 20.	Post Office Bldg., Rome, N. Y.	Oct. 18
Nov. 20.	Dredging, Norfolk, Va.	Oct. 18
	Adv., Eng. Record, Nov. 8.	
Nov. 22.	Pier and dredging, Boston, Mass.	Nov. 8
Nov. 22.	Dover, N. J.	Nov. 8
Nov. 22.	Ft. Myer, Va.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Nov. 22.	Lock, etc., Pittsburg, Pa.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 8.	
Nov. 22.	(Ft. Morgan), Mobile, Ala.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 8.	
Nov. 22.	Coal plant, Portsmouth, N. H.	Oct. 18
Nov. 22.	Navy Bldg., Portsmouth, N. H.	Oct. 18
Nov. 24.	Nashville, Tenn.	Oct. 25
	Adv., Eng. Record, Nov. 1.	
Nov. 25.	Ft. Riley, Kan.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Nov. 25.	El. wiring Pub. Bldg., Boise, Idaho	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 26.	(San Diego Harbor) Los Angeles, Cal.	Nov. 8
Nov. 26.	Storehouse (Ft. Greble), Newport, R. I.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Nov. 26.	Washington, D. C.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Nov. 26.	Newport, R. I.	Oct. 25
Nov. 28.	Dover, N. J.	Nov. 8
Nov. 29.	Ft. Huachuca, Ariz.	Nov. 8
Nov. 29.	Storehouse, Norfolk, Va.	Nov. 8
Nov. 29.	Dredging, Philadelphia, Pa.	Nov. 8
Nov. 29.	Machine shop, Boston, Mass.	Nov. 8
Nov. 29.	Htg. & Vent. Pub. Bldg., Boise, Ida.	Oct. 25
	Adv., Eng. Record, Oct. 25, Nov. 1.	
Nov. 30.	Plattsburg Barracks, N. Y.	Nov. 8
Dec. 1.	Ft. Lincoln, N. D.	Nov. 8
Dec. 1.	Ft. D. A. Russell, Wyo.	Nov. 8
Dec. 2.	Dredging, Boston, Mass.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Dec. 3.	(Rappahannock River, Va.) Wash., D.C.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 3.	Emporia, Kan.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Dec. 4.	Ft. Monroe, Va.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 6.	(Breton Bay, Md.) Washington, D. C.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 6.	Smithery, Boston, Mass.	Nov. 8
Dec. 6.	Dredging, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 8.	
Dec. 10.	Jetty work, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 8.	
	BUILDINGS.	
Nov. 11.	School, Boston, Mass.	Nov. 8
Nov. 11.	School, Watertown, N. Y.	Nov. 1
Nov. 11.	School, South Orange, N. J.	Nov. 1
Nov. 11.	Library, Fond du Lac, Wis.	Oct. 25
Nov. 12.	Bath Bldg., Brooklyn, N. Y.	Nov. 1
Nov. 12.	School, htg., etc., Brooklyn, N. Y.	Nov. 1
Nov. 13.	Pub. Bldg., htg., etc., Brooklyn, N. Y.	Nov. 1
Nov. 14.	Village hall, etc., Hendrick, Minn.	Nov. 8
Nov. 14.	Work at reformatory, Elmire, N. Y.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 8.	
Nov. 14.	Court House, Riverside, Cal.	Oct. 25
Nov. 15.	Htg. Pub. Bldg., Cleveland, O.	Nov. 8
Nov. 15.	Court house, Kentville, N. S.	Nov. 1
Nov. 17.	Pub. Bldgs., Pittsburg, Pa.	Nov. 8
Nov. 17.	School, Brooklyn, N. Y.	Nov. 8
Nov. 19.	Storehouse, Baltimore, Md.	Nov. 1
Nov. 20.	Barn, Columbus, O.	Nov. 1
Nov. 20.	Charity hospital, Shreveport, Pa.	Nov. 1
Nov. 22.	School, Berkeley, Cal.	Nov. 1
Nov. 25.	Jail, etc., Marion, Ind.	Nov. 8
Nov. 26.	School, New Prague, Minn.	Oct. 25
Nov. 27.	Cottages, Chicago, Ill.	Nov. 1
Dec. 1.	Library plans, Albert Lea, Minn.	Oct. 25
Dec. 2.	Capitol work, St. Paul, Minn.	Aug. 16
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Dec. 15.	Htg. Capitol, Columbia, S. C.	Oct. 4
[illegible]	Armory Plans, Brooklyn, N. Y.	Nov. 8
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11
	MISCELLANEOUS.	
Nov. 12.	Wharf, Baltimore, Md.	Nov. 8
[illegible]	Rem. of Garb., Parkersburg, W. Va.	Nov. 1
Dec. 1.	**Garb. disposal, Atlanta, Ga.**	**Oct. 4**
Mar. 5.	**St. R. R. franchise, Manila, P. I.**	**Nov. 1**

THE ENGINEERING RECORD.

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ANNOUNCEMENT.

Having now reached a time of life when I desire to retire from active business, I have accepted an offer from Mr. James H. McGraw to purchase The Engineering Record, feeling assured that a man so eminently successful as a publisher of technical journals will continue to maintain the paper's character. Moreover, his conduct of other publications makes me confident that the value of The Engineering Record will be much enhanced to both subscribers and advertisers.

While no longer financially interested in the journal I founded twenty-five years ago and have since conducted, I have agreed to act as an adviser in an editorial capacity, and I ask for Mr. McGraw the same cordial support from The Engineering Record's friends which has been a source of so much satisfaction to me in the past.

HENRY C. MEYER.

The statement by Mr. Meyer is so explicit that the friends of The Engineering Record need but a few words of explanation from me. The fields covered by The Street Railway Journal, The Electrical World and Engineer, and The American Electrician are such that the management with them of another paper devoted to civil and industrial engineering must be of advantage to the readers and advertisers of all these publications. I accordingly made the overture to Mr. Meyer which has resulted in the transfer to me of The Engineering Record, a paper which has won high commendation as being "always a servant of the public while a source of profit to the owner." Mr. Meyer has consented to give me the benefit of his counsel and active co-operation in maintaining the high standing of the paper, and the same staff that has executed his directions in recent years will continue to conduct its affairs. The only change that is proposed is an increase in the value of the journal in its well-established field, due to its affiliation with publications of similar standing in allied fields.

JAMES H. MCGRAW.

Columns for Buildings.

The durability of iron or steel columns is such an important element in the possible age, or lasting capacity, of the modern high building that it has once more come to be a subject of most careful and rather wide discussion. The modern steel building frame commonly carries the entire load sustained by the structure, including its own weight, and the columns are the main supporting members of the frame. Any active influence, therefore, which tends to impair the strength of the columns or to trench upon their durability weakens—and possibly fatally—the resistance of the building itself.

The danger of corrosion in iron and steel columns is no new subject of discussion, for engineering literature gives abundant evidence of its recognition at least forty years ago. Some of the most prominent forms of column section in the early days of iron and steel work were closed, thereby making it impossible to inspect their interiors and to protect them by painting. So essential, however, to its durability was the accessibility of the interior of a column considered that closed sections were permitted in bridge work for a short period only. The question was ably argued and experiences supporting both sides were cited, but the case was hopeless for the closed section and it was soon abandoned. In spite of this result for exposed columns, like those in bridges, an entirely different conclusion has been reached in connection with iron and steel columns used in buildings. Although closed columns, even in buildings, have been criticised and their comparatively short life set forth, together with all the sources of corrosion which, it has been alleged, would give them very uncertain tenure of life, they have held their own; and they form today the prevailing type of member for buildings. It is true that the Z-bar and some other forms which are not closed have been used to a considerable extent, and that some of the more prominent early closed sections have been either largely or wholly displaced, but the fact remains that the closed box column in one shape or another largely occupies the field in spite of the fact that its interior cannot be painted after the completion of the steel frame.

It is obvious that there must be some strong reason for this particular feature in structural development. It has been many times earnestly argued that the life of such a column must necessarily be limited by attacks of corrosion, both at the interior and exterior surfaces. Nevertheless, it persists, and it must be admitted that any serious danger arising from this particular feature of deterioration yet remains to be established. Undoubtedly, in a considerable number of cases, experience has shown the existence of some oxidation, but to no great extent; and in no case of good design has the rate of oxidation been shown to threaten serious danger within any reasonable period.

It is beyond question that the exposure of a bridge column is far more severe than that of practically any column standing in a well-designed building. In the latter case, compression members are usually entirely surrounded by masonry of one class or another, constituting almost complete protection even when the columns are embedded in an exterior wall, subjected to driving rainstorms.

The fact that every type of box column leads to more simple and convenient detailing than any other class of compression members undoubtedly accounts, in a large measure, for its wide adoption; but this fact alone is not a sufficient reason for the existing situation. In addition to it there is at least the strong opinion, based upon considerable experience, that no sensible amount of corrosion need be apprehended with any period affecting immediate values or those likely to exist in the near future. It may not be demonstrable that this judgment is not defective, but it is beyond reasonable doubt the most potent factor in the persistence of the closed column. Whether further developments in building construction will continue the use of that column, is a different question. Experience has shown enough to indicate, however, that when the box column or its type is displaced by another, the governing influence will be greater economy or some motive other than apprehension of interior corrosion.

The development of concrete-steel construction may indicate the field in which the improved column is to be found. Although the combination of concrete and steel has thus far been employed where greater tensile resistance than that of concrete alone has been imperative, it does not by any means follow that it may not be found advantageous for compression members, especially where a high capacity of resistance to heat of conflagrations is desired. Nearly all steel columns in buildings are enclosed in terra-cotta or masonry of one kind or another, either to secure a more ornate appearance or protection against high temperatures caused by fires. It is but a short and easy step to secure both of these results by a suitable combination of concrete and steel bars other than the usual steel compression member. In a number of cases the interiors of steel columns have been filled with concrete with an exterior covering of brick or other similar fire-resisting material. Abundant experience has demonstrated the efficiency of concrete protection against corrosion when the concrete is suitably mixed and put in place. A relatively wet mixture is needed so that voids will not exist and also that the surface of the steel may be covered with a wet cement coating. When steel is so completely embedded in a relatively large mass of concrete it receives rigid lateral support, enabling it to act in compression like a short block rather than like a long column. Under such circumstances each square inch of steel section may properly be assumed to carry much more load than when under conditions requiring the use of a column formula. Again, the concrete is so circumstanced as to sustain a large load itself, probably not less than 40 to 50 tons per square foot. Indeed, by suitably reinforcing the surrounding concrete with light steel sections, such as wire, the concrete's loading could probably be increased to 70 tons per square foot, without violating the canons of good practice. This development in the design and construction of compression members would possess a number of material advantages, including economy. The less expensive shapes of steel could be employed under much higher unit loads and their combination with concrete would result in a solidity of section making the compressive resistance of that material available as well as attaining complete fire-resisting capacity.

The New East River Bridge Fire, a carefully prepared account of which appears on the following pages, adds another large item to the already heavy bill for the careless use of matches, to which smokers seem especially addicted. The loss in this case, while very great, is not nearly so great as the early newspaper reports indicated. It seems hardly possible to make discipline rigid enough or to secure a sufficiently watchful oversight to entirely eliminate this danger. Nevertheless, every precaution should be taken to guard against the carelessness or maliciousness of the irresponsible individual on whom can fall but a small share of the burden of the damages.

The Fire on the New East River Bridge.

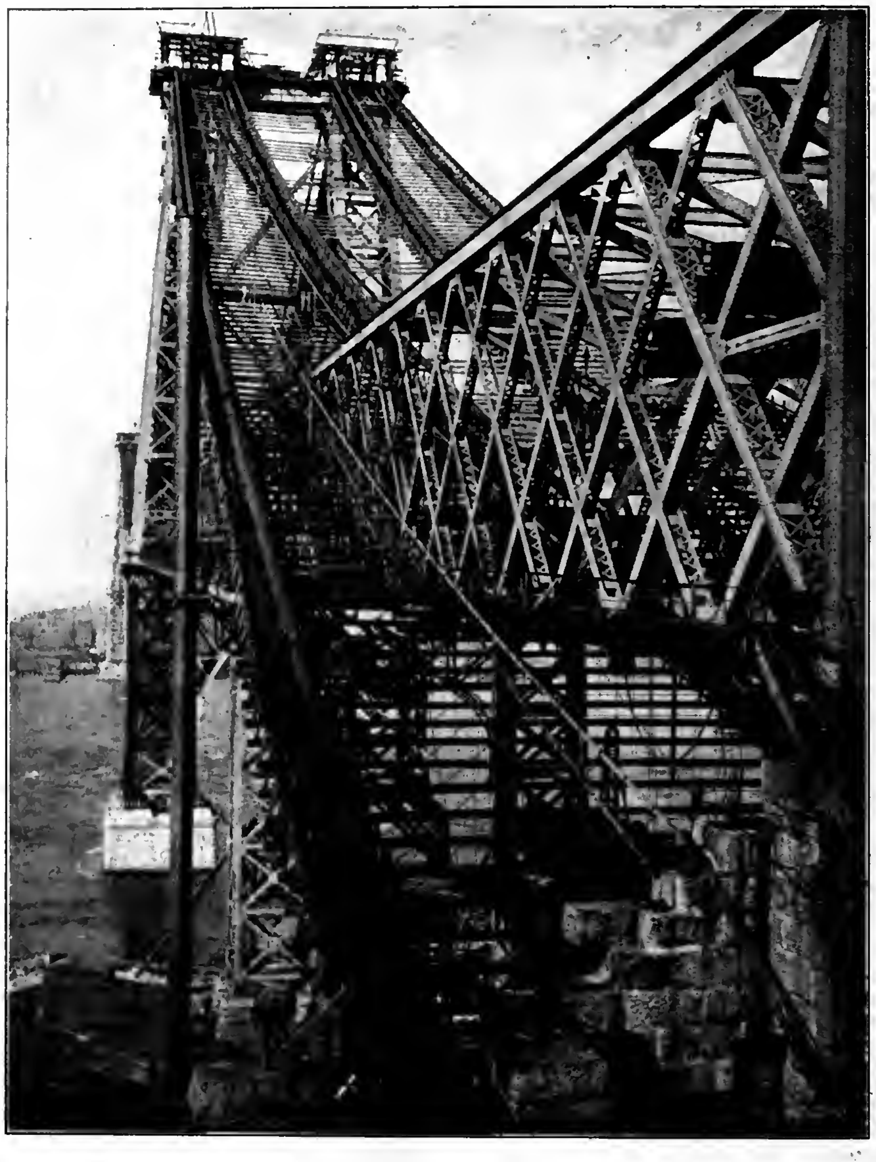
At 4.35 P. M., November 10, before all the workmen had left for the night, a fire was discovered on the temporary wooden working plantform at the top of the west main tower of the new East River Bridge, officially known as the Williamsburg Bridge, Greater New York. The flames spread rapidly and consumed all of the platform on the south side of the tower and pretty thoroughly destroyed that on the north side. The top of the tower has a skeleton platform of massive steel girders with solid steel floors under the cables. On this framework had been built the 25x100-foot wooden working platform, and above it a heavy wooden framework carrying shafts, pulleys and other machinery for the cable construction. There was about 53,000 feet of timber near the saddles, all of which was thoroughly dried and much of it saturated with oil, grease and the inflammable mixture used for water-proofing the cables. There were also two or three barrels of oil and a barrel of paint there. Consequently when a fire was started by a match dropped as the workmen were leaving, it rapidly spread and made a fierce blaze with heat so intense in places as to warp and twist heavy steel and burn and partly fuse small metal objects like nails. The great heat weakened the cables of the temporary falsework bridge, on which the main cables have been built, so that they broke and caused the collapse and destruction of this footwalk in its two spans adjacent to the west tower. Besides this damage was done to the lower platforms and the contractors' plant at this tower.

It was at first reported that three lives had been lost but this is not confirmed by later reports. The preliminary examinations which have been made up to the time of going to press do not indicate that the permanent structure has received serious damage or is in any way endangered; but some repairs will be necessary which may be of a delicate nature and slow to make, and the extremely difficult work of removing the wreck of the temporary foot bridge will be costly and will delay work which was ready for immediate prosecution on the west anchorage pier and on the suspended trusses of the main span. The contractors' engineer thinks that the direct loss may be about $50,000 and the delay two months, if there is no more serious injury to the main cables and tower top than is now indicated.

Over the center of the tower each cable is supported in the 19¼x16⅝-inch groove in the segmental top of a 34-ton cast steel saddle 19 feet long and about 5 feet high. The wires of the cable are here arranged in a nearly rectangular, solid cross-section, while beyond the saddle they are wrapped with wires and gradually brought to a circular cross-section. Up to about 20 feet from each end of the saddle each cable, excepting No. 1, had been permanently enclosed in duck wrappings and cylindrical steel shells. The 40-foot lengths of cables between the ends of the shells were not protected, and the flat steel cover plates had not been bolted over the tops of the saddles, so that the cable wires there were fully exposed and those on the surface were, doubtless, heated red hot, as is indicated by the scales and discoloration. Where the sides and bottom of the cables were enclosed in the saddle groove, the 3 inches of solid metal protected them, and so, while it may be found necessary to replace some of the upper outside wires, it is not likely that a large proportion of them will need attention. As the wires are all spliced with sleeve nuts new pieces can be inserted without weakening the cables, and the chief difficulties will be in getting hold of them and in adjusting their tensions. The main saddles were all temporarily set 3 feet nearer the anchorages than their final positions, and secured there by wooden braces, which were burned away, thus allowing all the saddles to move suddenly forward 8 inches on their rollers, and the cables to sag about 16 inches in the center. This has not apparently injured the tower and will not seriously interfere with the adjustments of the bridge, because when the saddles on the other tower are released and the final loads applied the cable will assume its intended catenary form.

The middle unfloored sections of the four transverse girders in the saddle platform are about 7 feet deep and 42 feet long with pairs of 6x6x¾-inch angles in the flanges, and in one of them the top flange was warped and twisted. Some of the floor plates and braces, also, were injured, but the damage did not appear to be so serious as to require the removal of the members when examined by a member of the staff of The Engineering Record. Most of the suspender cables for the support of the trusses had been attached to the main cables between the towers, and, as they enclosed the temporary foot bridge, they received it when it fell, thus sustaining severe impacts which may have injured them. Otherwise little damage appears to have been inflicted upon the permanent structure; but the condition of the tower and main cables cannot be accurately determined until very careful measurements shall have been made. Although the foot bridge had nearly served its intended purpose, it will have to be rebuilt in a modified form. Its original cost was about $150,000 and the salvage from it will be nearly as great as if it had been removed in the manner intended. Probably it will not be necessary to replace the falsework on the towers, but there will be loss of salvage on it and considerable loss of machinery, tools, and materials on the towers. The two northerly main cables are apparently uninjured.

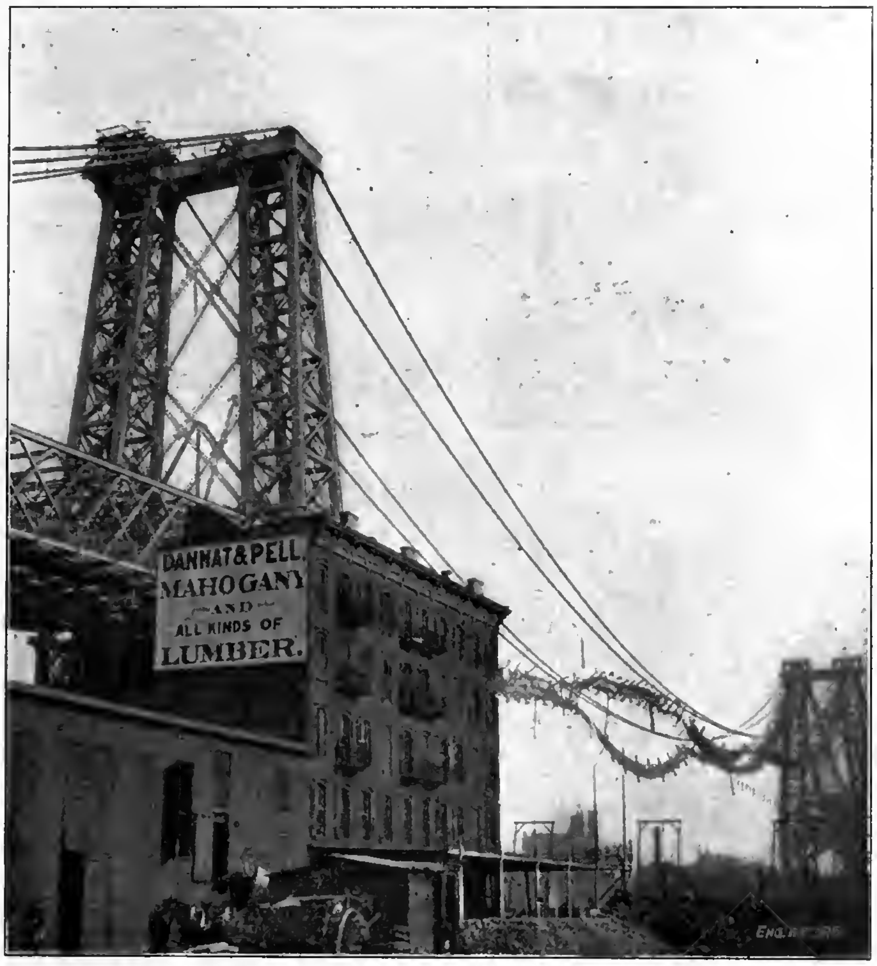
The top of the tower was accessible by wooden stairs between its columns on the north side and by the four lines of footwalks on the temporary suspended spans from the New York anchorage and the Brooklyn tower. When the fire was first noticed, there were about fifty men on or near the top of the tower, who immediately attempted to extinguish it, but being without apparatus, having little water and being unable to get very close to it, on account of the small area of platform, they were unsuccessful. They were reinforced by men coming back from the Brooklyn tower and were cutting away the wood work of the temporary bridge to prevent the spread of the flames when they were driven off by the danger of sudden displacement of the saddles and main cables, which soon afterwards occurred. They lowered ropes to the water 340 feet below for fire hose from the fire boat, but the hose could not be brought up this way and was carried up the stairs by the firemen, with great difficulty. The height was so great that two engines were unable to force a stream to the top, and when a third engine was coupled on the increased pressure burst the hose. Finally two engines succeeded in sending a weak stream to the top of the tower and one nozzle on the north side



Tower, Footbridge and Shore Span from Anchor Pier before Fire.

played feebly across to the south side but was not effective.

During the progress of the fire there were explosions of the barrels of oil and paint on the platform, and many large and small pieces of red hot steel and blazing timber fell to the river and the ground, but neither the men on the tower nor the spectators were injured. The falling foot bridge made navigation under the bridge dangerous for several hours and few boats attempted the passage. One man on a fire boat was seriously injured by a hot falling bolt, and planks and bolts fell on other boats, injuring them but not harming any person. The great height of the fire and the rain of glowing fragments made a brilliant spectacle, but the flames did not appear very large from the ground. The fire lasted about five hours. The following morning a secondary fire broke out on the platform at the roadway level of the approach span trusses, but it was quickly extinguished and its effects were not serious.



Looking toward Brooklyn after the Fire.

When the flames had subsided somewhat, Assistant Engineer K. L. Martin and two chiefs of the fire department made a very perilous ascent of the stairs through the shower of falling pieces of red hot steel and blazing timber, to the top of the tower. While they were there the flames threatened the stairway and they had much difficulty in driving back the fire and extinguishing it with a small quantity of drinking water. These men and the others who risked life and limb in fighting this unique fire deserve unstinted praise for their courage.

One of the men was escaping from the burning tower to the Brooklyn side and was in the center of the south foot bridge when its cables broke and the western end of it collapsed. He clung to the ropes and managed to make his way over the adjacent cross walk to the north foot bridge and thence to safety.

One of the accompanying illustrations is a view taken shortly before the fire, and the others are views taken the day after the fire for The Engineering Record by the photographer of the Pennsylvania Steel Company. The pictures give a clear idea of the most conspicuous damage, the wreck of the foot bridge and the destruction of the tower falsework. The main span of the foot bridge is festooned in the permanent suspenders for the trusses, and the shore span has fallen on the approach span, and is supported by it with its own loose cables sagged far below the original position, between the end of this span and the anchorage pier, where the last of the approach spans has not yet been erected. Part of the falsework remains on the north side of the tower and gives some idea of the character of the duplicate construction on the south side, which surmounted the saddles there and was wholly consumed.

The cables are numbered in succession from the south side of the tower. No. 1 had the steel casings completed up to the saddles and they are still in place and probably afforded considerable protection to the wires. The other cables were wrapped with the water-proofed duck up to the saddles; this burns persistently with a moderate flame and was consumed where exposed beyond the ends of the steel casing. Cable No. 2 was injured most, and cables Nos. 3 and 4 were injured least. Some of the discolored wires in the surface of the cables have been cut out for tests which will determine whether they have escaped permanent injury. Each wire is about 3/16-inch in diameter and when straightened was immersed in molten zinc, at a temperature of 800 degrees Fahrenheit. It is believed that a considerably higher temperature could be sustained by the wires without injury, and that the heat from the flames of wood and oil some distance away and chiefly above the cables has not done them much damage. Each wire has an ultimate strength of 6,000 pounds and a working load of 1,500 pounds. The new pieces of wire which it may prove necessary to insert can be stressed to any required tension by the splice nuts, and the tension can be estimated by the expert workmen to within about 10 pounds; but if necessary it can be determined by measuring with a dynamometer the force required to produce a given deflection in a measured length, as has been done by Mr. Hildenbrand in other cases of wires spliced into cables.

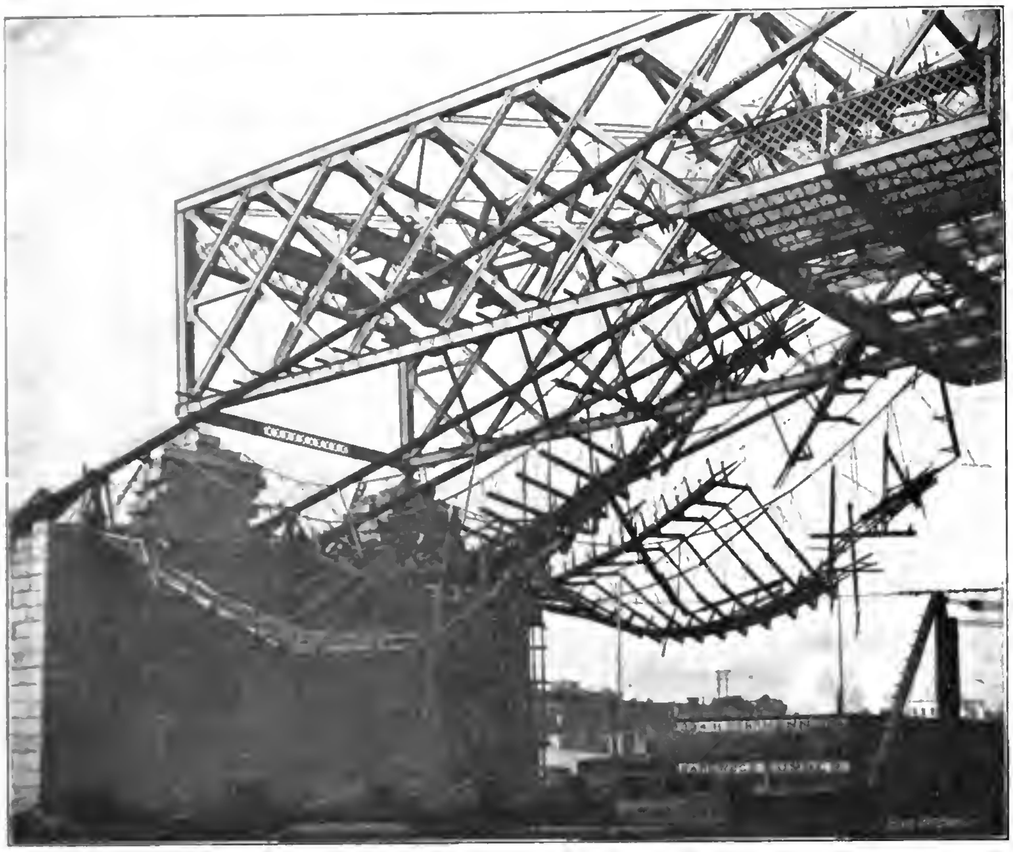
The saddles for the foot bridge cables show by their appearance that they have been heated to redness, and, doubtless, the cables that they supported were also red hot and therefore much weakened at that point. Each cable had a normal tensile strength of 624 tons and a factor of safety of 3.7 under the load of the foot bridge. If this strength had been reduced 66 per cent. by the fire they would still have supported the foot bridge, but could not have supported a large extra load or sudden shock. Before the fire the main cables, weighing with their suspenders about 1,000 tons each between towers and having a tension of about 1,500 tons at the top of the saddles, were very close above the foot bridge floors. When the saddles moved and lowered the main cables 16 inches, of course very heavy sudden loads were imposed on the foot bridges, which, it is believed, snapped their cables where they rested in the saddles, the stresses at these points being increased about 15 per cent. As nearly as could be seen from the tower, one of the broken cable ends appeared to have been snapped off short, and another to have been elongated like a specimen broken gradually in a testing machine. The saddles of the main cables were in equilibrium except for the stresses caused by temperature and by the incomplete loading. Timber struts were advisedly used, instead of iron, to keep the saddles temporarily on the anchorage side of the tower, because in their final removal they could be partly cut away and then permitted to crush gradually and allow the saddles to move slowly into the final position. The saddles will not need to be moved back to their original positions.

The total cost of the Williamsburg bridge and approaches, including land, is estimated at nearly $20,000,000, about $9,000,000 being for the structure itself. The main span is 1,600 feet long between centers of towers, the longest in the world. The steel towers are each supported on two masonry piers with pneumatic caisson foundations carried down to a maximum depth of 107½ feet below water level, rise about 335 feet above mean high water and support four main cables about 18 inches in diameter and 3,000 feet long. Each cable weighs 2,500,000 pounds, has an ultimate strength of 50,000,000 pounds, a working load of 10,000,000 pounds, is composed of 7,696 straight wires and cost about $350,000. The suspended span, which with part of the Brooklyn approach is all that remains to be built, has two trusses 67 feet apart and 40 feet deep on centers, with two decks to accommodate two railroad tracks, four trolley tracks, two roadways, two sidewalks and two bicycle paths, and will cost about $1,120,000.

The main cables were built from temporary foot bridges about 3,000 feet long, suspended from four cables reaching from anchorage to anchorage, adjacent and approximately parallel to the main cables. Each temporary cable was composed of three twisted steel wire ropes 2¼ inches in diameter, was first carried across the river and dropped to the bottom and afterwards lifted bodily to the tops of the towers. These cables carried four double deck wooden foot walks in the planes of the main cables and connected by cross walks. After the 37 strands of each main cable were completed, they were lowered several feet in the center, the upper decks of the foot walks were removed and a single wide platform was laid over the two narrow walks which were on each side of the center line of the bridge. At the time of the fire, the wind-brace cables were being removed preliminary to taking down the foot walks.

The shore spans of the bridge were described in The Engineering Record February 12 and 19, 1898, the cable specifications were printed November 18, 1899, the design of the approaches described May 12, 1900, the design of the temporary foot bridge October 27, 1900, the suspended span May 4, 1901, the stretching of the temporary cables September 14, 1901, and the cable-making May 3 and October 25, 1902.

Mr. L. L. Buck, M. Am. Soc. C. E., is consulting engineer, and Mr. O. F. Nichols, M. Am. Soc. C. E., is engineer in charge of the New East River Bridge. The John A. Roebling's Sons Company is the contractor for the cables: the Pennsylvania Steel Company has the contract for the approach viaducts and the suspended trusses, and was in readiness to commence the erection of the latter when the fire occurred; Messrs. Shanly & Ryan are the contractors for the anchorage on the New York side, on which the wreckage of some of the temporary works fell; and Edward Smith & Company are furnishing their durable metal coating which is being applied to the cables for water-proofing. The New York tower of the bridge was erected by the Terry & Tench Construction Company. Mr. Wilhelm Hildenbrand, M. Am. Soc. C. E., is the engineer for the Roeblings.



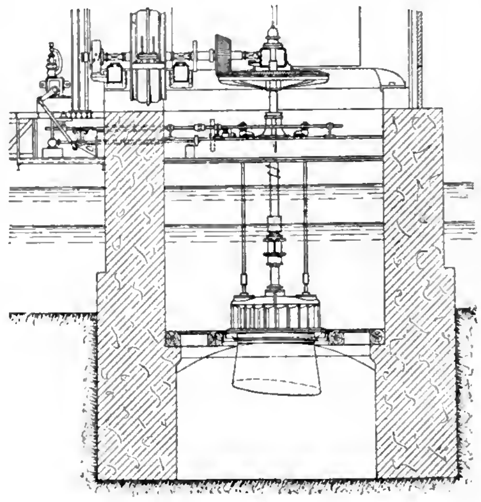
WRECK OF FOOTBRIDGE HANGING FROM SHORE SPAN.

SADDLES AND WRECKED FALSEWORK ON NORTH SIDE OF TOWER.

Recent European Water-Power Plants.

The handicap under which European industrial enterprises requiring power are compelled to operate because of the high price of fuel as compared with the prevailing American figures, has naturally encouraged the development of Continental water powers where there is a lower effective head than is considered of use in this country, and where the conditions are such as to call often for apparatus and methods not generally employed here. A description of several such plants was recently given in a paper read before the Engineers and Architects Association of Zurich, by Mr. Zoelly, the director of the firm of Escher, Wyss & Company, of Zurich, from which the following notes have been taken:

The first plant described was that of the municipal light and water works at Schaffhausen. In this case it was proposed to replace the existing installation of three Jonval turbines, developing from 200 to 260 horse power under heads varying from 11½ to 14¾ feet, by the same number of Francis turbines, having a guaranteed capacity of 350 horse-power at

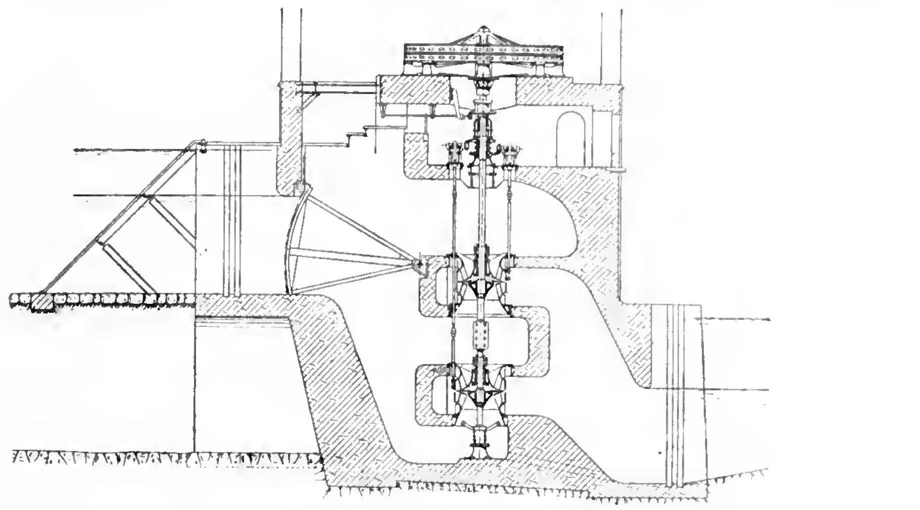


SCHAFFHAUSEN POWER PLANT.

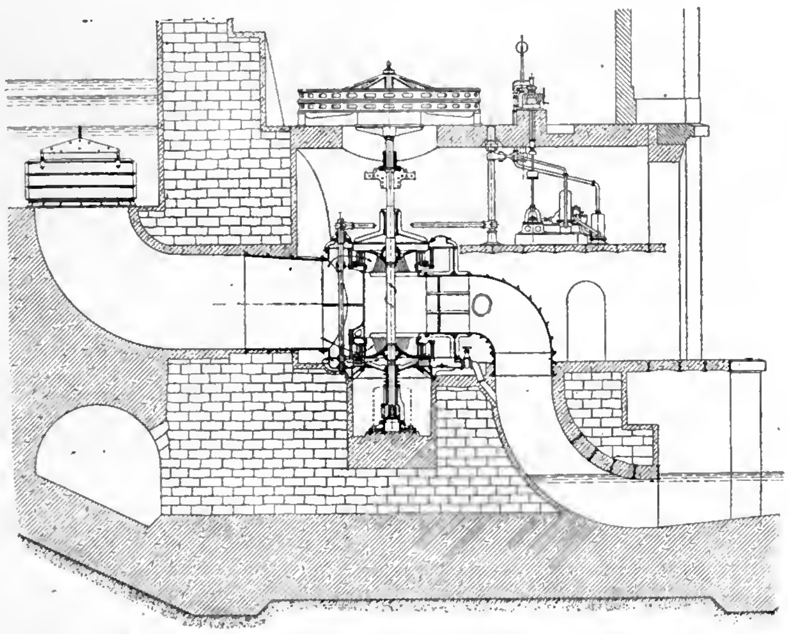
12½ feet head. The volume of water available for each turbine was from 270 to 300 cubic feet per minute. Because of the existing electrical plant it was desirable to retain the former number of revolutions per minute, which was 60, and also to use the former turbine foundations, which necessitated an outer diameter of 80 inches and a draft fall of 40 inches. A vertical section of the wheel pit is shown in the illustration. The guide ring is 25½ inches high and has 24 openings, while the runner has 20 blades, its diameter increasing toward the bottom. Between the guide ring and the runner is a regulating gate of the Zodel type, controlled by a hydraulic regulator, for which hand regulation can be substituted at any time. The shaft is vertical, and has four bearings, the upper one being a ring suspension bearing of the usual type, which takes the whole weight. Because of the radial direction of the entering water and the short draft, the pressure on the bearings is not great. Tests of these turbines show 430 horse-power developed under 12½ feet head, and an efficiency of 86.6 per cent. at full load, 82.6 per cent. at three-quarter load, and 77 per cent. at one-half load, in spite of the limitations under which they were designed.

Where the available head is between 13 and 50 feet, and it would be inadvisable to couple a simple turbine direct to the dynamo because of the small number of revolutions per minute, it is frequently found desirable to put several turbines on the same shaft. This has been done in the second installation of the Geneva city power station, at Chèvres. There there are five older conical-turbines, of 800 to 1,000 horse-power at 80 revolutions, and 10 recently installed double centrifugal turbines of 900 to 1,200 horse-power at 120 revolutions. The head varies from 14 to 26½ feet and the volume of water from 4,230 to 42,300 cubic feet per second, these fluctuations occurring at times with but little warning. Each of the older units consist of two turbines on a vertical shaft, each turbine being composed of three wheels, through which the water flows from the upper side to the lower. The wheels are of different diameter, and their blades are differently set, as the lower one is designed to work alone at maximum economy under the higher heads. The step-bearings of these have to support the water pressure as well as the weight of the working parts, so that it is necessary to supply them with oil under 75 pounds pressure.

The new turbines are of different construction, as shown in the illustration. They have each two wheels, of which the lower one is designed to work alone under the high heads, and there are two sets of guides for each wheel,



Chèvres Power Plant.



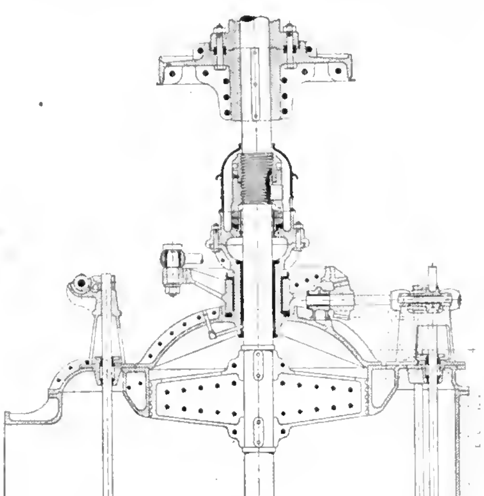
Arrangement of 1,500-Horse-Power Turbines, Lyons.

one above and one below. The water flows in a direction parallel with the axis into each wheel both from above and from below, and leaves at the circumference in a radial direction. The wheel-casing on both the upper and lower turbines is so arranged as to admit more pressure to the under side than the upper, in this way so far balancing the pressure that an overhead suspension bearing may be used.

The speed is controlled by cylinder gates placed around the runner, each being in two parts and operated by a hydraulic governor. Turbines of this design are held to have the advantage of developing a high speed at low heads, are easily balanced and regulated and are of high efficiency, but they are of somewhat complicated construction. The setting of the turbines is entirely of cement and steel construction, as may be seen by reference to the drawing. The admission gates are of the pattern known in this country as the Tainter gate. This gate has a sylindrical surface, the convex side towards the incoming water, and is pivoted at the axis of the cylinder, which lies in the horizontal plane, somewhat above the bottom of the head race. It is raised and lowered by a cord or chain working over pulleys, and has the advantage of requiring but little power to move it.

A notable example of the employment of the Francis turbine is the power station of the city of Lyons, where there are 22,000 horse-power installed, forming one of the largest plants in Europe. The water is taken from the river Rhone, above Lyons, by a canal 11½ miles long, the power house being about 1½ miles from the lower end. The upper part of the canal forming the head race is 8¼ feet deep in the shallowest part, and varies from 197 to 344 feet wide. Its construction was a considerable undertaking, as the bottom is about on a level with the surrounding country. One bank was formed by a natural slope, but the other had to be filled in, the earth taken from the cut necessary for the tail race being used for this purpose. The labor was increased by soft ground and insecure foundations, it being necessary to concrete a considerable portion of the head race bottom just above the power house. The canal was intended to serve for navigation and irrigation purposes as well as water power, and therefore the natural conformation of the land was taken advantage of to make a basin of considerable size about the middle of its length. Here a spill-way was placed, in order to prevent an undue rise of the water. There is also a lock adjoining the power house to allow boats to pass up the dam. The available head varies from 33 to 39 feet, at times of extreme high water falling as low as 26 feet for a short time. The present installation consists of eight 1,250 horse-power turbines, three of 250 horse-power, and two of 1,500 horse-power, six units of the latter size being now under construction. All the large turbines are coupled to alternating current dynamos directly above them on the same shaft, the 250 horse-power units delivering exciting current for the alternators.

The water is led to each turbine through a separate penstock built into the masonry, and the admission is controlled by a lifting bell over each opening, which is raised or lowered by a rope and pulley. The power house has three stories, the lower serving for the turbines, the second for the regulator connections, the suspension bearings and the oil pumps, and the upper one for the generators and the hydraulic governors. The floors are of cement and steel construction. The 1,250 horse-power turbines, which were the first installed, are run at 120 revolutions per minute, and are of the Francis type. They have a conical wheel at the end of a vertical shaft, working in a cast-iron casing which supports the guides.



1,250-Horse-Power Turbine, Lyons.

These, as well as the turbine blades, are divided into three annular portions by cast partitions, the openings of which are furnished with gates so that the amount of water admitted may be varied according to the height of the available fall. The downward pressure on the wheel is partly balanced by a disk revolving in the upper part of the casing, and the remaining part of the load is carried by an elaborate self-oiling suspension bearing just above it.

The 1,500 horse-power turbines are of later design, and differ considerably from the foregoing. They are of the double type, this form being adopted in order to give more power, and because the variations in the available head proved to be larger and more frequent than had been anticipated. The two wheels of each turbine discharge into a common draft tube, built partly of steel and partly of cement reinforced with steel, leading to the tail race. The regulation is by Fink swinging gates, worked by a servomotor under oil-pressure. By virtue of their arrangement the wheels are hydraulically balanced, and in order to neutralize the weight of the turbine as well, the disk of the lower wheel is allowed to receive the water pressure, while that of the upper wheel is perforated, so that the suction of the draft tube acts on both sides. In this way the pressure acting on the main shaft is so much reduced that a small suspension bearing of ordinary design is ample to carry it. These turbines, working under a head of from 33 to 39 feet, have shown an efficiency of 76 per cent., but this is not to be regarded as their maximum. The wheels are described in greater detail in the "Zeitschrift" of the Society of German Engineers.

The Municipal Testing Laboratory at Philadelphia is stated, in the annual report of Geo. S. Webster, chief engineer of the Bureau of Surveys, to have resulted in securing to the city the performance of the necessary testing work at a cost of about one-fifth what would have been charged by a private laboratory.

Examinations for Civil Service positions are announced as follows by the Municipal Civil Service Commission of New York City: Topographical draughtsman, sixteenth grade, Monday, December 1, at 10 A. M.; annual compensation, $3,000 or more. Assistant engineer, tenth grade, Wednesday, December 3, at 10 A. M.; annual compensation not exceeding $2,100. Leveler, fourth and fifth grades, Friday, December 5, at 10 A. M.; compensation more than $1,050, but not more than $1,350 per annum. Assistant engineer, Rapid Transit Commission, fourth grade, Monday, December 8, at 10 A. M.; annual compensation not exceeding $1,200. Building inspector of masonry and carpentry, fourth grade, Wednesday, December 10, at 10 A. M.; annual compensation not exceeding $1,200. The receipt of applications in each case closes a few days before the date set for the examination. For further particulars, address the secretary of the commission, Mr. S. William Briscoe, at 61 Elm Street.

The Equipment of a Modern Paving Brick Plant.

A paper by Willard D. Richardson, Cleveland, O., in Volume IV. of the Transactions of the American Ceramic Society, October, 1902.

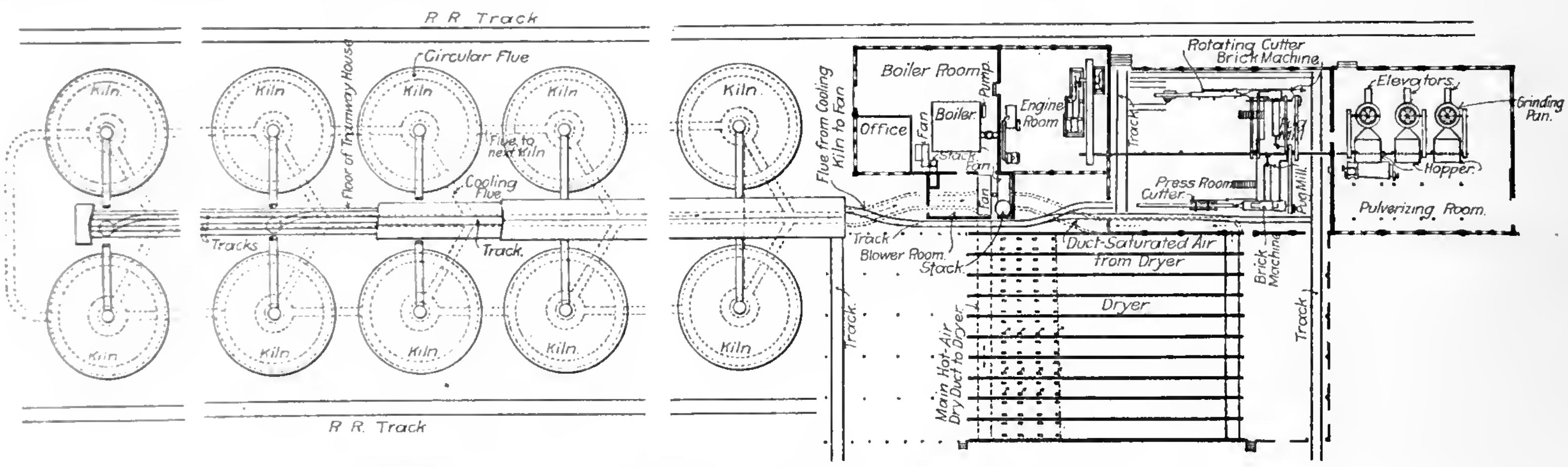
In planning a brick plant, due consideration must be given to the special purpose of the proposed establishment, and to the special local conditions, such as the size and topography of the site for the building, the location of the clay and the railroad, etc. These local conditions must always determine to a greater or less degree, the general plan to be adopted.

The plans described are for a paving brick plant, about one mile south of Cleveland, Ohio. The shale to be used is situated above the level of the factory, to which it will be conveyed by a gravity railway. The direction from which the shale must come is directly opposite to that from which must come the spur from railroad for receiving coal and shipping brick. These facts necessarily influenced me in settling upon the general arrangement of yard.

The cars of shale enter the factory at an elevation of twenty-two feet and are dumped into hoppers built so that one man, by operating gates from below, can attend to the feeding of three or four drypans—or the shale can be dumped outside of the hoppers in the storage machines, for convenience in receiving and discharging clay.

The brick machines are the standard auger type, largest size, with automatic cutting tables and separating belts. In this special factory, one machine is to be used for making sewer and building brick, not repressed, and the other for the large size paving block demanded in this market. With the latter machine is one double die repress. The cars, loaded from the separating belt or repress, pass to a transfer track, just back of the machines at the rear of the press room, and thence to the receiving tracks of the dryer.

The power is transmitted to machinery by a line shaft extending through the center of the building and supported upon cast-iron columns with brackets cast upon them. The boiler room is situated at the lower end of dryer, at the head of the kilns, for convenience in receiving fuel and in furnishing steam for blower engine, and so as to utilize the combustion gases for dryer, if desired, and also exhaust steam. The boilers, of the water-tube type, have induced artificial draft, being connected so as to be operated by separate fan discharging into atmosphere, or by the dryer fan discharging into dryer.



GENERAL PLAN OF PAVING BRICK PLANT AT CLEVELAND, O.

DESIGNED BY WILLARD D. RICHARDSON.

room and fed to pans, in stormy weather, in the usual manner. These pans are placed in the pulverizing room back of the press room in a row on a line parallel with the general progressive movement of the clay and brick, so that the clay is easily conveyed from the screens to a central hopper for feeding to pug mills.

The simple stationary inclined screens are used, the clay being elevated from pans to sufficient height to permit of these screens being twenty-four feet long. The width of each screen is six feet, and in order to secure a uniform distribution over the surface of so wide a screen, the clay is dumped from elevators into an U trough conveyor having an adjustable slot in bottom, over the screens. The tailings from the screens pass to the shale hoppers instead of directly to the pans. The screened clay is collected at the foot of the screens by a conveyor that carries it to the hopper above the press room.

The hopper for fine clays is in an upper room separated from the press room by dust-tight partition and floor, the lower part of the hopper projecting through this floor into the press room, and above and between the pug mills. This hopper is also an automatic feeder, supplying, when in operation, a constant uniform quantity of clay to the pug mills, making uniform tempering an easy matter. The capacity of this hopper and feeder is sufficient for the two largest pug mills. These pug mills are placed back to back, at right angles to brick

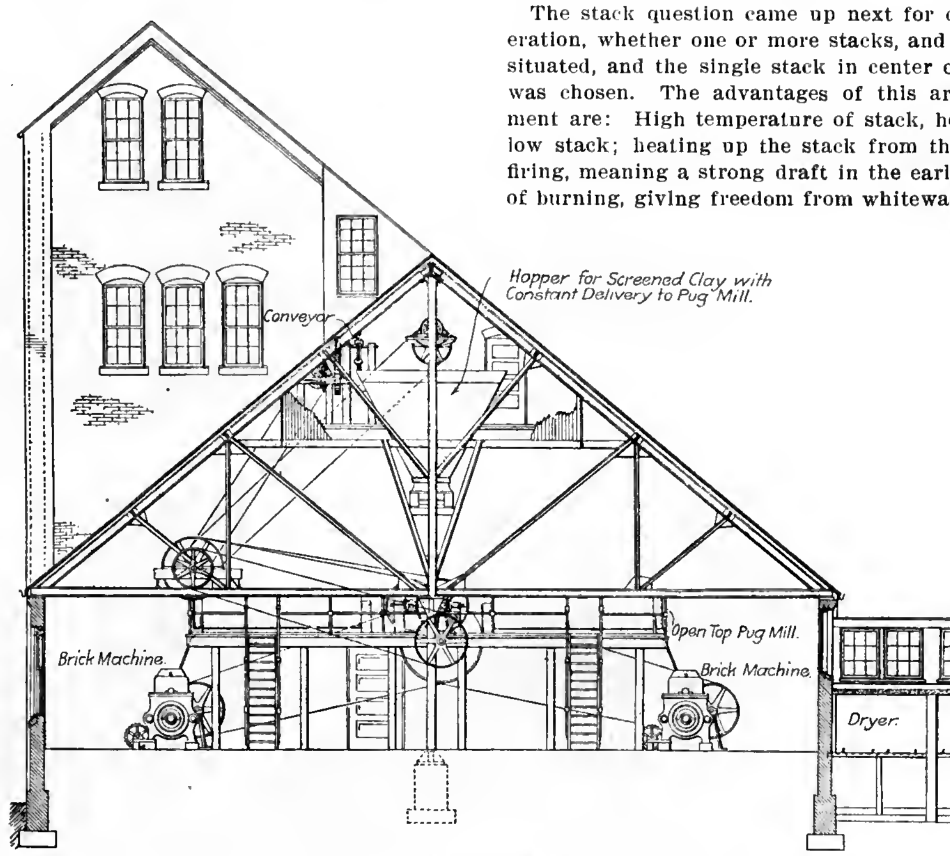
The engine room, between the boiler room and the press room, contains a 250-horse-power Corliss engine for running the factory, and an automatic engine for running generator, dryer fans and machine tools. The machine tools situated in engine room are lathe, planer and drill press. The generator is for running motors that operate fans for induced draft of kilns and also for lighting. The buildings are practically fire-proof, the walls of brick and the roof framing of steel. This roof frame is covered with matched pine one and three-fourth inches thick and upon this, slate or roofing tile. The underside of the wood, between the rafters, is to be covered with two coats of lime whitewash, or other fire resisting paint. The floors are mostly of concrete and nearly all posts and beams of iron.

The dryer, constructed for the most part in the usual manner, consists of a series of tunnels separated by brick walls, each tunnel containing two tracks 100 feet long. The receiving tracks are twenty-three feet long and the cooling tracks forty-four feet long. The construction of the dryer is absolutely fire-proof, the roof, of course, being the special feature. Upon the top of the division walls, which are six feet and nine inches between centers, is constructed four inches of concrete, made from vulcanite cement, gravel and coal cinders, reinforced with a net work of iron strips. Upon this concrete is a course of hollow book tile laid in cement, and upon the tile is a gravel roof, the felt being stuck to the tile. This roof slopes from the receiving end of the dryer to within ten feet of the discharge end, one-fourth inch to the foot, this being the slope of the track in the tunnels. The last ten feet of roof at the discharging end is built up to slope backwards, forming a valley. In this valley are openings into 4-inch conductor pipes laid in each wall, and passing downward to the sewer pipe drain below.

The special feature in addition to the roof construction is the slope of one-fourth inch to the foot in the tracks from the receiving end, the last ten feet being level, and the method of moving the cars through the tunnels. The cars are coupled together automatically when placed in the dryer, so as to insure no break in their ranks as they move by gravity down the decline. At the bottom of the decline is a device for braking and stopping the cars. By throwing a lever just outside the entrance of the tunnel, the forward car on any track is disengaged and the car back of it is blocked. After the forward car is removed, the lever is reversed and the other cars let down and blocked, each car being uncoupled automatically about ten feet from the end of the dryer. Thus one car is always free to be removed from dryer, and a car can be put into dryer at receiving end without the necessity of pushing other cars.

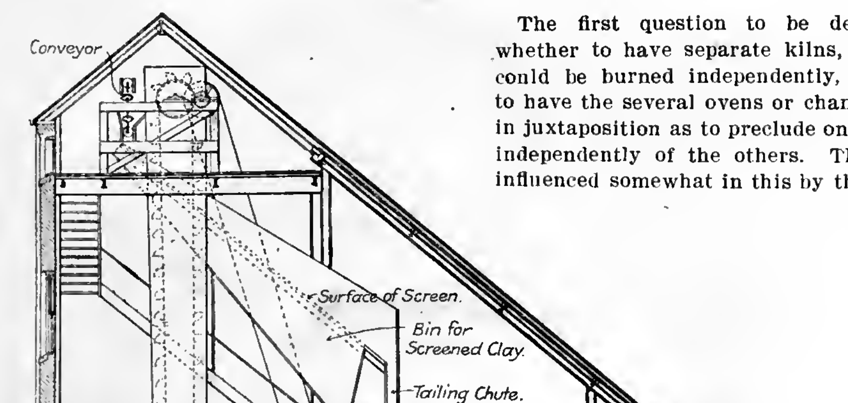
The heat for drying is obtained from cooling kilns by means of a fan, the distribution of heat being in the usual manner. The special feature, however, is that the saturated air is removed from the dryer through an underground flue by means of a fan coupled with the fan that furnishes the hot air, both fans being upon the same shaft and driven by the same belt, the driving pulley being in the boiler room upon the shaft extending from the engine room.

In making plans for a brick plant, especially for the manufacture of paving brick, one's chief study must be in designing the kilns for burning. The kiln for this purpose must have the following features: Down draft; uniform distribution of heat; durability, costing little for repair, and economy of operation, saving fuel, labor and time, and so constructed as not only to utilize waste heat, from cooling kilns for transmission to dryer, or for heating air for combustion in kiln furnaces, but also it must utilize the waste heat escaping from the hot burning kilns in heating up other kilns. In other words, it must have the advantages of the continuous kiln, without its disadvantages.



Section of Brick Machine Room.

The first question to be determined was whether to have separate kilns, each of which could be burned independently, if desired; or to have the several ovens or chambers so placed in juxtaposition as to preclude one being burned independently of the others. The author was influenced somewhat in this by the judgment of friends who have had large experience with continuous kilns, and also by the fact that in building separate kilns, he would be following along the line of his previous practice, and would feel more confident of obtaining the desired results.



Section of Pulverizing Room.

Having decided upon separate kilns, the next point to determine was the form of the kiln, whether round or rectangular. Experience with both forms enabled the author to decide at once in favor of the round kiln, chiefly for two reasons: Because the round kiln is less expensive in first cost, and especially in repairs; and because it gives better distribution of heat and fewer underburned brick.

The stack question came up next for consideration, whether one or more stacks, and where situated, and the single stack in center of kiln was chosen. The advantages of this arrangement are: High temperature of stack, hence a low stack; heating up the stack from the first firing, meaning a strong draft in the early part of burning, giving freedom from whitewash and shortening the time of burning; a kiln of larger diameter, with hard brick to the center. The disadvantages of stack in center of kiln are: Inconvenience in setting, and space occupied in kiln. These disadvantages have not been found so great as at first thought. The stack in the center of a large kiln is not much in the way, in fact, hardly more in the way than a stack in any other place. The space occupied in the kiln is, for a thirty-foot kiln, only about two per cent. of the inside kiln space and for a thirty-six-foot kiln, about one and one-half per cent. These are thirty-six foot kilns, with twelve furnaces to each kiln, and there is really no grate surface at all. The fire-hole is two feet wide, without grate bars. The firing door is covered in the usual manner with a fire clay slab, reinforced with iron bands. The coal is thrown upon a coking table, made partly of cast iron and partly of fire-clay tile and shoved down upon the fire just before a fresh supply of coal is added.

The special feature of the kilns for this plant is the system of utilizing the hot gases escaping from the burning kilns for heating up other kilns, and likewise of using the cooling kilns for heating the air for combustion. To accomplish this the kilns are connected by an underground flue, extending from the center of each kiln to a circular distributing flue in the next kiln ahead. This circular flue is in the hub of the kiln, with openings into each fire box, adjustable by dampers. The movement of the gases is induced by a fan connected to the stack of any kiln by a cylindrical steel flue. The fan is portable, being erected upon a car moved along an elevated track between two rows of kilns and operated by an electric motor directly connected.

The author calculates in this manner to be-able to draw the heat from a hot kiln through at least two other kilns and that by the time that the kiln under fire is finished, the kiln just ahead will be partially or wholly incandescent, so that heavy fires can be put into the furnace at once. There will thus not only be a saving in fuel, but a considerable saving also in the time of burning.

The Damage to the Williamsburg Bridge.

The fire upon the Manhattan tower of the Williamsburg Bridge in New York City is described upon another page of this issue. The official report of the fire by Mr. O. F. Nichols, Engineer in Charge, to Bridge Commissioner Lindenthal, describes the damage done as follows: The blocking which retained the saddles in their position back of the center of the tower burned away in all cases, and the three southerly saddles moved forward about 9 inches and the northerly saddle D moved forward 5 inches, toward the river. The movement of the saddles lowered the cables on the channel span and precipitated a greatly increased load on the foot-bridges, the cables of which parted under this stress, the cables of the south foot-bridge parting first. Examination of the wires in these cables shows that the wires were elongated in breaking, their strength being considerably decreased by the heat to which they were subjected, although this heat was not sufficient to burn off the galvanizing for more than a few inches each side of the break.

In falling, the land span of the foot-bridge, on the Manhattan side, fell on to the end spans, the easterly cables of the foot-bridge were slacked off, and the land span on the Brooklyn side dropped some 10 or 15 feet, and the river span, west of the Brooklyn tower, fell away from the main cables in the same way, while the balance of the foot-bridge cables toward the Manhattan tower were caught in the loops of the suspender ropes and were thus prevented from falling into the river. The foot-bridge is, therefore, practically a total wreck. An examination at the top of the tower shows that the wires of the C and D cables are practically uninjured, the filling compound in the saddles not having been melted out.

The wires of the A and B cables, on the other hand, were subjected to intense heat, which melted out all the cable protecting material in the saddles and burned off the slushing oil to some depth into the cables for the whole length of the saddles. This depth cannot be exactly ascertained, but it is probable that it extends from 3 to 5 wires deep in each of these cables.

Wherever the steel cable cover enclosed the cables, the wires were fully protected, and in some cases the canvas wrapping, which had been placed on both of the southerly cables, has only been burned off for a distance of 6 or 8 feet from the saddles.

The bolts, sheaves and heavy material in falling through the tower have bruised the lighter angles and lattice bars to a considerable extent, and one of the main girders in the top platform of the tower has its top flange bent about 2 inches out of line. The plate covering of the south portion of the tower has also been buckled to some extent by the heat. It is of course impossible to tell just how much damage has been done to the wires of the A and B cables until they have been tested. Mr. Nichols speaks in the highest terms of the work of Assistant Engineer Kingsley L. Martin in assisting in extinguishing the fire.

Havana, Cuba, has a record for the year ending with September entirely free from yellow fever.

The twenty-fifth anniversary of The Engineers' Club of Philadelphia will be celebrated by a banquet at the Union League, on the evening of Saturday, December 6th.

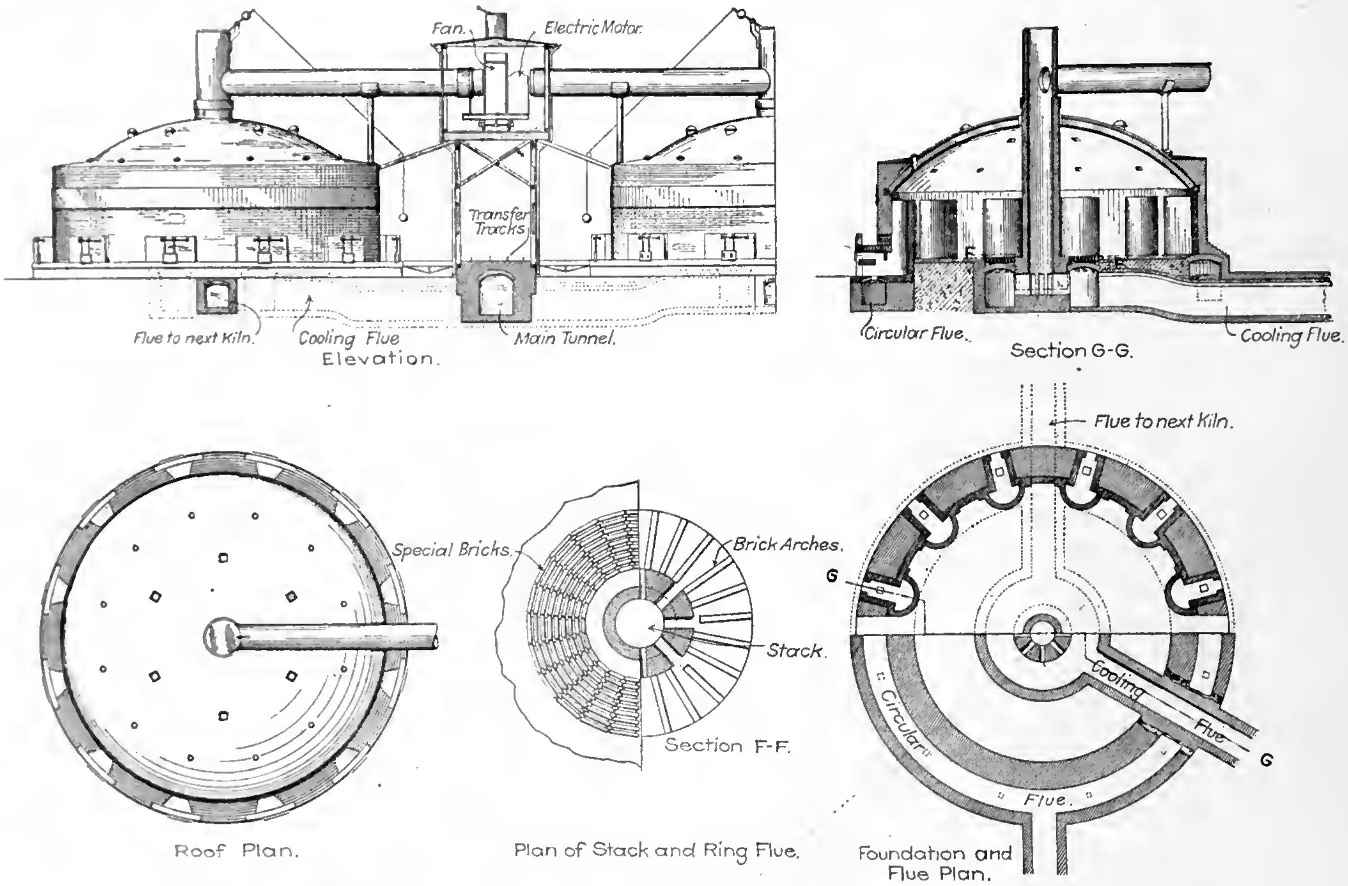
The Removal of Snow and Ice from the streets of Manhattan Borough, New York City, during the coming winter, is causing Commissioner Woodbury of the street cleaning department some anxiety. Proposals have twice been rejected, there being each time only one bidder, who offered to do the work for 39 cents per cubic yard, which is considered to be about four times too much.

The Corner Stone of the $3,000,000 public library building for the City of New York was laid on November 10. Messrs. Carrerre & Hastings are the architects and the Norcross Brothers are the builders of this structure.

The British Pacific Cable was completed on October 30, when the last section between Brisbane, Australia, and Vancouver, B. C., was laid at the Fiji Islands. One section of this cable, between Bamfield Creek, Vancouver Island, and Fanning Island, is the longest in the world. A speed of over 100 words per minute has been attained on this long section with the Deerlove transmitter.

The Pacific Northwest Society of Engineers held its regular meeting in Seattle on November 1, at which Mr. J. M. Clapp, Assistant U. S. Engineer, read a paper entitled "The Improvement of Gray's Harbor, Wash.", describing the preliminary survey work, the construction plant, the method of driving piles for the railroad tracks along the jetty, the process of constructing mattresses for the foundations of the jetty and the method of completing the sea wall.

Distribution of Disinfectants is carried on at Charleston, S. C., during six or eight months of the year, according to the last report of the health officer, Mr. J. M. Green. A solution of copperas is sent through the streets and applied to all places needing deodorizing. Quick lime, chloride of lime, and copperas solution are also given to anyone applying. In all cases of contagious diseases carbolic acid is supplied, and at the termination of the case the premises are fumigated with formaldehyde gas, and articles of clothing, bedding, etc., are carried to the disinfecting cylinder, where they are subjected to a temperature of 230 degrees Fahr.



DETAILS OF A KILN IN THE PAVING BRICK PLANT AT CLEVELAND, O.

A Septic Tank at Bedford, Ind.

The sewerage system recently installed at Bedford, Ind., comprises about 7½ miles of vitrified pipe lines, which will collect the sewage from about half the territory covered by the city limits, and a large septic tank so arranged as to be capable of dealing at almost any desired rate, with whatever quantity of sewage reaches the tank. This result is accomplished by dividing the tank lengthwise into three compartments of different widths, and arranging an inlet trough so that each compartment can be used separately, two together, or all three continuously. This feature is considered of great importance because of the fact that the most effective period of flow through a septic tank varies very considerably according to the quality and amount of dilution of the sewage, and the temperature.

At the inlet end of the septic tank, and covered by the same roof are two detritus tanks, or grit chambers, each 24x7½ feet in size and about 8 feet deep below the flow line. Solid matters are to a large extent deposited in these tanks. The sewage enters each of them through two 10-inch pipes leading from a diversion manhole from which the sewage can be turned into either or both of the chambers, as may be desired. A 2-inch baffle board about 3½ feet deep is placed across the center of each chamber.

On the top of the 24-inch concrete wall which separates these grit chambers from the septic tank proper, is arranged a wooden trough 12 inches wide, with a weir about three feet long and 9 inches above the bottom of the trough, opening from each of the grit chambers. On the other side of this trough are three more weirs, each opening into one compartment of the septic tank. The crests of all of these weirs are about 3 inches below the flow line, so that, except when a new compartment is filling, there is no appreciable disturbance of the surface of the liquid as it passes from the grit chamber to the septic tank. In building this controlling trough, three 4x6-inch wooden blocks were bedded in the concrete wall, one at the center and one at each end, and were anchored to it by two ¾-inch anchor bolts for each block. The trough, which is of 2-inch planking, was then securely nailed to these blocks, after being bedded in cement. All of the five weirs in the inlet trough can be closed when desired by wooden gates made to slide vertically in grooves at the sides. By means of this arrangement, therefore, the sewage can be made to flow from either or both of the grit chambers into the trough, and from there into any of the septic tank compartments. Baffle boards 3½ feet deep are placed close to the trough across both the grit chambers and the tank compartments, so as to insure an even flow of the liquid. Baffle boards are also placed across the center of each tank compartment. A similar trough and weir arrangement at the outlet end of the tank provides for the effluent, a 12-inch outlet pipe leading directly from this outlet trough.

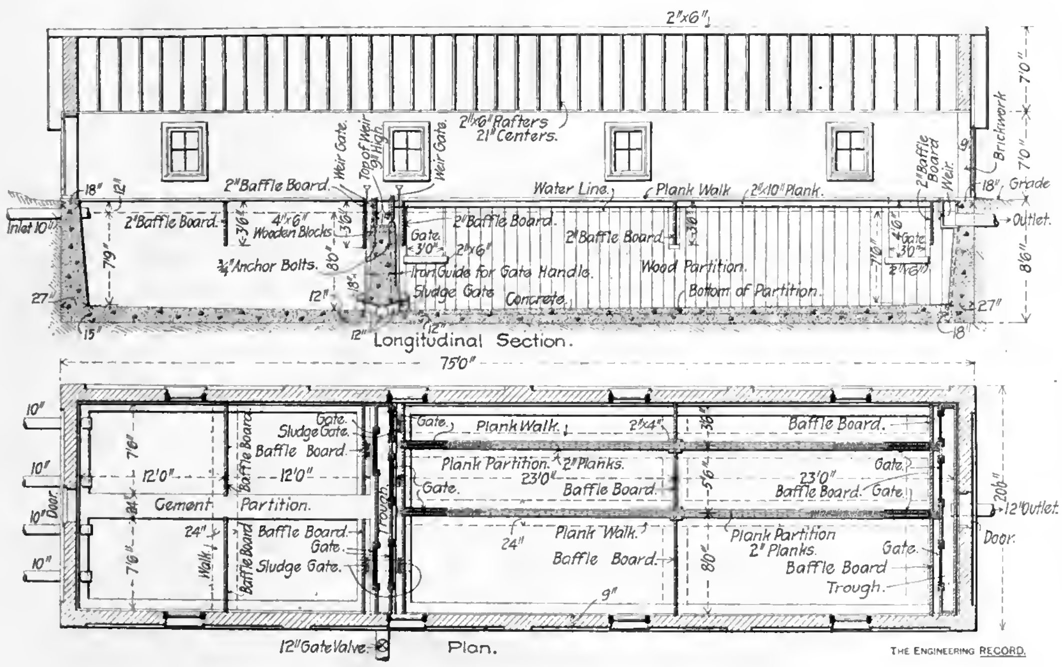
The septic tank is 46x17 feet in largest inside dimensions, and about 7 feet 9 inches deep below the flow line. It is divided by plank partitions into three longitudinal compartments, as shown in the illustrations, and large wooden gates are provided at both ends of each partition, so that the sewage can be passed first through the large compartment, then back through the central one, and then through the smallest one to the outlet or, if so desired, the flow may take place in the opposite direction, beginning with the small compartment, and ending with the large one. If such a long rest period is not desired, any two of the compartments may be used and the third cut out entirely, or it may be still further reduced by making use of only one of the compartments. It is thus seen that a variety of combinations are available, by means of which the proper rest period for any given condition of the sewage may be found by experiment. The widths of the compartments are about 3½, 5½ and 8 feet, respectively, and the capacity of the smallest compartment is about 8,700 gallons, and of the three combined, 42,800 gallons, thus giving a wide range.

As will be seen from the illustrations, the main body of the tank is of concrete, with outside walls 27 inches thick at base and 18 inches thick at the top. At the division wall between the grit chambers and the septic tank proper the thickness of the floor is 12 inches, which thickness is gradually increased to 18 inches at the outlet end and 15 inches at the inlet end. The bottoms of the grit chambers as well as the septic tank thus have a slope toward the main division wall, where, at the lowest level, a sludge gate is provided for each compartment. Whenever considered necessary, any one of these gates can be opened and the accumulated sludge drawn off through a 12-inch drain without interfering in any way with the operation of the rest of the installation.

The concrete used for this work was a 1: 2 : 4 mixture, the broken stone or gravel ranging in size from 1 inch to ⅛ of an inch. The side walls were laid first, with grooves about 4 inches deep left in them at the proper places, in which the plank partitions were afterward bedded. After the roof was put on, the whole inside of the tank was given a coat of plaster consisting of equal parts of Portland cement and sand. The bottom was laid after the side walls were completed, and the wood partitions were put in place before the last 4 inches was laid. The partitions are made of three thicknesses of 2-inch planking placed on end and well nailed together, with a 2x10-inch pine batten along each side at the top, and bolted through the partition every 18 inches with ½-inch carriage bolts. The grooves in which the partition gates slide were made by cutting the inner one of the three thicknesses of planking 3 inches wider and deeper than the outer ones. These gates can be raised or lowered by hand, either directly or by means of levers.

The roof over the septic tank is supported on 9-inch brick walls. An ordinary timber roof framing was employed, with 2x6-inch rafters spaced 21 inches apart, and 2x4-inch cross pieces. One-inch boards and No. 27 galvanized iron were the materials used for the roof covering. A door at each end and four windows on a side were provided. Two-inch pine plank walks were laid along all the main divisions of the tank, for convenience in getting at the numerous gates.

This septic tank was designed and the specifications for it drawn up by Messrs. Alvord & Shields, of Chicago, while the map and profiles for the sewerage system in connection with the tank, were drawn by the city engineer, Mr. G. C. Houston, in consultation with the above-named firm. The specifications for the sewerage system were also prepared by the city engineer with some suggestions from Messrs. Alvord & Shields. Although the matter of filter beds for further purification of the tank effluent has been considered, no definite plans have as yet been prepared, and the septic tank will be operated alone for the present. The information and drawings from which the preceding description has been prepared were furnished by Mr. Houston.



SEPTIC TANK AT BEDFORD, IND.

A Chimney with wash room and store rooms arranged in two stories in the bottom of the structure serves the Trebbinerstrasse power station of the Berlin, Germany, elevated and underground railway. The plant is one in which close utilization of space was necessary, and the boilers being located in a story above the engine room, the smoke flue did not have to begin below them. The stack is some 262 feet high and square in section at the bottom, between 21 and 22 feet on a side.

The Storm-Water Run-Off in the city of Philadelphia is being carefully investigated, according to the latest report of Mr. Wm. C. Haddock, director of the Department of Public Works, with a view of obtaining data for the accurate design of sewers. For several years past the Bureau of Surveys has been installing instruments for the observation of the rise and fall of the flow of water in the sewers, and comparison has been made with the amount of rainfall as indicated by pluviometers installed in the various district offices. In addition, by careful observations with proper instruments, velocities of the flow of water in the sewers at various depths have been tabulated. A careful record of the high and low tides occurring in the Delaware River is also kept.

The Water and Lighting Plant at St. Louis, Mich.

A combined water-works pumping station and electric lighting plant capable of being operated either separately or together, and run by both water and steam power, comprises the interesting installation owned by the city of St. Louis, Mich. The city is located in Gratiot County, and has about 1,200 inhabitants. A moderate size stream called Pine River flows through the city, and water power was developed a number of years ago under a twelve-foot head, which afforded ample power for the city's needs, except during about six to eight weeks in the summer time when steam power had to be resorted to. A moderate rental is paid for this power.

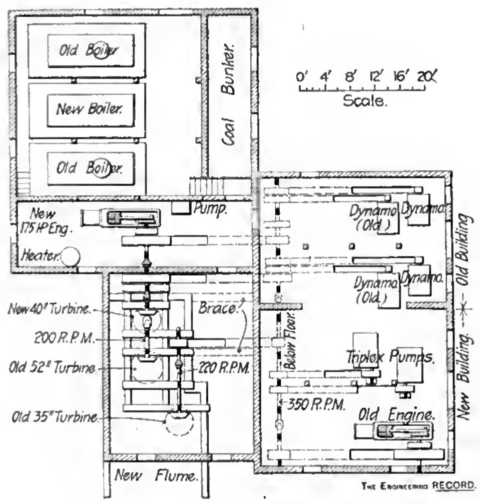
The city installed a small water-works plant in 1879 with approximately four miles of pipe, varying in size from 4 to 8 inches in diameter. No standpipe was used and a 500,000-gallon duplex power pump was installed, operated by a vertical turbine wheel of the old Leffel pattern. About the same time a franchise was granted to private parties for an electrical lighting plant. This plant was installed some distance below the water-works, and consisted of two 150-ampere Thomson-Houston dynamos furnishing current at 110 volts and driven by a 52-inch Leffel special turbine.

There was also installed a relay steam plant consisting of an 80-horse-power tubular boiler and an automatic engine. As the population of the city increased, it was found that the pumping capacity at the water plant was inadequate and an 80-horse-power tubular boiler with a 12x8x12-inch single-cylinder fly-wheel steam pump was added, and the old turbine wheel was exchanged for a 35-inch Sampson wheel. This proved to be only a makeshift, however, and for some years past the city has been without fire protection and has had an inadequate supply for domestic purposes, while the operating expenses were largely increased by the necessity of using steam power continually as well as water power.

The electric lighting plant was purchased by the city in 1900, when it was discovered to be as inadequate for its needs as the water plant. To correct this defect, the city purchased two modern dynamos capable of furnishing 500 amperes each at 110 volts, only to find that the combined power of the engine and water wheel was unable to carry this load satisfactorily, besides running the operating expenses up to a point out of all comparison with the work performed. The coal bill for this plant amounted to over $3,000 per year, and further expense was entailed by the employment of two sets of operating engineers, and the annual rental for the water power. In April, 1901, the old timber dam furnishing the water power was washed out by a flood and Mr. A. T. Maltby, of Chicago, was called in to devise a method of putting both plants into condition to take care of present and future requirements. A new dam of concrete and steel, with a 12-foot fall was constructed at a point about a quarter of a mile farther down the river and about 50 feet above the lighting plant.

The river bed is underlaid with a deep bed of blue clay or marl, very hard and making an excellent foundation. It is covered, in the neighborhood of the dam site, with a layer of gravel about 2 feet thick. Two trenches were excavated across the stream into this hardpan for core walls to prevent any flow under the dam. Foundations of concrete were also provided at the same time for seven steel pipes or columns. These columns were connected together with tie plates 8 feet above tail water and again 3 feet above high water. The wing walls at each end of the dam were made of rubble stone masonry laid in cement, and in the dam proper, concrete was tamped into a form up to the 8-foot tie plates. A steel apron was riveted to these plates, covering the top and downstream face of the dam and a plank apron was built in the bed of the river extending 32 feet downstream. Angle irons were riveted to the sides of the columns for the flash boards to rest against, which at ordinary flow are 4 feet high, making the total fall 12 feet. This arrangement of flash boards was provided in order to take care of the spring floods. The steel columns were filled with concrete, and on top was laid a bridge for foot travel, which also provided a platform from which to handle the flash boards. The dam is 60 feet long between the pier walls, and an earth embankment about 90 feet long was necessary at one side of the head gates.

It was decided to consolidate the water and lighting plants and to abandon the old water plant entirely, except that the turbine wheel and boiler would be used at the new location. The old flume leading to the electric light plant was found to be in a bad state of decay, besides being too small; but the wheel pit was in good condition and large enough to accommodate another 100-horse-power turbine, besides being susceptible of enlargement to accommodate the 35-inch Sampson wheel from the water-works plant. A new flume was therefore constructed.



Power Plant, St. Louis, Mich.

The building containing the dynamos was of brick, two stories high, and was extended in the same design and manner of construction to receive the new pumps. A new brick engine and boiler house 30x40 feet was also constructed for the steam plant, and a wheel house of wood covered with steel in imitation of brick. In the original plant a countershaft was located below the floor of the dynamo room and the engine and turbine wheel were connected by belts. This countershaft was extended under the floor of the new pump room with a clutch coupling. The 35-inch, 75-horse-power Sampson turbine from the old water plant was installed in the new flume and connected by a belt to this new countershaft. The old engine previously used in the lighting plant was placed in the pump room and also belted to this countershaft, which at full speed ran the same as the part which drove the dynamo.

Two 7x8-inch double-acting, triplex power pumps of 750,000 gallons capacity each were purchased and installed in the pump room, and driven by belt power from the countershaft, the object being to operate the pumps either by steam or water power from the countershaft.

The old steam boiler was brought over from the abandoned water station and placed alongside the one already in use and a new one of the same size and capacity purchased, making a battery of three boilers in the new plant. A 175-horse-power four-valve simple engine of the Russell make was installed in place of the old engine, together with a Stilwell open heater and purifier and a 6x4x6-inch boiler-feed pump. The old 52-inch Leffel turbine was left in place and a modern 40-inch Sampson wheel added to drive the lighting plant. It will be perceived that the water and lighting plants can be operated separately or together as circumstances may require, by the manipulation of the clutch coupling in the countershaft. The power of the large engine or turbines can be transmitted to the pumps or the power from the small turbine or engine in the pump room can be transmitted to the dynamos, or all can be combined.

As the pumping plant is operating under the direct pressure system, with no standpipe, the speed will vary in accordance with the amount of water consumed, and consequently when the engine is in operation it will have to be controlled by the throttle, and in order to gain as much economy as practicable, the governor was set to cut off at not later than ¼-stroke. This arrangement was found to work very satisfactorily, requiring very little attendance. To the practical engineer the saving in steam by using the cut-off engine is apparent, the consumption being 35 pounds against 60 to 150 in the small direct-acting steam pumps. The synchronous action of the triplex pump makes it perfectly practicable for a belt drive, and no trouble whatever is expected from this source. A 6-inch relief valve was placed in the main near the pumps to guard against excessive pressure.

A Sewer Enlargement in Grand Rapids, Mich., is described as follows in the last report of L. W. Anderson, city engineer: The enlargement consisted in removing the upper portions of the old brick oval sewer to within 6 or 10 inches of the bottom, leaving sufficient to carry the ordinary flow. Outside of the old bottom, concrete footing and side walls were constructed, and after plastering the bottom, a 6-inch concrete arch was built in place.

The Chamber of Commerce of the State of New York dedicated its new house on Liberty Street, New York City, on November 11. Many distinguished men attended the ceremonies, among them President Roosevelt, who summed up the genius of the organization when he said, in the course of his address: "I greet you in the name of the people, not merely because you stand for commercial success, but because this body has been able to show that the greatest commercial success can square with the immutable and eternal laws of decent and right living and of fair dealing between man and man." The Chamber of Commerce was organized in 1768, but now for the first time occupies a building of its own.

The Smoke Nuisance is receiving the attention of the city authorities of Providence, R. I., who are endeavoring to obtain necessary legislation for its abatement. Three large industrial concerns have voluntarily encouraged this movement by offering to install apparatus in their power stations which would prevent black smoke. With this purpose the Rhode Island & Suburban Railway has contracted for an equipment of Roney mechanical stokers for its new boiler plant of an ultimate boiler capacity of 8,300 horse-power. The Narragansett Electric Lighting Company is installing a complete equipment of Roney quadruplex stokers, under Babcock & Wilcox boilers of 4,500 horse-power capacity. In the plant of the Brown & Sharpe Manufacturing Company, similar stokers have been in use for some time under two batteries of Babcock & Wilcox boilers, with excellent results.

The Mechanical Plant of the Ansonia Apartment Hotel, New York City.

One of the latest apartment hotels in New York City and probably the largest and most complete in this country is the Ansonia, a seventeen-story structure fronting on Broadway from 73rd to 74th Streets, and occupying about 37,000 square feet of ground area. Like the larger part of the buildings of this class that have been erected in New York (some 90, it is stated, in the last two years), it has its own mechanical plant, which is of interest apart from its size, on account of a number of unusual features. Among these are the installation of direct-acting plunger hydraulic elevators of high lift, elaborate provisions for condensing as much exhaust steam as possible, the utilization of the heat of the flue gases for feed-water heating and a very extensive system of ventilation.

The Ansonia Apartment Hotel, New York.

The ground floor of the building will be occupied by a bank and several high-class stores, a large restaurant, a grill room, a ball room, and a reception room, together with the necessary offices in connection with the hotel proper. Of these the manager's office is of greatest importance, due to its appurtenances. Below the first floor there is a basement containing an up-to-date kitchen and laundry with a large amount of storage space for the use of the tenants, and below the basement is the cellar containing the power plant, a large swimming tank with accessory baths and lockers, and a storage room for automobiles.

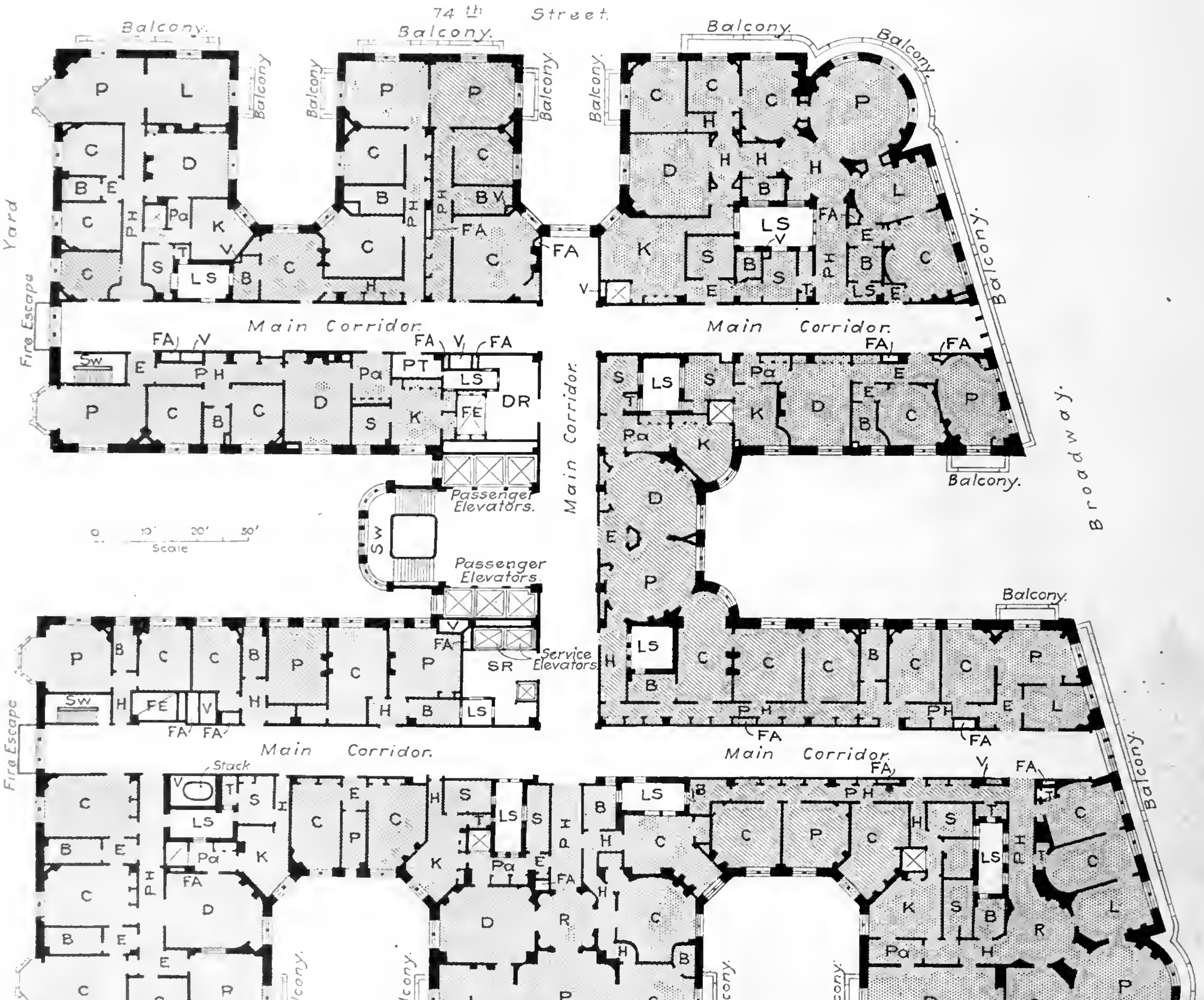
With the exception of the second, sixteenth and seventeenth floors the upper stories are practically identical, each being divided by the H-shaped form of the corridors into five groups of apartments, as shown on the typical floor plan here given. By the ingenious arrangement of this floor plan, different combinations may be made to give suites of various sizes from one to fourteen rooms. The larger suites have kitchens (the cooking being done with gas ranges or electric stoves), dining rooms, parlors, bed rooms, servants' rooms and baths; many of the two-room combinations also have bath rooms. There are a number of single rooms easily isolated from a large suite if but one room is wanted.

Dining accommodations for tenants who do not wish to have cooking done in their apartments are supplied on the sixteenth floor in a large, richly decorated dining room extending up through the seventeenth story; in this room 250 persons can be served at once. A small kitchen adjoins, and when its facilities are not adequate, the larger kitchen in the basement is called upon, intercourse between the two being accomplished by three electric dumb waiters. The second story is modified from the regular arrangement by replacing the section around the Broadway court with private dining rooms. The two tower corners of the seventeenth floor on Broadway are to be used for studios, and the remainder of that story, where not cut out for the high-ceiled dining room on the floor below, is divided off for servants' quarters. In general the apartments are heated by steam, but in addition most of the rooms have open fire places with gas logs.

The power plant, shown in the accompanying plan, is in the cellar under the rear of the southern half of the building, that is, along 73rd Street. The coal is delivered at the rear of the building and dumped, through manholes in the court, to the storage space below. The capacity of the coal storage is 340 tons. The boilers are near and facing this space and the coal is carried by cars on tracks and dumped in front of the furnaces. The firing is done by hand and the ashes are removed in wagons which are lowered into the fire room by a wagon lift. This lift is also used to lower automobiles to their storage room. The boiler equipment consists of four Caldwell water-tube boilers with McClave shaking and dumping grates, and are arranged in two batteries. Each battery contains one boiler of 428 and one of 301 horse-power. The tubes are 4 inches in diameter and 16 feet long. The total heating surface is 13,136 square feet and the total grate surface is 297.5 square feet, making the ratio of heating to grate surface 47 to 1. The boilers and grates were installed by Messrs. James Beggs & Co., of New York City. The chimney is a steel plate stack 240 feet high erected inside a brick casing, which also serves as a ventilating flue and a shaft for the exhaust steam pipe to the roof.

The steam, at 125 pounds pressure, passes from each boiler through a valve into the middle of a horizontal connection of U-form; one leg of this enters a 12-inch main and the other a 7-inch auxiliary main, each leg having a valve at its end. The 7-inch main passes backward around one end of the boiler room toward the engine room and supplies several pumps on its way, finally entering one end of the engine header which is also fed at the middle by the 12-inch main run around the other end of the boiler room. In the event of an accident to either main the other may temporarily carry the whole supply. The 12-inch main contains a Foster automatic stop valve which closes if the pressure on the boiler side falls below that on the other side, and opens again when they are equal. The 12-inch header from which the engines are supplied also feeds the elevator pumps, and, continuing east, enters the refrigerating room to supply the ammonia and brine circulating pumps and the cold drinking-water pumps. All steam pipes are dripped through traps, the ends of the mains having drop legs with blank flanges pierced by the drain pipes. A separator is installed in both the 7-inch and the 12-inch mains where they connect with the 12-inch engine-room header. The pipes are covered with Keasbey & Mattison 85 per cent. magnesia sectional lagging. The plant as originally designed was to include a Morse garbage and rubbish destructor, the gases of combustion of which were to be utilized in a Foster steam superheater. This has not been installed as yet, although shown in position on the plan of the power plant. The engines are of the American Ball compound duplex type with the low-pressure cylinder above the high and in the same casting. They are direct-connected to Westinghouse multipolar generators. Three engines of 440 horse-power are coupled to 250-kilowatt machines, and two of 220 horse-power to 125-kilowatt machines. The larger engines have cylinders 19 and 32x18 inches and run at 200 revolutions per minute, and the smaller ones are 13 and 21x16 inches, running at 225 revolutions per minute.

The exhaust from the engines enters a main located in a trench under the floor; which discharges, with all pump exhausts, into a 16-inch main above the floor containing a Webster grease extractor. Beyond the extractor this main branches, one part going to the house-heating system, the second to the hot-water drum for the hot-water system of the building and to the feed-water heater, and the third to the outboard exhaust riser in the chimney casing, the usual back-pressure valve being provided in this pipe in the sub-basement. The riser is of 16-inch spiral riveted pipe and branches at the roof to a special air-cooled condenser on one side and through a relief valve on the other, this valve being arranged to open nine stacks of 1¼-inch pipe, each stack being 6 feet wide by 7 feet 4 inches high and having a thermostatic valve on its return, the Webster system of vacuum heating having been applied to the heating system. These stacks are in a housing of No. 22 galvanized iron supported by a frame of 2-inch angle irons, through which a current of air, drawn from the vent shafts from the kitchen and power plant, is forced. While the air is warm, it is assumed that it will be at least 120 degrees cooler than the steam to be condensed. The exhaust head is the open condenser type, described in The Engineering Record of July 22, 1899. The exhaust, in order to reach the outside air, has to pass through some 160 sheet-iron tubes 2 inches in diameter and air and water. Exhaust steam is utilized as stated, but when insufficient in amount, live steam can be supplied through a pressure reducing valve. The radiators are of the direct type and of cast-iron, with two or three exceptions where coils of common pipe are used. In most cases the radiators are located in window recesses, the brick side being covered with furring, and are boxed in with asbestos lined wooden covers containing registers over the top. The registers are sometimes in the center, but more often near one end of the cover, so that the remainder may be used for a window seat. The air inlets opening from the rooms are on the front near the floor. Where enclosed the radiators are of the flue type.



TYPICAL FLOOR PLAN.

B—Bath Room.
C—Chamber.
DR—Delivery Room.
D—Dining Room.
E—Entry.
FE—Freight Elevator.
FA—Fresh Air Flue.
H—Hall.
K—Kitchen.
L—Library.
LS—Light Shaft.
Pa—Pantry.
P—Parlor.
PH—Private Hall.
PT—Public Toilet.
R—Reception Room
S—Servant's Room.
SR—Serving Room.
Sw—Stairway.
T—Toilet.
V—Vent Flue.

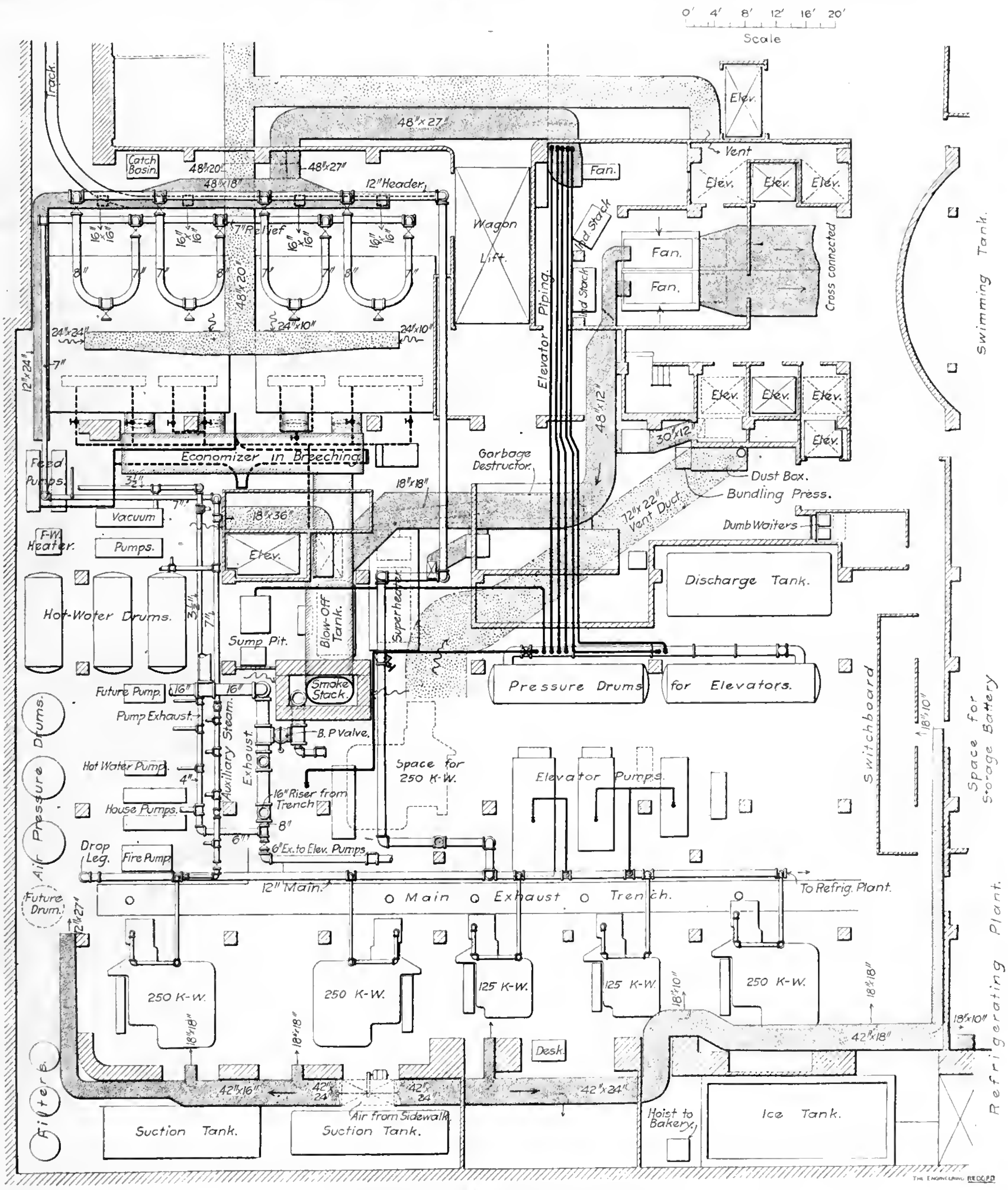
Adjoining apartments are distinguished by two kinds of shading.

only when the heating system and condenser do not absorb all of the exhaust. Steam passing through the relief valve reaches the atmosphere through a special exhaust head. The condenser and exhaust head were designed by the consulting engineer, Mr. Reginald Pelham Bolton. The former is the same in construction as a pipe coil heater but is designed to effect the condensation of steam within it and not the warming of the air outside it. It consists of is more or less condensed by the exposure of the tubes to the outdoor air. The condensed steam is caught in a pan and is returned with the water from the condenser to the return tank in the basement.

The Webster vacuum system of steam heating is employed, as stated, each radiator having the customary thermostatic valve on the return connection which closes when in contact with steam, but opens when surrounded with cold

The suction on the returns of the heating system is usually about 7 inches of vacuum. All returns are collected with the drips previously mentioned in two 6-inch mains which unite at the vacuum pumps. A dirt pot is installed in each of these branches near their union to remove any sediment liable to collect. The cleansed returns are delivered by the pumps to a receiver or drum from which the boiler feed is taken. If the returns become greater in amount than the pumps can handle, the surplus is removed through an overflow; or should the pumps stop, the relief valves placed on the returns will discharge the condensation to a sump pit which is excavated well below the level of all machinery and sewer pipes. The contents of the pit is discharged into the sewer by an automatic bilge ejector or by a 5-inch submerged vertical centrifugal pump.

The vacuum pumps, two in number, are of Knowles make, 10x16x16 inches in size, with drips, such as those from the live steam mains and the exhaust mains beyond the grease extractor, are delivered direct to the heater. The returns from the heating system are received by gravity through a 3-inch pipe from the bottom of the overhead receiving tank, the pipe extending down to the cellar floor and then rising to the top of the heater. This loop seal, constantly filled with water, prevents any air in the tank from entering the heater instead of passing out through the vent to the atmosphere, which all extra feed water required, in addition to the condensation from the heating system, is passed on its way to the heater. A 1-inch spray of cold water condenses the vapors contained in the tank. The tank has a 4-inch blow-off connection and a syphon overflow, both of which discharge into the sump pit. On the outside the tank is provided with a glass water level gauge and a pressure gauge. When desired the tank may be discharged directly to the sewer by a 6x4x6-inch duplex pump.



PLAN OF THE MECHANICAL PLANT.
Reginald Pelham Bolton, Mechanical and Electrical Engineer.

the steam supply under automatic control of a diaphragm valve, which is in connection with the return mains to maintain the desired vacuum. The return tank which receives the air and water from the vacuum pumps, is located in the basement story above. The tank is 36 inches in diameter and is 6 feet long and made of ¼-inch open-hearth steel with dished head of 5/16-inch plate.

The feed-water heater is a Webster Star open heater of 1,000 horse-power capacity. All clean as might happen with a straight connection. The exhaust steam inlet to the heater is 10 inches in diameter and the feed outlet 5 inches. The cold water inlet at the top of the heater is 3 inches in diameter.

The drip drum for foul drips and blow-offs is 4½ feet in diameter and 10 feet long, of ⅜-inch steel with ½-inch heads, and was tested at 175 pounds pressure. Within it is a condensing coil of 2½-inch galvanized-iron pipe, 7 feet long with galvanized-iron headers through

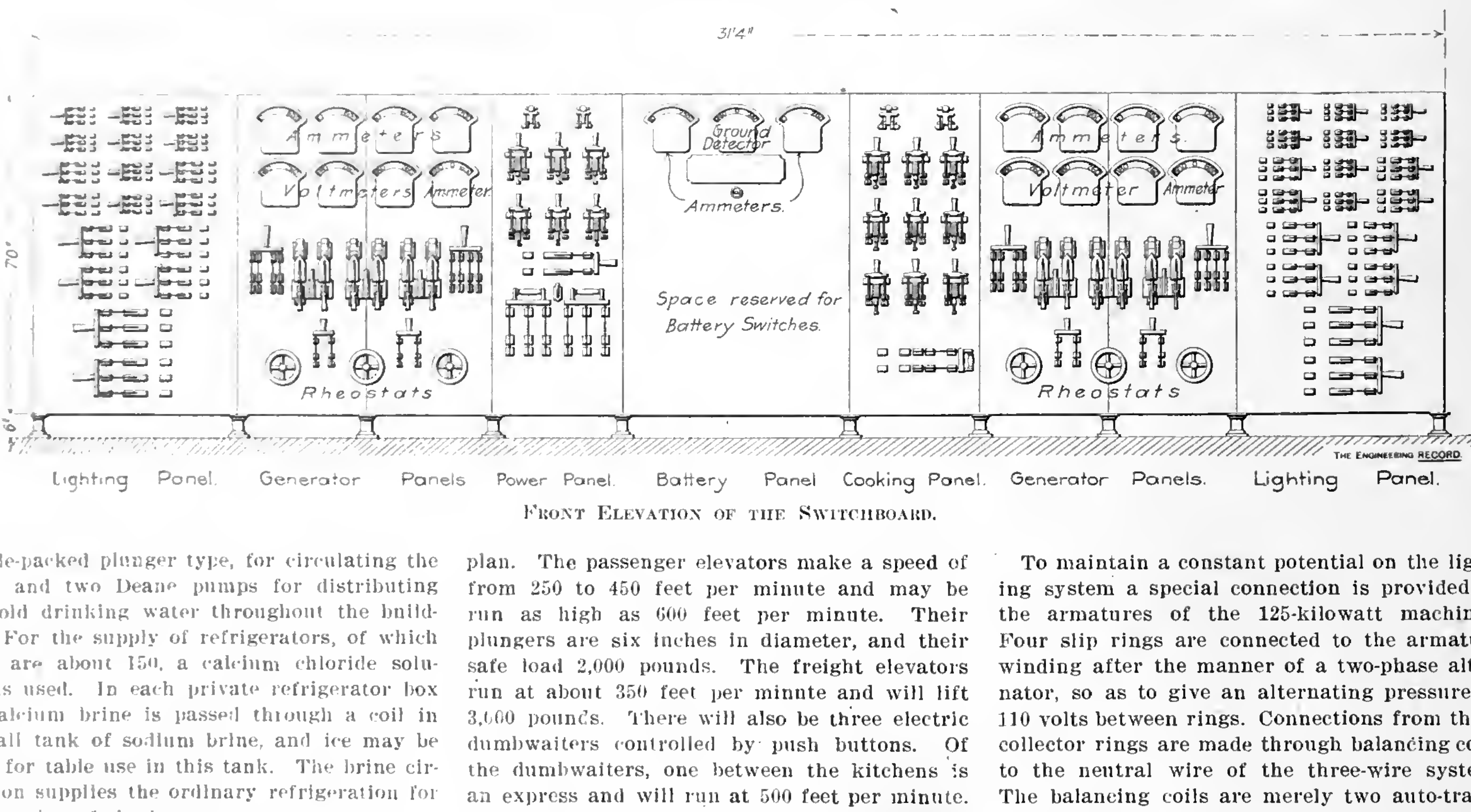
The feed water is drawn from the heater and pumped through a flue economizer to the boilers. The pumps are two of the M. T. Davidson Company's compound type with cylindrical steam-actuated valves. The steam cylinders are 7 and 12x12 inches and the water cylinders 7x12 inches. The steam supply is regulated by a float governor on the heater. The discharge of the pumps is carried in a 6-inch pipe to the smoke connection of the boilers. The economizer is contained in the upper part of the smoke passage and is merely a loop of 6-inch extra heavy pipe passing the length of the breeching to an external header and back again from the header to the center, where it passes out with a sweeping bend to the feed main between the batteries. On the header there is a safety relief valve piped to the feed heater and a blow-off connection. The longer length of the 6-inch pipe is in two pieces, the middle ends being joined in a U-shaped loop by a flange union and projecting through the flue casing. This allows for support, expansion, and repairing. When desired the feed may be by-passed around the economizer directly to the boilers, or the boilers may be fed directly by two 3-inch Metropolitan injectors.

The refrigerating plant is in the sub-basement and was installed by Messrs. Steele & Condict, of Jersey City, N. J. It operates on the ammonia absorption system and has a capacity of 70 tons of refrigeration in 24 hours. In the ordinary day's run probably not more than 5 tons of ice will be made. The rest of the plant's capacity will be used for cooling drinking water and for the tenants' private refrigerators and the kitchen refrigerators. The equipment comprises an absorber, duplicate retorts or generators, a heater or exchanger, duplicate condenser tanks, a cooling tank for ice water, a large brine tank, and an ice-making tank. The pumps are two Knowles pumps for circulating the ammonia, two Knowles compound pumps, 12 and 18½x8½x18 inches of the rated capacity of 1,300 gallons per minute. A reserve pump, 14 and 22x12x18 inches, of the same capacity but of compound type, may be used when the load is excessive. The night service is provided for by a compound pump 12 and 17x10x15 inches, rated at 700-gallons capacity. All of these pumps deliver water at 140 pounds pressure to two pressure tanks, each consisting of two drums, one above the other, 5 feet in diameter and 20 feet long connected by 16-inch pipes. An air cushion is kept on the surface of the water in these drums by a Westinghouse locomotive type air compressor. In ascending, the elevator plungers receive water from these drums and in descending discharge it into a surge tank 8x8½x22 feet, from which the water is again pumped into the drums. The freight elevators are fitted with extra heavy pipe and are operated at 400 pounds pressure, for excessive loads such as safes, by a small heavy-duty Worthington pump, 9 and 3½x10 inches. The wagon lift is 20 feet by 12 feet and has three plungers, one in the center 8 inches in diameter, and one half way between the center and either end 5 inches in diameter.

The complete elevator service embodies six passenger elevators, arranged three on either side of the main corridor and about the center of the building, two waiters' elevators, two freight elevators and one wagon lift. There are also seven private service elevators extending up through the tiers of apartments. The location of all elevators may be seen on the typical floor

will probably be installed at some future time. The adjoining panels are for the power and cooking circuits. These are flanked by two generator panels and the two outside panels control the lighting system. At right angles to the ends of the board are two panels containing fuses in the distributing circuits of the lighting system and behind the center of the board two other panels have been placed for the meters of the Edison Company; one to be used for those on the lighting current and one for those on the power and cooking current. On the back of the main board there are two sets of buses. The three bars constituting the upper set are for the positive, negative and neutral leads from the street service and the five bars of the lower set are the positive, positive equalizer, neutral, negative equalizer and negative buses of the house plant.

The generators are all compound wound and have their series fields in two parts equally divided in both leads. This was necessary for the smaller machines, because the lighting load is on the three-wire system, and, when one side is carrying a greater load than the other, the field excitation must be correspondingly increased. Obviously, if the entire series field was in the other lead no extra excitation would be provided. The larger generators were similarly wound because all machines are connected to the same set of bars on the switchboard. This dividing of the series fields made two equalizer bars necessary.



FRONT ELEVATION OF THE SWITCHBOARD.

outside-packed plunger type, for circulating the brine, and two Deane pumps for distributing the cold drinking water throughout the building. For the supply of refrigerators, of which there are about 150, a calcium chloride solution is used. In each private refrigerator box the calcium brine is passed through a coil in a small tank of sodium brine, and ice may be made for table use in this tank. The brine circulation supplies the ordinary refrigeration for the interior of the box.

The hydraulic elevator equipment is of the direct-acting plunger type, which is notable on account of the high lift required. The elevators were installed by the Plunger Elevator Co., of Worcester, Mass. It was, of course, necessary to bore a well beneath the shaft to a depth equal to the height to which it is required to run the elevator, in this case from 200 to 230 feet. The drilling was done by a Davis-Rand Australian drill and solid pieces of the core were taken out 12 inches in diameter and sometimes as long as 12 feet.

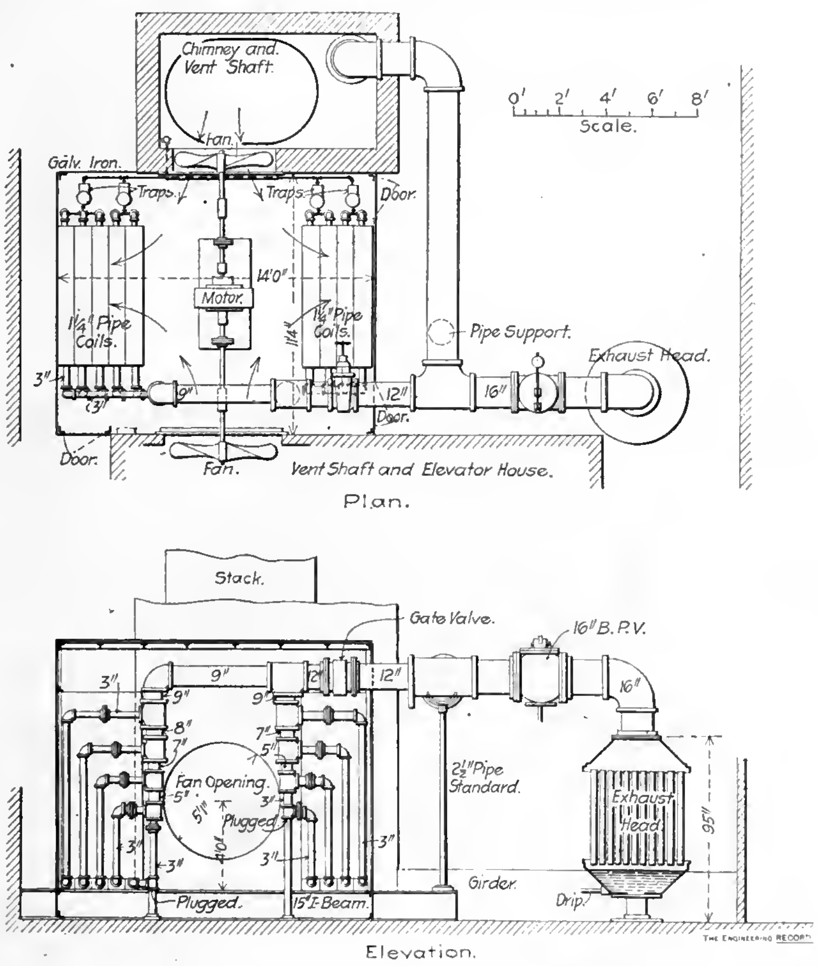
For the passenger elevator service three Worthington pumps are used. For the ordinary demands a duplex, triple-expansion pump is used, with steam cylinders 13, 18 and 29 inches in diameter and a water cylinder 14 inches in diameter, with an 18-inch stroke, and having a plan. The passenger elevators make a speed of from 250 to 450 feet per minute and may be run as high as 600 feet per minute. Their plungers are six inches in diameter, and their safe load 2,000 pounds. The freight elevators run at about 350 feet per minute and will lift 3,000 pounds. There will also be three electric dumbwaiters controlled by push buttons. Of the dumbwaiters, one between the kitchens is an express and will run at 500 feet per minute. The others pass through the serving rooms on each floor.

The electric power and lighting system is independently capable of supplying all of the needs of the building, but connections to the street mains of the New York Edison Company have been provided, so that a crippling of their plant may not cause any inconvenience to the tenants. The motors for dumbwaiters and fans are supplied from a two-wire circuit and the lighting load is on a three-wire system with particular features for maintaining constant voltage.

The switchboard, of pink Tennessee marble, is 7 feet high and 31 feet 4 inches long, and contains seven panels. The arrangement of the board and its parts is shown by the accompanying elevation. The middle panel is reserved for the connections to a storage battery which

To maintain a constant potential on the lighting system a special connection is provided in the armatures of the 125-kilowatt machines. Four slip rings are connected to the armature winding after the manner of a two-phase alternator, so as to give an alternating pressure of 110 volts between rings. Connections from these collector rings are made through balancing coils to the neutral wire of the three-wire system. The balancing coils are merely two auto-transformers, one in each phase, with their middle points connected together and to the neutral wire. Their purpose is to equalize the current in the several sections of the armature when the load on one side of the system exceeds that on the other and thus prevent the voltage in the overloaded side from dropping.

The plans provide for the installation at some future time of a storage battery auxiliary of about 134 cells placed in parallel with the generators with their middle point connected to the neutral wire. By its use the generators will be assisted in carrying the peak of the load, and during the lightload hours the battery can be charged through a motor-driven booster to be provided for that purpose. The battery is to have a normal rate of discharge of 420 amperes at 240 volts for four hours and furnishing as high as 3,000 amperes, if necessary. At



Air-Cooled Condenser and Exhaust Head.

present the battery panel contains two ammeters which will be inserted in the two legs of the battery to show their individual currents at all times, and a double-throw voltmeter for a ground detector to measure the leakage in either side of the system.

The power and cooking panels each have circuit-breakers on their distributing feeders and a double-throw, two-pole switch for connecting to the generators or the street mains. On the lower part of the power panel are two three-pole switches for connecting the street service to their buses.

The generator panels are alike, each providing for two 250-kilowatt machines and one 125-kilowatt machine. The present plant has but three of the larger generators, but space has been reserved for another large unit in case it is required. Each small machine is connected to the bus bars through a four-pole, single-throw switch on the left of the panel; the positive and negative leads also pass through a two-pole circuit-breaker with a magnet on each leg so that an overload on either side of the system will open the circuit. The other four-pole switch controls the balancing coil connections to the armature. The two circuit-breakers on either side of the one just mentioned are for the two larger machines and have magnets on but one leg, the negative; the other leg connects to the negative equalizer. The positive and positive equalizer leads connect to the two-pole switches at the bottom of the panel and are protected by a single-pole circuit breaker at the generator in the positive brush lead.

At the top of the generator panels are the meters. The two outside ammeters on the upper row have a capacity of 1,200 amperes and indicate the current supplied by each of the 250-kilowatt generators on that panel. The middle two meters with a 600-ampere capacity show the current the small generator supplies to each side of the three-wire system. The remaining ammeter has the same capacity but is double-throw and shows at a glance which side is receiving the most current and what the excess amounts to. The three voltmeters and the three rheostats at the bottom are for the three machines.

The lighting panels have double-throw switches on all of their distributing circuits so that any or all may be connected either to the street system or to the house plant. The total number of lights in the building will be about 18,000. The wiring of each apartment is controlled from panel boxes containing switches to the various rooms. The cooking current is on an independent feeder. Throughout the building all risers are boxed in and all horizontal runs are made in the space between the ceiling and the floor above. A pull box is provided in the conduits for every four quarter bends.

The ventilating apparatus is quite elaborate and complicated, combining plenum and exhaust systems. The principal fresh air inlet is through a centrally located shaft, about 8 feet square in cross-section and rising beside one group of passenger elevators. The fans are in the cellar and draw the air from the base of the shaft through cheese cloth screens and tempering coils, which will warm the air to about 70 degrees. The coils are arranged in two sections having in all 8 stacks of 1¼-inch pipe, giving a total of about 4,600 square feet of heating surface. The usual temperature regulation is provided by a cold air by-pass.

The air circulation is established by two 140-inch New York blowers set side by side and belted to two 20-horse-power C & C motors. At their normal speed of 230 revolutions per minute each blower has a rated capacity of 47,000 cubic feet and may be run as high as 300 revolutions, when desired. In addition to their regular discharges there are two smaller openings 12x24 inches, one in the casing of each blower, which combine to supply ventilation to the large dining room on the sixteenth floor. The discharge ducts from the fans can be tied together, so that either one can supply the whole building, if necessary. They deliver through horizontal ducts along the ceiling of the cellar which decrease as risers through the building are taken from them. At their largest point, near the blowers, these ducts are 72x36 inches in area. At the base of each riser the air is further warmed by extended surface radiators which are supplied, as are the main tempering coils, from the heating system, using exhaust steam, and returning their condensation through thermostatic valves to the return system. This method of subdividing the heating of the air possesses several advantages, in that the ducts can be smaller for the same quantity of air passed than if heated entirely at the fans, in that less heat is given up to the basement, and in that independent control and regulation of the heat for different sections is afforded. These supplementary heaters are located at the base of various flues, distributed about the building and the air is delivered in each apartment through a register just inside the entrance door.

For removing the vitiated air from the five tiers of apartments into which the building is divided, as described, there are five vent fans on the roof. These are connected at the fifteenth and seventeenth floors by crossngs from widely distributed vent flues. These fans are 48-inch Seymour exhaust fans and are direct-connected to 5-horse-power C & C motors. Every tier of toilet rooms and every tier of kitchens has a vent shaft with branches at each floor. The kitchen vent openings are under the hood of the gas ranges. The gas log fire places, about 300 in number, also serve as vents and are connected to the same five fans. Instead of using chimneys for each of these, a single terra-cotta drain pipe is run vertically for each line with a branch to each fireplace having a damper placed beyond the control of the tenant. At the fifteenth floor these flues are connected into the various systems by black-iron ducts, 18 inches wide and 8 inches deep, and on account of the high temperature of the gases, are covered with 1 inch of air-cell asbestos. These are laid on furring over the finished ceiling. The vent ducts crossings are 10 inches deep, of widths varying from 16 to 26 inches, and are of galvanized iron. All toilet vents project well into the center of their flues to obviate any danger of their contents backing up into living rooms.

All ventilation thus far discussed applies only to the floors above the first. The cellar and basement are ventilated with untempered air. The power plant receives fresh air from two sources. One system at the 73rd Street side takes air from the sidewalk and distributes it in opposite directions through two ducts. There are two fans at the air inlet, one for each duct. They are of the disk type, 42 inches in diameter and mounted on the same shaft which is belt-driven by a 6 horse-power C & C motor. This system has seven outlets in the engine room and three in the ice plant. The second system supplies air to the boiler room through a duct with five outlets, and to the basement above through two risers. The blower for this system will be located in the space near the large main fresh air shaft from which it will take air unheated. This fan will be a 100-inch New York blower, rated at 12,000 cubic feet per minute capacity, but not expected to be called upon for more than 70 per cent. of that amount or about 8,400 cubic feet.

The exhaust air from the boiler room will be taken through a duct having a header with four inlets over the boilers. This duct will connect with a vent from the north section of the cellar and the basement and first floor and will discharge into the north elevator shafts to the exhaust fan on the roof. The engine room is vented through openings in the base of the chimney, the space between casing and steel stack serving as the flue. Close by is an inlet into the base of another flue primarily intended for the basement kitchen ventilation.

To remove the odors of cooking from the kitchen in the basement and keep them from the floors above a rather extended system of ventilation will be employed. Taking it for granted that ample heating will be provided by the cooking ranges, the air is admitted cold from the sidewalk. A pair of 42-inch motor-driven fans distributes the air through large many-branched ducts to all parts. The exhaust ducts are even larger and more widely distributed and will discharge into the vent shaft previously referred to, which rises to the roof. The air from this flue and from the chimney casing is that air which is used for cooling the exhaust steam condenser on the roof. Between the steam coils and in the same housing, there is a 12-horse-power Lundell motor protected by a galvanized iron shield from the heat and direct-connected at each end to a Seymour fan 54 inches in diameter. The latter, through openings on two opposite sides of the housing, will draw the air from the two vents and discharge it against the steam coils and out of the other two sides of the chamber.

The first floor receives its fresh air from the large main systems already described, but is vented on a system of its own. The foul air is drawn down to a system of vent ducts on the cellar ceiling, divided north and south, and connecting to the bases of vent shafts at the rear of the main elevators in which the counterweights run. These are exhausted by two New York steel plate blowers each driven by belts from 12-horse-power C & C motors. Each equipment is housed and the discharges are through screens in the side. The south exhaust fan has a wheel 5 feet in diameter, runs at 250 revolutions per minute and can discharge 10,000 cubic feet of air per minute, and the north fan has a 6-foot wheel with a capacity of 14,000 cubic feet per minute at 230 revolutions.

Having now reviewed the mechanical plant of the Ansonia, it will be interesting to note how, at all times, its performance is indicated to the manager, and how, from his office, he can control it. In this office there is to be a cabinet of black carved oak containing a panel for gauges which show all working pressures on the different services, including the high-pressure live steam, low-pressure steam and vacuum for house heating, these being also provided with recording gauges, and the pressures of the upper and lower water supply systems, ice water system, city pressure and brine pressure. The board also contains thermometers giving the temperatures of the interior of the air supply and voltmeters on the electric system. All of these enable the management to keep a check on the engineering staff and to deal promptly with complaints.

Communication to the engine room, servants' quarters and all apartments is afforded by bell signals and telephones. A central board of 362 stations is located here, connecting all apartments and the public service. The privilege of telephone service is free to all tenants. The Miles Company's system of pneumatic tubes is installed between this point and all serving rooms on each floor, and the main kitchens and stewards' offices. Fire alarm signals are provided at four places on each floor, which ring in this office. If an alarm is received which demands it, the manager may warn the whole of the house at once, or any separate part, by bells throughout the building, provided for such an emergency.

The building was erected and is owned by Mr. W. E. D. Stokes and was planned under his supervision by Mr. Paul Duboy, of New York City. The consulting engineer for the mechanical and electrical work was Mr. Reginald Pelham Bolton. The steel and iron work was done by Messrs. J. B. & J. M. Cornell, and the masonry by Messrs. T. J. Riley and T. J. Brady. The electrical wiring, including the switchboard, was installed by Mr. Frederick Pearce, of New York. The steam fitting was done by Francis Bros. & Jellett, Inc., of New York, and the galvanized iron work by Messrs. Herrmann & Grace, of Brooklyn.

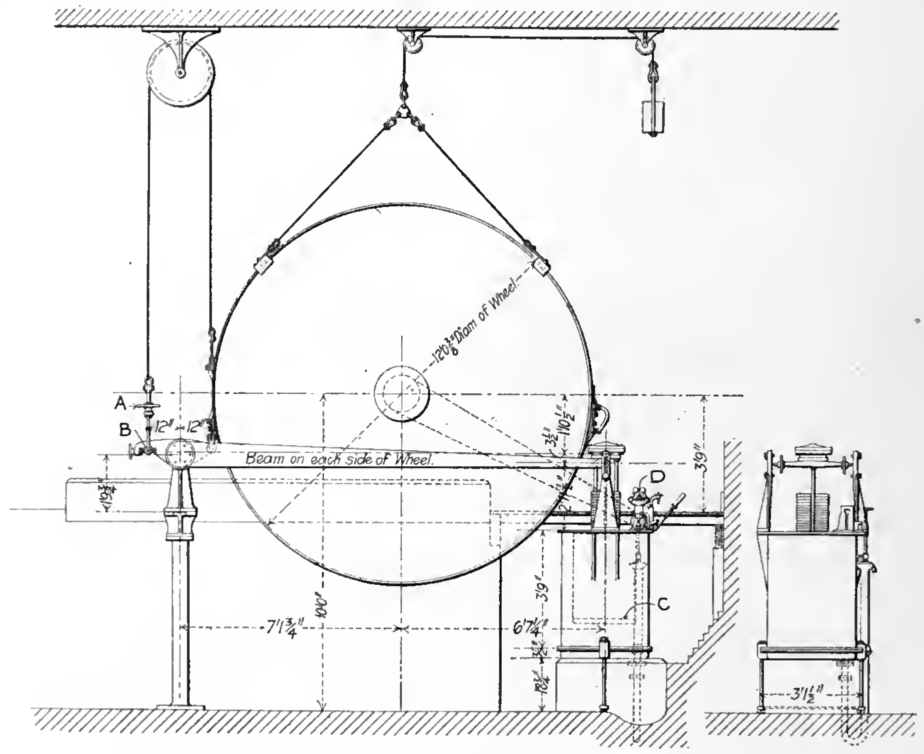
The water supply systems of the Ansonia building were described in The Engineering Record of November first.

Steam Engine Testing Apparatus in the Manchester Municipal School of Technology.

The city of Manchester, England, has recently opened a new and unusually well equipped municipal technical school. It occupies a main building of 7,300 square feet area, exclusive of a textile annex, which covers additional ground space of 1,248 square feet. The basement of the building is a large workshop and laboratory, devoted to mechanical, electrical, steam and hydraulic engineering, and to spinning and weaving. Throughout the building there are chemical, physical and metallurgical laboratories, and numerous workshops and lecture rooms. Besides a preparatory course and a course in pure and applied mathematics, there are departments of mechanical engineering, electrical engineering, sanitary engineering, theoretical and applied chemistry, textile industries and photographic and printing crafts. In the equipment of the steam engineering laboratory, which is under the direction of Professor J. T. Nicolson, head of the department, an extraordinary effort seems to have been made to obtain apparatus which would allow of elaborate and valuable investigations along lines of importance in the field of mechanical engineering; and this is particularly so in the design of the experimental steam engine. From an extended article on the school, in a recent issue of London "Engineering," the following description of the engine and the apparatus for testing it is taken:

The engine is of the horizontal compound condensing type and is capable of developing 350 brake horse-power. The cylinders are 11½ and 20 inches in diameter by 36 inches stroke. It was constructed by Messrs. James Carmichael & Company, of Dundee. There are two interchangeable cylinders of each size, which may be fitted alternately for purposes of experimental work. One of the 20-inch cylinders has slide valves with Meyer expansion plates, while the other has Corliss valves and gear. Of the smaller cylinders, one has been supplied with Sulzer drop valves, and the other with Corliss valves and gear. It is therefore possible to compare the effect of size of cylinder as well as of type of valve. Pressure up to 250 pounds to the square inch can be used and the engine will work to 110 revolutions per minute.

Each end of each cylinder has separate exhaust pipes, so that the amount of steam taken by these respectively can be found by measurement after condensation, separate condensers being provided for the purpose. The ends, sides and pistons of the cylinders are steam jacketed. The steam when supplied to any of the cylinders, may either go directly into the steam chests, or be passed through the jackets before entering them. In the latter case it may, or may not, pass through a steam separator.



ABSORPTION BRAKE FOR A 350-HORSE-POWER EXPERIMENTAL ENGINE.

Steam may be supplied to the jackets directly from the main steam pipe.

The valve casing of the Corliss cylinder is made as a separate casting, which is bolted to the cylinder with an intermediate thin plate. There are two plates, which may be used alternately, one having an opening in it corresponding to the port area, while the other is blank, so as to shut off the cylinder from the steam chest. In this way when the blank plate is in place and the valves are operated under steam pressure (the other engine giving the motion through the crank shaft), the amount of steam which leaks past the valve when closed can be drawn off by itself and conducted to the measuring vessel. It is arranged that the measuring vessel and drawing-off passage are in communication only when the valve is closed, and in addition, by first admitting steam to the measuring vessel and throttling it on opening its exhaust pipe, the conditions of pressure on the two sides of the main valve are made to approximate those occurring during actual running. Indicator cards can be taken in the measuring vessels to show the rate of variation of pressure in them, due to leakage, while the valves are in motion. Allowance is to be made for the condensation taking place in the vessel by taking the temperature of the walls and finding the condensation area from this and the cards.

The surface condensers are designed with roughened surfaces in the steam space to retard the flow of the heat-giving steam and the passages for the flow of water are contracted to obtain a high velocity. The condenser consists virtually of two concentric tubes, the water flowing in the space between them and the steam filling the space inside the inner tube and outside the outer tube. It is believed that the additional pumping power that may be needed for any increased surface friction, will be compensated for by higher efficiency and reduction in space occupied. It is stated that a condenser of this type has effected the condensation of steam at atmospheric pressure at the rate of 113 pounds per square foot of cooling surface per hour.

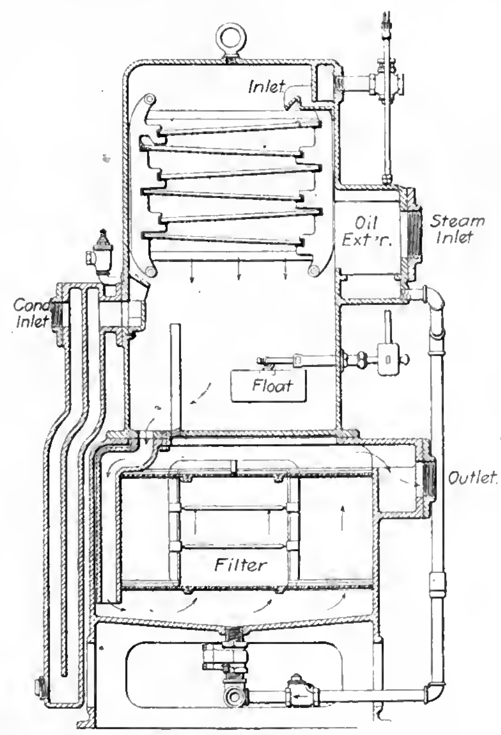
The accompanying drawings are reproduced from the article mentioned to show the general construction of a brake provided for absorbing the power of the engine. It is a band brake, consisting of two pieces of steel riveted together, one on top of the other, leaving a shallow space between for water circulation. The circulation of water in the space is very rapid, on the principle applied in the condenser. Beech slabs are bolted to the cast-iron wheel to prevent too rapid wear or the possibility of firing. The band goes once round the wheel, the tight end being fastened to the lever, and tending to raise the latter. The slack end passes over a pulley on the ceiling and back to the lever, thus tending to pull it down. The difference is recorded by means of a diaphragm and gauge. The band can be tightened by means of a screw and wheel at A. The point of application of the slack side of band to the lever can be altered by means of the screw at B.

For regulating the weight on the brake there is a novel arrangement at the opposite end of the lever. It consists of a double-walled tank, the inner wall forming an inner circular vessel. The weights which depress the brake lever have beneath them what is known as a buoyancy tank C, which is partly submerged in the inner vessel. A tap continually supplies water to the tank at a constant rate, and this water escapes at a rate which may be varied by a governing device. The bottom of the inner circular vessel is surrounded by a fixed ring on the bottom of the tank. This ring is pierced by holes, and in the bottom of the circular vessel there are corresponding holes of the same size. The circular tank is capable of turning on its vertical axis, and in this way a multi-ported valve is formed. To regulate the escape of water automatically there is a centrifugal governor, shown at D, mounted on the top of the tank and driven from the engine shaft. This by suitable mechanism operates a valve in the bottom of the tank, opening or closing it as the speed of the engine varies. By this device the acting weight on the lever is varied according to the conditions of running of the engine, as the height of water level in the inner vessel is governed by the rate of flow. The device is intended to check hunting due to cyclical variations of torque.

Dr. Nicolson points out that with a hand brake on an engine fly-wheel two things may happen. First, the co-efficient of friction between the band and wheel may vary from some cause other than change of angular velocity of the fly-wheel; or, second, a change of speed may occur due to change of steam pressure, and consequently equilibrium between brake and engine torque would be destroyed. In the first case, supposing a friction increase, then the weights and buoyancy tank will be raised, thus putting more load on the brake lever, and so tending to restore equilibrium. At the same time the speed of the engine would have diminished and the governor balls would tumble in, closing the water valve and tending to float the tank up. This would reduce the brake load, and speed up the engine again. In the second case, it is supposed the engine speed increases due to greater engine torque. This requires additional weights on the brake arm, an end which is attained by the governor balls flying out and opening the waste valve. The buoyancy of the tank is reduced, thus making the weights more effective. The co-efficient of friction between the band and wheel also diminishes with increase of speed, and so needs some correction.

The Webster Class C Heater and Purifier.

The accompanying illustration shows "Class C" type of Webster heater which has recently been placed upon the market to meet the requirements of those who desire a feed water heater of small to medium size in combination with a filter, the filter being added to make the heater particularly adapted for a feed water containing mud and salts of lime, magnesia, etc. The heater is of the open type and is in



The Webster Feed-Water Heater.

general somewhat similar to others of the same make. The feed water enters the heater through an inlet at the top and discharges into and fills a trough forming a water seal, the purpose of which is to prevent water hammer. The water overflows from the trough over a series of inclined perforated heating trays of copper, the water in its downward course being heated by steam in the heater, the water falling upon a division plate separating the heating and filtering chambers.

The filter is located in the lower casing. After the water is heated it passes through a pipe into the settling chamber at the bottom of the heater, where precipitated salts and impurities collect. The water then rises through cast-iron perforated screens which hold the filtering material and a number of screens to the under side of the division plate, whence it travels to an outlet leading to the boiler feed pump. The purpose of employing the upward method of filtration is to separate from the feed water all the precipitated salts and impurities that can be removed by sedimentation so that the filter has only to deal with the lighter impurities. As in other heaters of the Webster type, the admission of cold water is controlled by a float so that a constant level is maintained in the chamber below the inclined screens. The returns from the heating coils, steam engine jackets, reheating receivers, etc., are carried into the heater through a connection at the side provided with the water seal. Means are provided for relieving the heater of air, and a Webster oil separator is provided in the connection through which exhaust steam is admitted. The drip from the separator is connected to a blow-off pipe leading from the bottom of the heater. The makers of the heater are Warren Webster & Company, of Camden, N. J., from whom further particulars may be obtained.

Trade Publications.

The use of concrete for building purposes, in the form of patented hollow blocks, is described in a catalogue published by Harmon S. Palmer, 14th and Binney Sts., Washington, D. C., who has also patented a machine for molding the blocks. The blocks are made 9x10x32 inches, a size equivalent to 42 ordinary bricks, and of different sizes in proportion. They can be molded with different outside surfaces, as desired, and ornamented or colored for special work. The molding machines are portable and have a capacity of 150 to 200 blocks per day of 10 hours.

The Milwaukee Boiler Co., Milwaukee, Wis., has issued an illustrated catalogue of boilers, including the Reynolds' vertical and several classes of horizontal tubular boilers for both standard and high pressures, of foundry ladles, of steel stacks and of the Reynolds' feed-water heater. Boiler specifications and capacities are given in tabular form.

A discussion of the proper distribution of artificial light has been presented by the Nernst Lamp Company, Pittsburg, in a brochure showing the way in which the requirements of satisfactory illumination are met by the Nernst lamp.

The Brown-Cochran Co., Lorain, O., has prepared a nicely printed and illustrated pamphlet devoted to its lines of manufacture in ice-making and refrigerating machinery, in gas engines and in compressors. The method of refrigeration is the carbonic anhydride system; the gas and gasoline engines are built in both the vertical and horizontal types, and the compressors are provided with mechanically operated inlet valves of the Corliss type on the compressing cylinders and with the Meyer cut-off valves in the smaller sizes of steam cylinders and with the Corliss valves in the larger sizes.

The Berger Manufacturing Co., Canton, O., has issued a booklet illustrating the uses of Multiplex, a manifold plate made from black and galvanized sheet steel for floors, roofs and concrete sidewalk vault construction. The pamphlet describes also various fire-proof specialties, among which are studs, angles, furring strips and sockets for supporting metal lath, fire-proof partitions, ceiling and wall furring and luminous sidewalk lights.

The Rand Drill Co., 128 Broadway, New York City, has issued a 32-page catalogue devoted to its Imperial type of air compressors, both steam actuated and belt or gear driven. They are built in sizes of 20 to 420 indicated horse-power, the largest regular size, with a capacity of 2,394 cubic feet of free air per minute compressed to 100 pounds pressure. The book is well illustrated with cuts of the different machines, and has a corresponding number of tables of details and capacities.

The Samson windmill and the various kinds of steel towers for windmills, water tanks, etc., made by the Stover Manufacturing Co., Freeport, Ill., are described in that company's catalogue No. 552. This takes some 56 illustrated pages in which are shown the details of both mills and towers and which include some useful data regarding the power of windmills.

The importance of preserving woodwork exposed to wet or dry rot or to destruction by insects is discussed in a circular printed by Samuel Cabot, 70 Kilby Street, Boston, to introduce his "Conservo" wood preservative. This is a brownish liquid which is applied with a flat wide brush or by dipping the wood into the liquid.

A circular describing the Merrell pipe threading and cutting machines has been issued by The Fairbanks Co., Elm and Broome Streets, New York City. The machines can be run by hand or power.

The Mertes Duplex gas engine is the subject of Circular No. 2 of the National Gear Wheel & Foundry Co., for which J. D. Lyon & Co. are general agents at 331 Fourth Avenue, Pittsburg. The engines are designed for heavy duty, having ratings of 60 to 150 brake horse-power, at speeds of 180 to 160 revolutions per minute. They have poppet valves, a centrifugal throttling governor and electric ignition.

The C. O. Bartlett & Snow Co., Cleveland, O., has issued its general catalogue No. 7, a book of 288 pages covering machinery for cereal, flour and cement mills, elevating and conveying machinery, dryers and general mill supplies. It is profusely illustrated and contains descriptive matter, tables and price lists of the machinery. A large number of useful tables of general information are appended and ready use of the book is assured by an extended index.

To record some recent work done in the field of high-speed electric inter-urban railway engineering by Westinghouse, Church, Kerr & Co., New York, has taken 100 pages of a book entitled "Work Done." In addition to an extended description of several electric railway and power developments, there are numerous reproductions of working drawings and full-page half-tones from photographs of the different installations.

The Stephens-Adamson Manufacturing Co., Aurora, Ill., has prepared a pamphlet given up to its system of belt conveyors, including both self-oiling dust-proof and standard carriers. The inclined or troughing rollers turn on a spindle which is submerged and which revolves in oil.

The Joseph Dixon Crucible Co., Jersey City, N. J., is distributing a flyer on Silica-Graphite paint for the protection of heated surfaces, such as smoke stacks, boiler fronts and steel bridges.

The latest publication of the Associated Expanded Metal Companies is a 9x12-inch paper-covered book that contains about 120 beautiful reproductions from photographs of notable buildings in which the expanded metal system of fire-proof construction has been used. A copy of this valuable collection can probably be obtained from the New York Expanded Metal Co., 256 Broadway, New York.

Personal and Obituary Notes.

Maj. W. F. Robertson has been elected city surveyor of Wilmington, N. C.

Capt. T. M. McKennon has been elected chief engineer of the Blackstone & Chase City Railroad, Chase City, Va.

Mr. Schuyler Hazard, M. Am. Soc. C. E., has been appointed chief engineer of the Catawba Power Company, of Rock Hill, S. C.

Mr. Norton P. Otis, chairman of the Board of Directors of the Otis Elevator Company, has been elected to Congress from the 19th Congressional district, New York.

Mr. Edward S. Nelson has been appointed general inspector of concrete of the New York Central & Hudson River Railroad, succeeding Mr. H. Latimer, who has been transferred.

Mr. James Wilson, of Des Moines, Ia., for some twenty years with the Burlington railroad, has been appointed chief engineer of a narrow-gauge road to be built from Central City, Colo., to Yankee and Alice.

Charles Moehlman, foreman of the iron foundry of the General Electric Co., at Schenectady, N. Y., since 1895, died suddenly in that city, October 31. He was born in Westphalia in 1856 and emigrated to America in 1882.

Mr. J. D. Flack has resigned as engineer for the International Lithoid Co., to accept an appointment as erecting engineer and superintendent with the A. D. Granger Co., contracting engineers, 95 Liberty Street, New York.

James Campbell, superintendent of construction in the early days of the Southern Pacific Railway, died November 9 at Salt Lake City of pneumonia, aged 70 years. He was the first superintendent of the Salt Lake division of that road.

Julius F. Munckwitz, supervising architect and superintendent of parks of New York City from 1871 to 1884, died November 10 aged 71 years. He was first connected with the parks in 1857. Since 1884 he practiced his profession as architect.

Mr. Roger B. Williams, Jr., Jun. Am. Soc. C. E., and Mr. Ezra B. Whitman have formed a partnership under the firm name of Williams & Whitman, with an office in the Fuller Building, New York City, for the practice of civil and sanitary engineering.

Mr. Aug. Freihoff and Mr. J. Leon Wieland have purchased the business of the late A. M. Patitz and have established the firm of Freihoff & Wieland, as consulting mechanical and electrical engineers and superintendents, Germania Building, Milwaukee, Wis.

Mr. Owen L. Ingalls, assistant engineer, Department of Sewers, District of Columbia, has been appointed engineer in charge of waterworks and sewers in Manila, P. I. He was graduated from Cornell University in 1886 and has held his present position since July, 1890.

Prof. Estevan A. Fuertes has resigned as director of the College of Civil Engineering, Cornell University, on account of ill health, but The Engineering Record is glad to note that he will be able to remain in the faculty of the University as professor of astronomy in charge of the General A. C. Barnes observatory.

Civil Engineers E. H. Brownell, E. R. Gayler and P. L. Reed, U. S. N., whose appointments were recently noted in this column, have been ordered to the Portsmouth, N. H., the Brooklyn and the Boston Navy Yards, respectively. Passed Assistant Engineer R. Crawford, U. S. N., has been assigned duty at Cramp's shipyard at Philadelphia, as assistant inspector of machinery.

Prof. Ogden Nicholas Rood, the head of the department of physics in Columbia University for the last thirty-eight years, died of pneumonia at his home in New York, November 12, at the age of 71 years. He was graduated from Princeton in 1852, from Yale in 1854 and studied at the Universities of Munich and Berlin. Among his foremost achievements may be mentioned the application of stereoscopic photography to the microscope, the measurement of the duration of flashes of lightning and the making of a photometer independent of color. He was a member of many societies of both science and art, and was at one time vice president of the American Association for the Advancement of Science.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Great Barrington, Mass.—In a rough estimate T. H. McKenzie, of Hartford, Conn., places the cost of building the concrete dam, 40 ft. high, which would be necessary to convert the waters of Goodale Brook into a gravity water supply for this district, at $50,000.

Hammonton, N. J.—Jas. L. O'Donnell, Secy. Water Comrs., writes that the following bids were opened Nov. 7 for furnishing and erecting 2 500,000-gal. compound duplex steam pumps, 2 100-H.-P. boilers, heater and boiler feed pump and steam fitting; E. Keeley Co., Williamsport, Pa., $7,242; Henry A. Miller, Wilmington, Del., $6,111 (awarded).

New York, N. Y.—Bids are wanted Nov. 20 for furnishing, delivering and laying water mains in Claremont, Convent, Gerard and numerous other streets in the Boroughs of Manhattan and Bronx; the time allowed to complete the whole work will be 300 days, and the amount of security required $20,000. Robt. Grier Monroe, Comr. Dept. of Water Supply, Gas and Electricity.

North Beaver Township, Lawrence County, Pa.—The Cascaskee Water Co., of this place, has been incorporated, with a capital of $50,000 John B. Brown, Pres.; John P. Graham, of Moravia, Vice-Pres.; Jas. E. Mooney, of New Castle, Treas., and Stuart Thompson, Secy.

Newark, N. J.—Application for this city to furnish a water service has been made by property owners of Silver Lake and Soho Park sections of Belleville.

Washington, D. C.—The Comrs., D. C., have ordered that the sum of $50,000 be taken from the water fund and used for continuing the extension of the high-service system of water distribution.

The Northeastern Suburban Citizens' Asso. has again requested of the Comrs. that water pipes be extended to Langdon.

Wilmington, Del.—Local press reports state that the Superior Court of Delaware having decided that the Water Dept. of this city has a right to purchase land for reservoir purposes, it is expected that the work on the new basin will begin in the immediate future.

Allentown, Pa.—The Water Bd. is stated to have employed J. W. Hill, of Cincinnati, to recommend a plan to bring in and store the water from Schantz's Spring.

Walnutport, Pa.—The State Department has granted a charter to the Walnutport Water Co., with a capital stock of $1,000. The incorporators are: Alvin F. Newhart and Benjamin W. Roth, Treas., of Walnutport; Wilson F. Andrews, of Slatington, and others.

Quogue, N. Y.—The Quantuck Water Works Co., of Westhampton Beach, has been incorporated, with a capital of $100,000. Directors: J. P. Howell, Henry Gardiner and E. F. Post, of Quogue, and others.

Steelton, Pa.—The Boro. Council has sold $80,000 water bonds.

Keeseville, N. Y.—The Village Bd. has under consideration a proposition from the J. & J. Rogers Co., of Ausable Forks, N. Y., to provide the village with a new source of water supply (Gay Brook), to pipe said water to a reservoir near the village pumping station. Estimated cost of proposed plant, $30,000.

McKeesport, Pa.—The Bd. of Water Comrs. has decided to employ an expert engineer to make a recommendation as to the best plan the Bd. can adopt to secure a better water supply for the city. The Comrs. have under consideration the purchase of a section of ground about five miles up the river on which to erect a new reservoir.

Buffalo, N. Y.—The Bureau of Water is to extend the water mains by laying 16-in. pipe in Marilla and Fletcher Sts. Estimated cost, $8,000.

Bern Township, Berks County, Pa.—The Glenside Water Co., of this place, has been incorporated, with a capital of $3,000.

Bayonne, N. J.—Bids will be received Nov. 18 by the City Council for $22,000 water bonds. W. C. Hamilton, City Clk.

Lancaster, Pa.—The American Spring Water Co., John F. Stauffer, Pres., has made a proposition to the city to furnish water, asking for a 30 years contract, the minimum rental to be $30,000 per year.

Rochester, N. Y.—The Common Council has authorized Comr. McClintock to secure the title to Cobb's hill reservoir site either by purchase or condemnation proceedings. The estimated cost of the 55 acres of landed needed is $110,000. This acreage will accommodate a reservoir with a capacity of 70,000,000 gals. at an estimated cost, with necessary piping, of $572,000, making the cost of land and reservoir $682,000.

Alexandria, Va.—Walter Roberts, Pres. of the Alexandria Water Co., has recommended the construction of a reserve reservoir.

Elyria, O.—This city has contracted with the New York Continental Jewell Filtration Co. for a filter plant of 2,000,000-gal. capacity per day. The source of the supply is Lake Erie.

The following bids are reported to have been received by the Water Works Trus. for the erection of the pumping station and filter plant buildings for the new water works: Jacob Meyer, Lorain, $21,950 (awarded); Bonsor Bros., Lorain, $22,205; Fred Wolf, Elyria, $22,450.

Cincinnati, O.—The Bd. of Water Works Comrs. is said to be preparing to issue $1,000,000 water works bonds in February.

Mallard, Ia.—Recorder J. W. Johnson writes that the contract for constructing water works has been let to the Des Moines Bridge & Iron Wks., Des Moines, Ia., for $6,500.

Ottumwa, Ia.—City Engr. John T. Brady writes that bids will be received Dec. 1 for furnishing approximately 470 net tons of 16, 14, 12, 8 and 6-in. cast iron water pipe, and 19,000 lbs. of specials, to be delivered on or before Feb. 1, 1903; bids will also be received at the same time for the laying of said pipe on or before Apr. 1, 1903.

Waukegan, Ill.—Bids are wanted Nov. 17 for 5,760 ft. of 12-in. cast iron water pipe with 3 valves and 1 fire hydrant, to be laid in certain streets. H. Thacker, City Clk.

North Milwaukee, Wis.—This village has sold $30,000 bonds for a new water works system.

Harrison, O.—The village is considering the purchase of the water works and the lighting plant, now owned by Jas. Graft, which supplies the village.

Ashtabula, O.—Plans for a new water works system and supply at Ashtabula are reported to have been approved by the State Bd. of Health.

Indianapolis, Ind.—The Bd. of Pub. Wks. has ordered the Indianapolis Water Co. to proceed with its extension of water mains to Irvington. The order of the Bd. is for about 8 miles of mains and involves the putting in of about 50 fire hydrants.

Cleveland, O.—The Bd. of Control has authorized the Dir. of Pub. Wks. to contract with the Babcock & Wilcox Co. for the installation at Kirtland St. pumping station of a battery of 6 boilers, equipped with steel superheater and automatic stokers. Cost $43,454.

Columbus, O.—A committee, composed of Professors Ray, Bonnocker, Sherman and others, has under consideration the recommendation that the Ohio State University install an independent water plant.

Castana, Ia.—The Castana Water Co. has been incorporated with a capital of $4,000, to erect, establish and maintain a system of water mains in Castana. W. L. Wiley, Pres.; J. E. Kintigh, Secy.; C. W. Norcross, Vice-Pres., and W. W. Gingler, Treas.

South St. Paul, Minn.—Bids are wanted Dec. 1 for the construction of a standpipe and laying water mains to the pumps of Swift & Co. Chas. W. Clark, City Recorder.

Findlay, O.—City Engr. John W. S. Riegle writes that bids will be received Nov. 25 for laying 10.6 miles of 24-in. vitrified pipe, or 10.6 miles of 20-in. cast-iron pipe, with well connections, etc.

Gillett, Wis.—Village Clk. L. B. Studke writes that bids are wanted by the Village Council until Dec. 29 for the construction of water works, estimated to cost $6,000.

Burlington, Ia.—This city has voted in favor of granting the Citizens' Water Co. the exclusive right to acquire, operate, improve, extend and maintain the system of water works now constructed in this city for a period of 20 years.

Lake Linden, Mich.—Local press reports state that this town proposes to install municipal water works and an electric light plant.

Mount Carmel, Ill.—The Citizens' Light & Water Co. has been incorporated with a capital of $70,000. Incorporators: A. R. Manley, P. G. Manley and J. M. Mitchell.

Moline, Ill.—The City Council has decided to purchase the high-duty pump, 6,000,000 gal. capacity, of the Holly Mfg. Co., Lockport, N. Y., at its bid of $24,430, of which $1,680 is for connections. In his report Engr. Dan. W. Mead recommends that the bid of the New York Continental Jewell Filtration Co. be accepted for the construction of a filter system at a cost of $67,377.

Ardmore, Ind. Ter.—City Clk. G. H. Bruce writes that the piping for the $150,000 water works has been purchased, and work will begin in Dec. Engr. in charge, Chester B. Davis, of New York City.

El Paso, Tex.—City Engr. Geo. C. Wimberly writes that a water works franchise has been granted to W. J. Davis and associates of Los Angeles, Cal., for a term of 35 years.

St. Louis, Mo.—The ordinance appropriating $110,000 for alterations in the settling basins at the Chain of Rocks has been given its first reading in the City Council.

Sapulpa, Ind. Ter.—At the recent election $25,000 bonds are reported to have been voted for water works and $15,000 bonds for schools.

Lake Charles, La.—The charter of the Fresh Water Co. has been filed for record. The company is capitalized at $300,000. The officers are: J. W. McFatter, Pres.; F. C. Baker, Vice-Pres.; J. R. Lyles, Treas.; J. E. Gilsson, Secy., and J. E. Bland, Gen. Mgr., all of Calcasieu Parish. The company proposes to build a canal from Calcasieu River across to Great Calcasieu Prairie, east of Fenton, La.

Ft. Leavenworth, Kan.—The Secy. of War has appointed a Bd. of Officers, consisting of Col. Chas. W. Miner, Maj. S. S. Leach, Corps of Engrs., and others, to meet at Ft. Leavenworth to inquire and report upon the subject of water works at that post.

Eagle Lake, Tex.—The proposition to issue bonds for building a water works plant, is reported to have carried.

Harrodsburg, Ky.—The water works and electric light bond issues are reported to have carried at the recent election.

Lawton, Okla. Ter.—The City Council is reported to have awarded to Cook & Son, of Junction City, Kan., the contract for constructing water works for $104,959. The contract provides for 9 miles of mains, a power house, pipe and reservoir, all to be completed in 6 months after the Secretary signs the contract. Local press reports state that the United States Government pays for the entire system, and it then becomes the property of the city, and that sewers are to be built later in the same way.

Bay City, Tex.—Local press reports state that water works and electric light systems are to be built.

Covington, Tenn.—The City has purchased the water works for $14,720.

Memphis, Tenn.—The Water Com., of which Edw. B. Le Master is Chmn., has recommended that the city acquire possession of the Artesian Water Co.'s plant, and Com. also recommends an increase of fire hydrants.

Wagoner, Ind. Ter.—Bids are wanted for $160,000 corporation water works bonds. C. A. Rees, Fayetteville, Ark.

Ft. Romie, Cal.—The Ft. Romie Water Co. has been incorporated by A. James, N. A. Erickson, E. Harding and others, with a capital of $6,750. Principal place of business, Soledad.

Salem, S. D.—Bonds to the amount of $6,000 are reported to have been voted for a system of water works.

Wessington, S. D.—The proposition to issue $2,500 artesian well bonds carried.

Fargo, N. D.—An improved water supply is urged. Larger water mains in the business portion are proposed.

Colorado Springs, Colo.—Mayor John R. Robinson, in a communication to the City Council, recommends the appointment of an expert hydraulic engineer to take charge of Colorado Springs water works system.

Fort Lupton, Colo.—The Lake Lupton Irrigating & Reservoir Co. has been incorporated, with a capital of $40,000, to operate in Weld County. Principal office, Ft. Lupton. Directors: T. C. Winbourn, H. B. Cave, R. W. Haynes and others.

Ft. Flagler, Wash.—Col. J. H. Hathaway, Ch. Q. M., and Col. Timothy E. Wilcox, Ch. Surgeon of the Dept. of the Columbia, U. S. A., are said to be considering plans for securing an adequate water supply for Fort Worden, Ft. Flagler and Ft. Casey.

Pueblo, Colo.—The North Side Water Works Trus. have ordered plans and specifications for a pipe line from 6th St. and Grand Ave. to Fairmount Park.

Marion, S. D.—The construction of a water works system for fire protection is said to be under consideration.

Armour, S. D.—The city authorities are considering the matter of providing a new supply of water for domestic and fire protection purposes.

Los Angeles, Cal.—It is stated that bids are wanted Nov. 24 for a pumping plant at Buena Vista, consisting of a double-acting duplex pump of 4,500 gals. per minute, lifted to a height of 230 ft., or a vertical inverted engine, and 2 water-tube boilers. Wm. Mulholland, Supt. of Water Wks.

Brandon, Manitoba.—The City Council has resolved to make improvements to the water works plant to the amount of $25,000; improvements to include the installation of new machinery and the extension of water mains.

Stratford, Ont.—The City Council has passed a resolution to submit a by-law to the people to acquire the water plant and mains of the Stratford Water Supply Co., for $95,000.

SEWERAGE AND SEWAGE DISPOSAL.

Waterbury, Conn.—This city is considering various plans for the disposal of sewage, one plan which provides for a chemical precipitation of the solid matter with subsequent land filtration of liquid matter near Platt's Mills, would require an investment of at least $400,000, according to local press reports, with an annual cost of operation amounting to about $28,000.

Medford, Mass.—The Comrs. of Sewers have ordered the construction of a sewer in Irving St., work to be done under the direction of City Engr. W. Gavin Taylor.

Northampton, Mass.—Engr. Bowditch, of the State Bd. of Health places the estimated cost of the proposed extension of the Northampton sewer system to the Connecticut River at over $100,000. The Sewer Comrs. (L. M. Thacher, Engr.) have petitioned the city government for an appropriation of $50,000 for the extension.

West Hoboken, N. J.—The Town Council on Nov 5 adopted a resolution directing the Com. on Streets and Sewers to present to the Council plans, estimates, etc., for additional relief sewers. According to plans prepared by Sebastian Maulbeck, Town Surveyor, the estimated cost of said sewers is $30,000.

New York, N. Y.—Bids are wanted Nov. 20 for the construction of a pipe sewer and appurtenances from the Public Comfort House in the North Meadow to existing sewer near 99th St. and 5th Ave., all in Central Park. Wm. R. Willcox, Comr. of Parks.

Bids are wanted by Geo. Livingston, Comr. of Pub. Bldgs., until Nov. 18 for repairs to sewer in Stanton St.; security required $10,000. Also for repairs to sewer in 12th and 13th Aves., in 27th, 28th, 29th and 30th Sts.; amount of security required $7,500.

Canajoharie, N. Y.—Morrell Vrooman is reported to have been engaged to prepare plans and specifications for the sewer system, for which $36,000 bonds were recently voted.

Reading, Pa.—A plan is said to be under consideration for the issue of $400,000 bonds for public improvements, including the construction of certain sewers and a bridge at Spring St.

Glassport, Pa.—This Boro. has voted to issue $60,000 bonds for sewer work, street work and general improvements.

Brooklyn, N. Y.—Bids will be received Nov. 26 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and constructing a sewer in portions of Ovington Ave. and outlet sewers in portions of Silliman Pl. and Second Ave. Engineer's estimate is as follows: 1,750 lin. ft. 12 and 18-in. vitrified stoneware pipe sewer laid in concrete, 19 manholes, 4 receiving basins and 11,600 ft. B. M. foundation planking.

Mt. Vernon, N. Y.—City Engr. Geo. W. Drumheller writes that Snow & Barbour, of Boston, Mass., have commenced surveys for revised map of sewer system for Chester Hill and Corcoran Manor Districts of this city.

Johnstown, N. Y.—The Sewer Com. has recommended the construction of a 12-in. trunk tile sewer through Market and other streets. Total length 2,400 ft.

Corinth, N. Y.—Village Engr. S. J. Mott has placed the estimated cost of the Palmer St. sewer system at $8,321.

Bradley Beach, N. J.—Bids will be received Nov. 20 by Wm. E. MacDonald, Boro. Clk., for constructing sewers in said Boro.

Depew, N. Y.—Bids will be received Nov. 17 by the Bd. of Village Trus. for furnishing material and constructing lateral sewers. J. C. Glade, Village Clk.

Easton, Pa.—The Finance Com. has reported to the Common Council having approved the ordinance providing for the increase of the city debt $300,000 for the purpose of improving streets and the sewerage system.

Penn Yan, N. Y.—Wm. T. Morris, of Penn Yan, and associates have petitioned the Village Bd. of Trus. for a franchise to lay a complete system of sewers in the village.

Leetsdale, Pa.—The Leetsdale Drainage Co. has been incorporated, with a capital of $10,000.

Crafton, Pa.—Bids will be received Dec. 2 by W. O. H. Elliott, Boro. Clk., for $25,000 bonds, to be used for improving sewers, streets, etc.

Bond Hill, O.—Village Clk. A. J. Kiphart writes that on Nov. 4 it was voted to issue $40,000 bonds for the construction of a sewerage system for the suburbs.

Grand Rapids, Mich.—The City Council on Nov. 3 instructed the Bd. of Pub. Wks. to reject all bids opened Oct. 17 for the construction of a sewer along the West Side Ditch, and to ask for new bids to be received Feb. 1. The work contemplated comprises the construction of a concrete and concrete-metal sewer of about the following lengths and dimensions: 2,305 ft., 7.5 ft. in diameter; 2,207 ft., 7 ft.; 2,633 ft., 6.5 ft.; 1,585 ft., 5 ft.; 1,959 ft., 4.75 ft.; 461 ft., 4.5 ft.; 2,588 ft., 4 ft., and 1,287 ft., 3.5 ft. in diameter. L. W. Anderson, City Engr.; John C. Brown, Clk. of Bd. of Pub. Works.

Des Moines, Ia.—Bids will be received Dec. 2 by the Bd. of Pub. Wks. for constructing 12-in. vitrified clay pipe sewers, about 3,690 lin. ft., in portions of 3 streets. J. E. Stout, Chmn.

Clinton, Ia.—City Engr. Chas. P. Chase writes that it is expected to commence work in the spring upon the sewerage system, for which he is preparing plans. Estimated cost $250,000 to $300,000.

Jerseyville, Ill.—The City Council is reported to have let the contract for the first system of sewers to Wolfe, Maupin & Curdie, Alton, Ill. The sewer system will be 4,000 ft. in length, 10 and 12 in. in diameter.

Peoria, Ill.—The City Council has authorized the construction of 3 sewer systems; total estimated cost $141,390. The North Peoria sewer system, which is estimated to cost $87,970, includes 5,000 ft. of tunnel, to run 80 ft. below the surface.

Washington, Ia.—This city is said to be planning additional sewers.

Racine, Wis.—The proposition to issue $55,000 sewer bonds is reported to have carried.

Columbus, O.—The Bd. of Pub. Wks. has recommended to the Council for passage ordinances authorizing the construction of central relief sewers in the Long St. Dist., Walnut St. relief sewers and a system of sewers on the West Side north of Broad St.

The contract for the construction of sewers in West Side sewer Dist., Section A, has been awarded to J. B. Sheets & Co., of Pittsburg, for $51,840.

Indianapolis, Ind.—The Bd. of Wks. has taken final action on ordinance for a local sewer in Arsenal Ave. Estimated cost, $5,400.

Nashville, Tenn.—City Engr. Wm. W. Southgate writes that the following bids were opened Nov. 6 for constructing the Edgefield Branch sewer work, to include 5,000 ft. of 9 ft. 3 in. to 11 ft. brick sewer, with 16 manholes, average depth of excavation 5½ ft. in earth: Lightman & Butler, Nashville, $66,317; Patterson & Brieson, Baltimore, Md., $86,767; Nashville Plumbing Co., Nashville, $66,224; Henry Herman (U. S. Const. Co.), Cincinnati, O., $84,251; J. T. Allen, Nashville, $69,439; Pease & Davidson, Nashville, $66,942; E. T. Lewis Co., No. Front St., Nashville, $59,895. The contract has been awarded to the E. T. Lewis Co., its detail bid being as follows: Excavating 16,882 cu. yds., 35 cts.; brick work, plain, 5,061 M, $10.60; brick, radiated, 1½ M, $10.60; masonry, 10 cu. yds., $8; concrete, 10 cu. yds., $8; iron casting, set, 8,080 lbs., total $15; 18-in. pipe, 200 ft., 70 cts.; 15-in. pipe, 30 ft., 50 cts.; 12-in. pipe, 30 ft., 40 cts.; 6-in. pipe, 225 ft., 15 cts.; 30-in. pipe, 25 ft., $2; 24-in. pipe, 20 ft., $1.25.

Lawton, Okla. Ter.—See "Water."

Gueydan, La.—The syndicate that bid in the work of excavating 24 miles of drainage canals between this town and Grand Lake, was organized Nov. 8 into the Inland Canal Co., capitalized at $100,000, with the following officers and directors: J. M. Booze, of Roanoke, La., Pres.; T. J. Curtis, Vice-Pres.; Henry L. Gueydan, Secy. and Treas.; C. D. Babbit, V. Wainwright, D. L. McPherson, of Abbeville, and Bernard Titche, of New Orleans. Work is to begin before Jan. 1, 1903. C. D. Babbit is the Engr. of the Co.

The following bids were opened Nov. 4 for approximately 500,000 cu. yds. of dredge work on Canals A, Vermilion Parish: E. B. Connors, New Orleans, at 8.39 cts.; Menzler & Co., New Orleans, at 7.875 cts.; H. L. Gueydon, Gueydan (awarded), at 7.47 cts. No bids were received on Canals B, Vermilion Parish, for 43,000 cu. yds. of dredge and scraper work.

New Orleans, La.—The Executive Com. of the Sewerage & Water Bd. has reported favorably on the acceptance of the bid of the Camden Iron Works for furnishing steam and electrical equipment to the pumping stations, amounting to $246,000. The Com. also recommends that after specifications are modified so as to make a larger number of smaller contracts for the construction of sewer work, new bids be asked to be opened Feb. 2.

Houston, Tex.—Local press reports state that it will cost several thousand dollars to repair the filter beds of the sanitary sewer plant. Dr. W. M. Brumby, City Health Officer, may give further information.

Hannibal, Mo.—An extensive culvert and sewerage system is to be constructed on Grand Ave. in order to convert this thoroughfare into a boulevard. The improvement, it is estimated, will cost about $10,500.

North Yakima, Wash.—Ernest McCullough, of Lewiston, Idaho, has been engaged to prepare plans for a sewer system for this city, also for underdraining for city; estimated cost $60,000.

Flagstaff, Ariz.—A special election has been called for Dec. 8 to vote on the issue of $9,500 bonds for the purchase and improvement of the sewer system. L. W. Quinlan, Town Clk.

Los Angeles, Cal.—At the recent election it was voted to issue $1,000,000 bonds for outfall sewers and $400,000 bonds for storm drains.

Fairbury, Neb.—Press reports state that the Sewer Co. will extend the sewer system.

BRIDGES.

Boston, Mass.—Bids are wanted Dec. 1 for constructing Wellington bridge, Middlesex Fells Parkway, Somerville and Medford. Total length of bridge about 950 ft. Wm. B. De Las Casas, Chmn. Metropolitan Park Comn.

Bemuspoint, N. Y.—There is reported to be a movement on foot in Chautauqua County looking to the construction of a bridge across "The Narrows," near Bemuspoint, to cost about $50,000. At a meeting held here Nov. 1 an organization was perfected, with Jared Hewes Pres. and Henry W. Flabavens, Secy.

West Albany, N. Y.—A press report states that the N. Y. Central & Hudson River R. R. Co. will construct a 9-track bridge over Schenectady turnpike. W. J. Wilgus, Ch. Engr., New York.

Pittsburg, Pa.—The Pittsburg & Washington St. Ry. Co. is stated to have awarded to the McClintic-Marshall Construction Co. of Pittsburg the contract for the construction of 3 steel viaducts, one 1,000 ft. long, another 480 ft. long and the third 270 ft. long.

Glenolden, Pa.—The Boro. Council is stated to have passed an ordinance granting the Philadelphia, Baltimore & Washington R. R. Co. the privilege of building an overhead bridge at Ashland. The company is required to macadamize Ashland Ave. from Linwood Ave. to the pike, for a width of 19 ft., and make other improvements.

Braddock, Pa.—The American Steel & Wire Co. is stated to have petitioned the Boro Council for permission to construct 3 overhead bridges at its 9th St. plant.

Erie, Pa.—The Council on Nov. 6 passed an ordinance providing for the construction of a bridge on the Buffalo Road over the Phila. & Erie R. R. tracks, to cost $45,000. The Pennsylvania R. R. Co. (W. W. Brown, Ch. Engr., Philadelphia) and the Erie Motor Co. will each pay part of the construction.

Washington, D. C.—Col. John Biddle, Engr. Commr. of the District, in his annual report recommends that the K St. bridge over Rock Creek be rebuilt at a cost of $20,000. He also calls attention to the serious condition of the Anacostia bridge.

Baltimore, Md.—Bids are wanted Nov. 24 for the construction of a steel bridge over Patapsco (north branch). Estimated cost $2,000. W. W. Crosby, Baltimore Co. Roads Engr.

Boyds, Md.—The County Comrs. Rockville, Md., have decided to change the roadway near Neelsville, so as to allow a bridge to be built over Little Seneca stream on the road leading from Clarksburg to Neelsville.

Franklin, Pa.—Bids are wanted Dec. 9 for furnishing material and constructing the superstructure and substructure for a steel bridge over the Allegheny River at Scrubgrass. J. M. Black, Chmn. of Co. Comrs.

Castlemans Ferry, Va.—The citizens of Clarke County are stated to have voted Nov. 4 to issue $40,000 bonds for the construction of a steel bridge across Shenandoah River at Castlemans Ferry (Berryville, C. H.).

Youngstown, O.—The citizens are stated to have voted Nov. 4 to levy a tax for the construction of a bridge over Mill Creek at the w. end of Mahoning Ave.; probable cost $140,000.

Geneva, O.—The Ashtabula Co. Comrs. are reported to have been here consulting with Jas. Ritchie, Ch. Engr. of the C. P. & A. Ry., in regard to constructing a wider bridge over Cowles Creek on E. Main St. (Jefferson, C. H.).

Cincinnati, O.—City Engr. Stanley is stated to have been directed by the Bd. of Pub. Service to prepare plans for a steel viaduct at Ida St.

A press report states that Martin Brodbeck, Chmn. of the Comn. on Track Elevation, has introduced in the Bd. of Legislation an ordinance to abolish the Harrison Ave. grade crossing. Arrangements were once made to build a viaduct there at a cost of $270,000, but the courts enjoined the work. The cost will now be paid as follows: 50 per cent. by the Baltimore & Ohio R. R. Co. (J. M. Graham, Ch. Engr., Baltimore, Md.), and C., H. & D. R. R. Co. (C. A. Wilson, Ch. Engr., Cincinnati); 25 per cent. by the city and 25 per cent. by the Traction Co. (J. R. Heizenecker, Ch. Engr., Cincinnati).

Andrews, Ind.—Citizens of Andrews and Dallas Townships are stated to have petitioned the County Council, at Huntington, for an appropriation of $16,000 for a bridge across Wabash River at Andrews.

Newport, Ind.—The Chicago & Eastern Illinois R. R. Co. is stated to have decided to erect two 70-ft. steel bridges. W. S. Dawley, Ch. Engr., Chicago.

Chillicothe, Ill.—The Santa Fe R. R. Co. is stated to have decided to erect a steel bridge across the river above Chillicothe. Jas. Dun, Ch. Engr., Chicago.

Chicago, Ill.—The lowest bids opened Nov. 5 by the Drainage Bd. for the bascule bridges to span the Chicago River at Loomis and 18th Sts., are stated to have been from the Lydon & Drews Co. for the substructure of both bridges, $62,728 for the Loomis St. and $70,716.40 for the 18th St., and the Jackson & Corbett Co., for the superstructure $121,620 for Loomis St. and $115,870 for 18th St.

Detroit, Mich.—The citizens on Nov. 4 voted to issue $600,000 bonds for the construction of a second bridge, to be placed at the upper end of Belle Isle.

Portsmouth, O.—City Clk. Frank L. Sikes writes that it is proposed to construct a bridge across Funk's Gut. Engr. in Charge, B. C. Bratt.

Jonesboro, Tenn.—Bids are wanted for constructing an iron bridge across the Nolichucky and Watauga Rivers. Address H. J. De Pew.

St. Joseph, Mo.—It is stated that bids are wanted Nov. 20 for constructing a bridge at Ablf. Theo. Steinacker, Co. Surveyor.

Manhattan, Kan.—Bids will be received Nov. 22 by the Bd. of Fancy Creek Township for constructing 3 arch bridges on Walnut Creek, 1 between Jackson Township and 2 between Sherman Township and Fancy Creek. E. B. Senn, Clk.

Chehalis, Wash.—Co. Aud. A. Schooley writes that new bids have been asked until Dec. 1 for the construction of a bridge across Cowlitz River at Mayfield, span to be 140 ft. long.

Sidney, Neb.—Bids are wanted Nov. 24 for building a bridge across the Lodgepole Creek. Jas. Burns, Co. Clk.

Los Angeles, Cal.—The citizens voted Oct. 29 to issue $100,000 bridge bonds.

PAVING AND ROADMAKING.

Swansea, Mass.—At a special town meeting held recently it was voted to appropriate $6,000 to construct the proposed road from Bark St. to Somerset town line.

Meriden, Conn.—The Bd. of Pub. Wks. is said to be in favor of the paving of Colony St. from the end of the asphalt now laid to Camp St. Estimated cost $14,000 if asphalt is used, or $10,000 if macadam is used.

Newport, R. I.—At the recent election bonds to the amount of $50,000 were voted for bituminous macadam pavement on Broadway and Spring St.

Crafton, Pa.—See "Sewerage & Sewage Disposal."

New York, N. Y.—Bids are wanted Nov. 18 for regulating and repaving with asphalt on present pavement relaid as foundation, numerous streets of the Boro of Manhattan, in all 101,275 sq. yds. of asphalt pavement, including binder course. Bids are also wanted for paving with asphalt block in certain streets, in all 8,365 sq. yds. of asphalt block: also for 6,800 sq. yds. of granite block pavement on concrete foundation in New Elm St. Geo. Livingston, Comr. of Pub. Works.

Bids are wanted Nov. 20 for paving with granite block 2,830 sq. yds., on sand foundation, in E. 163d St., also for 1,320 sq. yds. of granite block repaving; for 1,030 sq. yds. of asphalt block pavement, 2,475 sq. yds. of sheet asphalt pavement with binder course, and 2,150 lin. ft. of curbstone reset in E. 171st St.; for 3,000 sq. yds. of repaving with new granite block and 4,800 sq. yds. of granite block pavement on a concrete foundation in E. 138th St.; for 7,205 sq. yds. of macadam pavement on telford foundation in E. 183d St.; for granite block pavement on a sand foundation in Tremont Ave., the engineers' estimate including 23,800 sq. yds. of pavement, 5,000 lin. ft. of new curbstone, 4,600 ft. old curbstone reset, 4,000 sq. ft. of new bridge stone, 5,800 sq. ft. of old bridge stone relaid, 33,000 sq. ft. of old flagging relaid, 4,000 sq. ft. new flagging, and 13 receiving basins to be rebuilt. Louis F. Haffen, Pres. Boro. of Bronx.

Windsor, N. Y.—A. N. T. Back, Chmn. County Bd. of Superv., Binghamton, has received from State Engr. Bond plans and specifications for the improvement of the following roads in Broome Co.: River road, Windsor, section 1, length, 1.868 miles, total estimated cost $16,450, the county's share being $8,225; River road, Windsor, section 2, length, 2.838 miles, the total estimated cost $25,900, the county's share being $12,950.

Duquesne, Pa.—Local press reports state that the Pittsburg, Virginia & Charleston R. R. proposes to macadamize a road 33 ft. wide between Duquesne and Dravosburg.

Easton, Pa.—See "Sewerage and Sewage Disposal."

Swarthmore, Pa.—This borough has voted in favor of borrowing $20,000 for road repairs.

Pennington, N. J.—See "Electric Railways."

Pittsburg, Pa.—Bids are wanted Nov. 29 for the purchase of $550,000 bonds, to be used for building, improving and repairing public roads, highways, etc. W. E. Thompson, Co. Compt.

Glenolden, Pa.—See "Bridges."

Glassport, Pa.—See "Sewerage and Sewage Disposal."

Brooklyn, N. Y.—A petition has been presented to the borough authorities to have 65th St. from the bay to 4th Ave. paved with asphalt. The total estimated cost is placed at about $50,000.

Syracuse, N. Y.—Bids are wanted Nov. 17 for furnishing material and paving with sheet asphalt or vitrified brick, portions of Warren and Willow Sts. Geo. J. Metz, City Clk.

Kent, O.—The lowest bid received for paving Water St. 9,208 sq. ft., with curbing, catch basins, sewer inlets, etc., was from Mr. Davidson, of Akron, at $17,197 for Metropolitan wire cut block.

Des Moines, Ia.—Bids will be received Dec. 2 by the Bd. of Pub. Wks. for curbing with Portland cement portions of 4 streets requiring about 9,621 lin. ft. of curbing; also on same date for paving with 1 course of No. 1 vitrified paving brick upon a 6-in. concrete foundation, with Portland cement top filler, portions of 2 streets requiring about 4,851 sq. yds. of paving. J. E. Stout, Chmn.

Local press reports state that it is proposed to pave either with brick or asphalt portions of University Ave., 35th St. and Forest Ave., in all about 40,000 sq. yds. It is estimated that the entire contract will be not less than $150,000, if paved with asphalt, and about $100,000 if paved with brick.

Toledo, O.—Bids are wanted by the Com. on Ways and Means of the Common Council until Dec. 9 for the purchase of $125,000 bonds issued for the purpose of paying the cost of repairing and improving existing streets and other public highways of the city. J. B. Wylie, City Aud.

City Engr. G. W. Tonson writes that the following bids were opened Nov. 3 for repaving (20,086 sq. yds.) on Front St.: A, Bodette & McMahon, Toledo, $33,658, vitrified blocks on concrete; $23,176.54, vitrified blocks on sand. B, C. H. Burchinal, Toledo, $52,453.56, asphalt blocks on concrete; $45,429.32, asphalt blocks on sand. C, H. G. Jennison, Toledo, $69,029.64, Medina blocks on concrete; $52,429.12 (awarded) Medina blocks on sand. For detail bids see accompanying table.

Items and Quantities.	A	B	C
Vitrified block on concrete......	$1.48	....	$1.66
Asphalt block on concrete......	2.72	$2.46	....
Medina Block on concrete......	3.40	....	3.24
Vitrified block on sand.........	1.03	....	1.02
Asphalt block on sand..........	2.18	2.12	....
Medina block on sand..........	2.72	....	2.42
Grading, 3,800 cu. yds..........	.18	.25	.15
Medina curbing, 200 ft..........	.58	.65	.60
Sewer pipe, 300 ft., 18-in......	1.00	1.25	1.60
Sewer pipe, 600 ft. 15-in.......	.92	1.00	1.50
Sewer pipe, 350 ft. 12-in.......	.86	.80	1.40

Bids are wanted Dec. 8 for furnishing material and improving portions of Wayne St. with block paving on a 6-in. concrete foundation, including grading, curbing, drainage, etc. Chas. H. Nauts, City Clk.

Springfield, Ill.—The Street and Alley Com. of the City Council has acted favorably upon ordinances which provide for the paving of Cook, Spring and Edwards Sts. with brick on a concrete foundation with stone curbing.

Pipestone, Minn.—The City Council has appointed a committee, consisting of Alderman C. W. Gilmore and G. H. Gurley, to investigate the advisability of purchasing a stone crusher for city use.

Owosso, Mich.—The proposition to issue $30,000 paving bonds is reported to have passed at the recent election.

Wapakoneta, O.—The Council has sold $30,000 highway improvement bonds.

Ft. Dodge, Ia.—The City Council is reported to have decided to pave 2½ miles of streets with asphalt.

Lafayette, Ind.—The West Lafayette Bd. has adopted specifications for improving State St. with asphalt to Purdue University.

Belvidere, Ill.—Press reports state that this city proposes to purchase a stone crusher and steam road roller.

Vincennes, Ind.—Co. Aud. J. D. Williams writes that Singer & Ridgway, of Sanborn and Carlisle, have received the contract for the building of 50 miles of gravel roads in Vincennes township, for $81,500.

Ironton, O.—It is stated that bids are wanted Dec. 6 for $12,000 street improvement bonds.

Peoria, Ill.—The City Council has authorized the paving of Chambers Ave. with asphalt, at an estimated cost of $23,975.

La Crosse, Wis.—The Special Street Improv. Com. has recommended to the Council that numerous streets be paved, during the ensuing year, with brick, and macadam. Jos. Boschert, Chmn. of Com.

Chicago, Ill.—Bids are wanted Nov. 22 for paving portions of 39th St. with asphalt on a concrete foundation. F. W. Blockl, Comr.

Louisville, Ky.—The lowest bid received for paving Spring St. with brick was from L. R. Figg at $1.42 per sq. yd.; total estimated cost $12,000.

The Bd. of Pub. Wks. has accepted the proposition from Park Asphalt Co. for the resurfacing of a portion of 7th St. with Logan County asphalt at 92 cts. per sq. yd.

Local press reports state that bids will be received Nov. 19 by the Bd. of Pub. Wks. for paving with asphalt on a portion of Peterson Ave.

Memphis, Tenn.—City Engr. J. A. Omberg is said to be preparing estimates for paving work which the Illinois Central R. R. proposes to do on the streets in the vicinity of its shops.

Atchison, Kan.—City Engr. Fred. Giddings writes that the City Council has adopted a resolution declaring it necessary to grade, pave with brick and curb with cement 11th St. It will require 9,781 sq. yds. of paving and 6,550 lin. ft. of curbing.

Hannibal, Mo.—City Engr. Buettler is said to be preparing plans and specifications for paving North 3d St.

St. Louis, Mo.—The City Council on Nov. 7 passed ordinances providing for the reconstruction of Broadway, between Chestnut and St. Charles Sts., and between Market and Chestnut Sts., with asphalt.

Taskegee, Ala.—At the recent election Macon County voted to issue $100,000 bonds for road building purposes.

Oakland, Cal.—City Engr. Turner has submitted to the Council estimates of the cost of improving the boulevard on the eastern and western shores of Lake Merritt; the work includes 99,140 cu. yds. of fill, 360,720 sq. ft. of macadam, 21,402 lin. ft. granite curbing, 63,598 sq. ft. gutter, 4,943 lin. ft. of rock wall, and 74,734 sq. ft. of cement walk; total estimated cost $185,000.

Lead, S. Dak.—Patrick McDonald, of Duluth, Minn., is reported to have received the contract for paving Main and Mill Sts. with Galesburg brick, 5-year guarantee, for $70,000.

Seattle, Wash.—According to local press reports the City Council, at its meeting on Nov. 3, ordered nearly $100,000 worth of additional street work.

POWER PLANTS, GAS AND ELECTRICITY.

Barre, Mass.—S. A. Morse, of Barre, Pres. of a syndicate which is planning to develop Barre Falls and the water sheds above for an electric plant, writes that there are 1,000 H-P. that can be developed and connected on two branches of Ware River. Probable cost $200,000. C. M. Ludden, 131 Milk St., Boston, Engr. in charge.

Clinton, Mass.—Town Solicitor Thos. L. Walsh is stated to have named a committee of 7 business and professional men to act in conjunction with the Bd. of Selectmen in making a 5 years' contract with the Clinton Gas Light Co. to install incandescent and electric arc lights in every district of the town.

Brooklyn, N. Y.—Bids are wanted Nov. 20 for furnishing all labor and materials necessary to complete the central power plant for the Brooklyn Institute of Arts and Sciences. Wm. R. Willcox, Comr. of Parks, New York City.

East Orange, N. J.—The Hatfield Gas Co., of East Orange, has been incorporated, with a capital of $25,000, to manufacture and deal in acetylene gas. Incorporators: B. M. Warner, D. W. Wells and others.

Marcus Hook, Pa.—The Council is stated to have passed an ordinance granting the Suburban Gas Co. permission to extend its mains through the Borough.

New York, N. Y.—Bids will be received Nov. 24 by John W. Brannan, Pres. Bd. of Trus., Bellevue and Allied Hospitals, for furnishing material for certain additions and alterations to electric light wiring in Bellevue Hospital.

Utica, N. Y.—The Cresset Electric Co., of Utica, has been incorporated; capital, $30,000. Directors: W. P. Campbell and J. C. Eichmeyer, Utica, and A. J. Potter, New Hartford.

Reading, Pa.—Mayor Yeager has signed a resolution appropriating $100 for the services of an expert electrician to make an estimate of cost for the erection of a municipal electric light plant.

Carbondale, Pa.—The Carbondale Light, Heat & Power Co. is about to be incorporated, to construct an electric light plant. C. S. Weston and E. L. Fuller, of Scranton, are among the incorporators.

Patchogue, L. I., N. Y.—T. G. Carlin, of Brooklyn, Pres. Brookhaven Gas Co., is stated to have petitioned the Village Trus. for a franchise for a gas plant.

Philadelphia, Pa.—Bids are wanted Nov. 24 for furnishing electric arc lights for the year 1903. Address Abraham L. English.

Staunton, Va.—E. M. Funkhouser, Pres. of the Staunton Gas Co., writes that his Co. has purchased the Staunton street railway, electric light and gas plants; it is proposed to improve and enlarge the gas plant and improve the electric light plant; it is desired to lease or sell the street railway property.

Williamsburg, Va.—The Council is stated to have appointed Prof. Hugh S. Bird to investigate the question of lighting the city with electricity. William and Mary College is at the head of this move, and the Council wants to join with them and light the city if possible.

Washington, N. C.—The City Council is stated to have granted Stephen C. Bragaw a franchise for an electric heating and power plant.

Tifton, Ga.—The Tifton Ice & Power Co. has been organized, to construct an electric light plant. L. P. Thurman, of Tifton, is Secy.

Findlay, O.—City Engr. John W. S. Riegle writes that specifications are being prepared, and a 5 or 10-year contract will soon be let for electric lighting for the city.

Indianapolis, Ind.—It is reported that the Indianapolis Gas Co. will erect a gas plant with a daily capacity of 2,000,000 cu. ft.

Hector, Minn.—Bids will be received Dec. 1 by the Village Council for $6,000 bonds to be used for constructing a gas plant. F. E. Ruesswig, Village Recorder.

Lake Linden, Mich.—A Council Com. is reported to be considering the installation of municipal electric light and power system.

Lansing, Mich.—An ordinance is reported to be before Council granting Hugh Lyons and John H. Chase authority to construct a plant for the production and distribution of heat, power, refrigerating and ventilation.

Manistee, Mich.—Louis Sands, proprietor of the Manistee Gas & Fuel Co. and the Sands Electric Lighting Co., which has the contract for lighting this city, has sold all his interests to a new company, the Manistee Gas & Electric Co., of which Harry C. Ulen, Jr., of Indianapolis, Ind., Pres. of the American Light & Water Co., is the president.

North Amherst, O.—Bids will be received Dec. 2 by F. E. Kaser, City Clk., for installing an electric light plant; probable cost, $10,000.

Akron, O.—The City Comrs. have recommended to Council that the Best Light Co., of Canton, be given the contract to establish the city's municipal vapor light plant. The aggregate cost will be about $7,500.

Tell City, Ind.—There is talk of constructing a municipal electric light plant here.

Medina, O.—The Medina Electric Lighting, Power & Heating Co. of Medina, has been incorporated with a capital of $50,000.

Jordan, Minn.—The Jordan Electric Light Co. is reported incorporated, to construct an electric light plant.

Chicago, Ill.—Bids are wanted Nov. 22 for furnishing the city with 5 arc light dynamos. Edw. B. Ellicott, City Electrician.

Harrison, O.—See "Water."

Hot Springs, Ark.—Bids are wanted Dec. 6 for furnishing this city with electric lights. H. Williams, Secy.; Sam. Hamblin, City Engr.

Little Rock, Ark.—Oscar Davis and Arthur Neill are stated to have petitioned the City Council for a franchise for a heating plant.

Lewisburg, Tenn.—The citizens are reported to be urging the construction of an electric light plant to take the place of the plant destroyed by the flood.

Nashville, Tenn.—A press report states that engineers are making surveys for the construction of a power plant at the Caney Fork Falls, 60 miles from Nashville, for the Great Falls Power Co., of Nashville, for the purpose of transmitting electricity to Nashville. C. H. Fisk, of Detroit, Mich., is Gen. Mgr. of the company. It is stated that the equipment and machinery for the plant will cost about $1,000,000.

Bay City, Tex.—See "Water."

St. Louis, Mo.—The Bd. of Pub. Improv. has approved the plans and specifications for the construction of municipal electric lighting plants in the new city hall, to cost $33,000, and in the insane asylum, to cost $13,000. The Mayor has also signed the ordinance.

Kansas City, Mo.—The Gas Com. from the Lower House has approved ordinances for the locating of 180 additional street gas lamps, 42 more electric arc lights and 6 gasoline lamps. It was also decided to give each ward of the city additional street lights not to exceed in cost $100 a month for each of the 14 wards.

Lake Village, Ark.—The Town Council is stated to have granted Thos. Neely and Jas. G. Yerger a franchise for an electric light plant.

Harrodsburg, Ky.—See "Water."

Madisonville, Ky.—It is reported that the electric light plant owned by the Bailey Light & Water Co. will be rebuilt. The citizens are reported to have voted Nov. 4 against municipal ownership of electric lights.

Davenport, N. D.—It is reported that Alex. Anderson and Lars Tiegen contemplate installing an electric light plant.

Prescott, Ariz.—An ordinance has been passed by Council granting to F. L. Wright a franchise to construct a gas plant.

Goldendale, Wash.—It is reported that J. T. Moffett has secured a franchise for lighting the city. The plant will be situated on the Little Klickitat River.

Sidney, Neb.—The Union Pacific R. R. Co. is said to contemplate the installation of a plant for lighting its shops and depot grounds. J. B. Berry, Ch. Mgr., Omaha.

Folsom City, Cal.—Bids will be received Nov. 22 by the State Bd. of Prison Dir., at Represa (R. M. Fitzgerald, Pres.) for furnishing the state prison, at Folsom City, with an electric light plant.

Gilroy, Cal.—City Clk. C. N. Hoover writes that on Oct. 27 it was voted to issue $15,000 bonds to purchase the gas plant. It is reported that an electric light and power plant will be added.

San Francisco, Cal.—The Pyramid Power Co., of San Francisco, has been incorporated by G. M. Sutherland, A. I. Kettle and others, with a capital of $5,000,000.

Rapid City, Man.—The Rapid City Power, Light & Woolen Mfg. Co. is reported to have been formed, with a capital of $25,000, to acquire water power on the Little Saskatchewan River, to build dams and transmit power for electrical purposes.

Manila, P. I.—See "Electric Railways."

ELECTRIC RAILWAYS.

Norton, Mass.—The Selectmen are stated to have granted a franchise to the Norton & Taunton St. Ry. Co. R. W. Hewins, Supt., Norton.

Amherst, Mass.—The State R. R. Comrs. are stated to have granted the Amherst & Sunderland St. Ry. Co. permission to construct and maintain its road in part over private land; also permission to extend its line into Pelham. L. N. Wheelock, Ch. Engr., Amherst.

Standish, Me.—The Selectmen are stated to have granted the Saco Valley Electric Ry. Co. a franchise to construct a line on the road leading from Bonny Eagle to West Buxton. R. W. Libby, Ch. Engr., Saco.

York Beach, Me.—Wm. D. Smith, of Bangor, is stated to have secured the contract to build an electric railroad from York Beach to Dover, N. H.

Plymouth, Conn.—The Bristol & Plainville Tramway Co. is stated to have decided to extend its line to Plymouth, a distance of about 4 miles. G. E. Cockings, Mgr., Bristol, Conn.

Oswego, N. Y.—Wm. P. Gannon, of Syracuse, Pres. Syracuse Rapid Transit Co., is stated to have petitioned the Highway Comrs. for permission to construct a railway from the southerly line of the Town of Oswego to the city line along West River Road.

Fairport, N. Y.—The Village Trus. are stated to have granted the Monroe County Electric Belt Line Co. a franchise through the village. C. A. Lux, of Clyde, is the chief promoter.

Pleasantville, N. J.—The Atlantic City & Suburban Traction Co. is stated to have petitioned the Council for a franchise through Pleasantville and along the shore road.

Pennington, N. J.—The Council is stated to have granted the Trenton St. Ry. Co. a franchise to extend its line through Pennington to Hopewell. The company has agreed to macadamize the main street. H. C. Moore, Mgr., Trenton.

Glassport, Pa.—It is stated that the Pittsburg Rys. Co. will soon commence extending its line to the borough limits. F. Uhlenhaut, Ch. Engr., Pittsburg.

York, Pa.—The York St. Ry. Co. is about to extend its tracks on E. College Ave. to connect with Albemarle St., making belt line s. e. section; about 1½ miles new construction. J. F. Dusman, Mgr., York.

New York, N. Y.—The Rapid Transit Subway Const. Co., 21 Park Row, has awarded sub-contracts for sections 1 and 3 of the Brooklyn extension of the subway system; sect. 1, which extends down Broadway from Ann to Bridge Sts., to the Degnon-McLean Contracting Co., 21 Park Row, and sect. 3, which is in Brooklyn, from near Clinton St. along Joralemon St., Fulton St. and Flatbush Ave. to Atlantic Ave., to Cranford & McNamee, 215 Montague St., Brooklyn.

Rome, N. Y.—Chas. A. Sweet, of Syracuse, is stated to have completed surveys for a trolley line to be constructed from Rome to Sylvan Beach, a distance of about 14 miles.

Ilion, N. Y.—The Utica & Mohawk Valley Ry. Co. is stated to have petitioned for a franchise to construct a line on Main St. to the east line of the village. C. H. Clark, Ch. Engr., Utica.

Rochester, N. Y.—A press report states that the final survey for the Rochester, Syracuse & Eastern Ry. has been completed between Rochester and Clyde, and that the final survey from Clyde to Newark will be completed within a few days. The remaining survey to Syracuse will be made in the spring.

Oneonta, N. Y.—The Oneonta, Cooperstown & Richfield Springs Ry. Co. is stated to have filed with the Secy. of State a certificate showing that it proposes to extend its route from Oneonta to Laurans, Mt. Vision and Cooperstown; also to Oak Creek and Mohawk. W. D. McQuesten, Oneonta.

South Amboy, N. J.—The Raritan Traction Co. is stated to have petitioned the Boro Council for a franchise through South Amboy, from the terminus of the bridge now building across the Raritan River.

Elkton, Md.—The Elkton & Chesapeake City Electric Ry. Co. is reported to have changed hands, M. P. O'Brien and Ambrose Higgins selling their interest to G. W. Buinbaker, W. W. Hess and G. E. Schlegelmalch, all of Philadelphia, Pa. The company has reorganized, with Mr. Buinbaker as Pres. and Ricketts Nelson, of Elkton, Secy. The new owners will commence at once the building of their line from Elkton to Stanton, at which point they will connect with the line to Wilmington, Del.

Newark, Del.—The Council is stated to have granted a franchise to the Delaware & Suburban Ry. Co.

Salamanca, N. Y.—The Berney Traction Company, of Salamanca, has been incorporated, to operate an electric road 4½ miles in length in Cattaraugus County; capital, $50,000. Directors: S. A. Holbrook, of Bradford, Pa., and W. K. Harrison, of Salamanca.

Tonawanda, N. Y.—The International Traction Co. is reported to have under consideration extensive improvements to its local system. Among them is the construction of a belt line by extending the Kenmore and Gratwick branch to the Falls line, and by building a connection between the same lines just south of Kenmore Park.

Allegheny, Pa.—A building permit is stated to have been issued to the Pittsburg Rys. Co. for a power house on Brunots Island, which is in the 9th Ward of Allegheny; the structure is to cost $100,000. F. Uhlenhaut, Ch. Engr., Pittsburg.

Washington, D. C.—A press report states that plans have been completed by H. J. Bingham, of Akron, O., for a power house to be built at Washington for the Washington, Baltimore & Annapolis Ry. Co.; the building will be of brick, and will cost about $300,000.

Staunton, Va.—See "Power Plants, Gas and Electricity."

Jacksonville, Fla.—The Jacksonville Traction Co. is reported incorporated, to build, equip and operate a street railway; capital $400,000. Incorporators: Arthur F. Perry, G. W. Shook and J. F. Campbell.

Sandusky, O.—The Sandusky Southwestern Ry. Co., of Wapakoneta, has been incorporated, with a capital of $1,000,000, to construct and operate an electric line from Sandusky to Wapakoneta, through Auglaise, Allen, Logan, Hardin, Wyandot, Seneca, Sandusky and Erie Counties. Incorporators: Fred O. Olson, Sam. P. Douglas and others.

Napoleon, O.—The Napoleon & Bowling Green Electric Ry. Co. is stated to have decided to extend its lines to Lakeside and Marblehead.

Degraf, O.—The Comrs. of Logan Co. at Bellefontaine, are stated to have granted the Dayton & Kenton Ry. Co. a franchise to construct a line from Degraf to Lewistown. R. E. Kline, Ch. Engr., Dayton.

Medina, O.—The Council is stated to have granted a franchise to the Cleveland, Elyria & Western Electric Ry. Co. F. T. Pomeroy, Mgr., Cleveland.

Andrews, Ind.—The Council is stated to have granted a franchise to the Ft. Wayne & Southwestern Ry. Co. S. L. Nelson, Mgr., Ft. Wayne.

Aurora, Ind.—E. W. Swarthout and C. W. McMullen, of Aurora, are stated to have petitioned the Council for a franchise. They propose constructing a line from Aurora to Rising Sun, with a branch to Dillsboro.

Lansing, Mich.—The Michigan Central Traction Co. is reported incorporated, with a capital of $200,000, to build an electric line between Lansing and Battle Creek.

Oakpark, Ill.—The Oakpark & Northern Ry. Co. is reported formed, with a capital of $20,000, to construct an electric railway from Oakpark to Evanston. D. L. Morrill and J. S. Murray are among the incorporators.

Warren, O.—The Western Reserve Traction Co., of Cleveland, has been incorporated, with a capital of $10,000, to build an electric railway from Warren to Kenilworth.

Wellsburg, W. Va.—The Wellsburg, Steubenville & New Cumberland R. R. Co. has petitioned the County Court for a franchise for an electric railway from Wellsburg up the river to a point opposite Steubenville, thence to the Hancock County line near Holliday's Cove. Henry M. Camp, Pres.

Marion, Ind.—John P. McGrath, of Hartford City, and W. J. Houck, of Marion, are stated to have secured a franchise for an electric railway to be constructed in Grant County.

Duluth, Minn.—The Co. Comrs are stated to have granted the Missabe General Electric Co. a franchise for an electric railway in St. Louis County. It will be constructed through the towns of Mesaba, Biwabik, Missabe Mountain, Fayal, Nichols, Clinton and Stuntz.

Louisville, Ky.—The Brownsboro Ry. Co. has been incorporated, with a capital of $25,000, to construct an electric railway along the Brownsboro road from the city limits to the limits of Jefferson County. The articles also permit extensions into Oldham, Henry, Spencer, Nelson and Bullitt Counties. Incorporators: Emery D. Fraser, of New York, N. Y.; A. G. Turnipseed, of Cincinnati, O., and Clayton B. Blakey, of Louisville.

South McAlester, Ind. Ter.—The Dirs. of the Indian Territory Traction Co. are stated to have awarded the contract for road work on the street railway line from South McAlester to Haileyville to Donald G. Grant, of Faribault, Minn. The system equipped with electric cars will cost $450,000.

Oklahoma City, Okla. Ter.—The Oklahoma Traction Co. is stated to have decided to construct an electric line from this city to Guthrie, a distance of 35 miles, within the next 8 months. The preliminary survey is now being made.

Dallas, Tex.—The Metropolitan St. Ry. Co. is reported formed, with a capital of $4,500,000, by C. E. Tripp, A. K. Bonta, Henry C. Coke and others, to construct and maintain electric lines in Texas.

Topeka, Kan.—The City Council has granted a 20 year franchise to the Topeka & Vinewood Ry. Co. to build a single or double track on 5th St. from the east side of Quincy to the Santa Fe depot.

Lewiston, Idaho.—It is stated that C. S. Merrick is about to petition the City Council for a franchise.

Lincoln, Neb.—J. E. Riley, of Omaha, has petitioned the City Council for a franchise to construct an electric railway between Omaha and Lincoln.

Portland, Ore.—The Council has granted franchises to the Portland Ry. Co. on Ford St. and to the Oregon Water, Power & Ry. Co. in the mill district in East Portland.

Berkeley, Cal.—It is stated that bids are wanted Dec. 1 for an electric street railway franchise, as applied for by the Oakland Transit Consolidated Co. Chas. E. Thomas, Town Clk.

Oakland, Cal.—It is stated that bids are wanted Dec. 1 for a double track street railway franchise, applied for by the Oakland Transit Consolidated Co. R. W. Church, City Clk.

Manila, P. I.—Competitive bids will be received Mar. 4, 1903, by the Municipal Bd. of Manila to determine the grantee of a street railway franchise united with a franchise to furnish light and power in the City of Manila. The street railway route is 35 miles long. The duration of the franchise is not to exceed 50 years. A deposit of $75,000 to accompany each bid, as security for performance. Col. Clarence R. Edwards, U. S. Army, Ch. of Bureau of Insular Affairs, War Dept., Washington, D. C.

RAILROADS.

Buffalo, N. Y.—Asst. Engr. Meddams, of the Lake Erie & Detroit R. R. has started a survey for the proposed new line from St. Thomas to Buffalo for the use of the Pere Marquette R. R.

Chase City, Va.—The Dirs. of the Blackstone & Chase City R. R. Co. at a meeting here in the early part of this month are stated to have elected Capt. T. M. McKennon Ch. Engr. and instructed him to employ assistants and survey and locate proposed line.

Christiansburg, Va.—Ingles & Simpson, of Radford, are stated to have secured the contract for the location and construction of a line from Christiansburg Depot to Blacksburg for the Virginia Anthracite Coal & Ry. Co.

Keyser, W. Va.—A press report states that the contract for improvements to be made by the Baltimore & Ohio R. R. Co. at Keyser, W. Va., Va., for $104,000. The improvements will include a 23 stall roundhouse to contain an 80-foot turntable; a brick storehouse for oils, 1 story high, 30x150 ft.; a trainmen's building of frame construction, 2 stories high; carpenter shop of frame, 30x50 ft. and a machine shop, 165x60 ft. The ash pits will be equipped with electric runways and hoist. The coaling station will have a trestle 450 ft. long and 30 ft. high. There will be 3 pockets, with a capacity of 100 tons each, and a sandhouse, 20x26 ft., will be built.

Plans will shortly be prepared for similar improvements at Glenwood, Pa.; Painesville, O., and Holloway, O. J. M. Graham, Ch. Engr., Baltimore, Md.

Chicago, Ill.—The Council has passed an ordinance granting permission to the Chicago Northern Ry. Co. to construct a line in the 29th Ward, steam to be the motive power.

El Dorado, Kan.—Co. Clk. H. A. J. Coppins writes that on Oct. 14 the proposition to issue $62,500 bonds, to aid in the construction of Topolobampo R. R., carried in two townships.

Kansas City, Mo.—Chas. E. Gibbs, of Kansas City, is reported interested in the construction of a railroad from Kansas City to New Orleans, La., passing through Springfield, Mo.; Yellville and Little Rock, Ark.; Natchez, Miss., and Baton Rouge, La.

Knoxville, Tenn.—J. J. Condon, of Knoxville, has the contract to build 12 miles of branch line of the Tenn. Central R. R. into Fentress County, Tenn.

Marshall, Tex.—The Tex. Southern Ry. Co. has been granted authority by the R. R. Comn. to register $497,000 first mortgage bonds in the office of the Secy. of State on 72 miles of completed line from Marshall to Winnsboro. Extension terminals have been secured in Marshall by said Co., and work will shortly begin on the extension south in the direction of Beaumont and Sabine Pass, about 225 miles. L. E. Walker, Pres., Marshall.

Florisant, Mo.—The St. Louis County Connecting Ry. Co., of St. Louis, has been incorporated to construct, maintain and operate a standard gauge rail road from Florisant to Manchester; capital $150,000. Length of proposed line is 15 miles. Incorporators: Jas. D. Houseman, John B. C. Lucas and others.

Muskogee, Ind. Ter.—The Muskogee Southern R. R Co. is stated to have commenced surveying for a line to be constructed from Muskogee to Ft. Smith, Ark.

Dallas, Tex.—A press report states that C. C. Waller, of Houston, Pres. of the Velasco, Brazos & Northern, which recently acquired the Dallas & New Mexico, will soon begin construction work on both of these roads. He is reported to have an office in the Jennie Bldg., Dallas.

Central City, Colo.—Jas. Wilson, of Des Moines, Ia., is reported to have been appointed Ch. Engr. of the narrow gauge railroad to be constructed from Central City to Yankee and Alice. The survey will probably be completed this month. Probable cost of the road will be $250,000.

Oroville, Cal.—The Butte & Plumas R. R. Co. has been incorporated, with a capital of $1,000,000. Principal place of business, Oroville. Directors: H. H. Yard, E. H. Benjamin, A. Ekman and others.

San Francisco, Cal.—Bids are wanted Dec. 15 for excavating 200,000 cu. yds. of material and constructing the roadbed for the first section of 4 miles of the Richmond Belt Ry. Wm. S. Tevis, Pres., Room 104, Crocker Bldg.

PUBLIC BUILDINGS.

Boston, Mass.—Architects Kendall, Taylor & Stevens, 93 Federal St., write that the contract for erecting 3 buildings for the Insane Hospital has been awarded to Ernest T. Wilson, of Natick, Mass., for $29,195.

Brooklyn, N. Y.—Bids are wanted Nov. 19 for furnishing labor and material required for general repairs and alterations to interior of Boro Hall, Boro of Brooklyn; amount of security required $10,000. J. Edw. Swanstrom, Boro Pres.

The Bd. of Estimate is stated to have allowed President Swanstrom $48,000 for the construction of 3 public comfort stations, two near the Borough Hall in Brooklyn and one in the Eastern District.

Washington, D. C.—Elliott Woods, Supt. of Capitol Bldg. and Grounds, in his annual report just submitted to the Secy. of the Interior, recommends an extension of the east front of the Capitol Bldg. at a cost of $2,500,000, the finishing and redecoration of the interior of the rotunda at a cost from $60,000 to $275,000, and the erection of an annex or office building for the use of the members of the House of Representatives, at a cost of about $4,300,000.

Brooklyn, N. Y.—Bids will be received Nov. 25 (extension of date) by Homer Folks, Comr. of Pub. Charities for the following work at the Kings Co. Bldgs.: For erecting a coal storage building, for installing a heating and power plant, an electric light plant, and for erecting a building for a heating, lighting and power plant.

Bids were opened Nov. 12 by Boro. Pres. J. Edw. Swanstrom for the erection of an interior public bath building on Pitkin Ave., near Watkins St., Boro. of Brooklyn, as follows: Fuller & O'Connor, 44 Court St., $79,300; W. & T. Lamb, $80,818; Thos. G. Carlin, $85,000; Thos. Dwyer, $86,200; Daniel J. Ryan, $86,900; P. J. Carlin & Co., $89,339.

Newark, N. J.—The City Hall Comn. is stated to have awarded the contract for the elevators for the new city hall to the Otis Elevator Co., of New York, N. Y.; the contract calls for the "Plunger type." There are to be 5 passenger elevators and 1 ash lift; the contract price is reported to be $23,500.

Scranton, Pa.—A swimming pool, with up-to-date equipment, is to be erected by the city in Nay Aug Park. Cost, $20,000.

Middletown, Del.—Bids will be received by the Light and Water Comrs. for furnishing and delivering 40,000 good, hard, red bricks, for building purposes. Address John W. Jolls, Secy.

Binghamton, N. Y.—Local press reports state that 9 architects have been requested to submit plans by Jan. 15 for the Carnegie Library, to cost not more than $60,000. Israel T. Deyo, Secy. Library Comn.

New York, N. Y.—The lowest bid (opened Nov. 6) for construction of a dormitory in the medical college building on Bellevue Hospital grounds, at 26th St. and 1st Ave., was that of Williams & Gerstle, 1st Ave. and 44th St., for $48,996.

Sault Ste. Marie, Mich.—It is stated that plans are being prepared for the erection of a Carnegie Library.

Detroit, Mich.—The citizens on Nov. 4 voted to issue $500,000 bonds to purchase sites for a central and 5 branch libraries, Andrew Carnegie having promised to appropriate $750,000 for the erection of the buildings.

Michigan City, Ind.—The Franciscan Sisters are reported to have purchased a site for the erection of a hospital, at a cost of $50,000.

Anderson, Ind.—A. Lawrence Valk, 100 B'way., New York, N. Y., is reported to have completed plans for a $35,000 church, to be erected by the First Presbyterian Society.

Decorah, Ia.—The citizens of Winneshiek County are stated to have voted Nov. 4 to issue bonds to erect a court house; probable cost $75,000.

Monticello, Ill.—Co. Clk. B. F. Kagen writes that on Nov. 4 it was voted to issue $100,000 bonds for constructing a court house and repairing jail.

Stevens Point, Wis.—Bids are wanted Dec. 1 for the erection and completion of a Carnegie Library at Stevens Point. W. B. Buckingham, Chmn. Bldg. Com. Henry A. Foeller, of Green Bay, Wis., is the architect.

Bellaire, O.—Bids are wanted Dec. 2 for steam heating and for the construction of lock-up cells for the new city hall. Giesey & Faris, Archts., Wheeling, W. Va. T. C. Nicholson, Chmn. of Bldg. Com.

Chicago, Ill.—The citizens of Cook Co. on Nov. 4 voted to issue $500,000 bonds for improvements to the hospital at Dunning.

Milwaukee, Wis.—Bids are wanted Nov. 25 for furnishing material and erecting a public natatorium and branch library station on North Ave. and 16th St., including ventilating, heating, plumbing, sewerage, gas fitting, electric work, etc. Chas. J. Poetsch, Chmn. Comrs. of Pub. Wks.

Waldron, Ark.—It is stated that a special tax has been voted for the erection of a $20,000 court house for Scott County.

Lake Village, Ark.—It is stated that bids will be received by the Co. Comrs. Dec. 1 for erecting a jail. F. B. & W. S. Hull, Archts., Jackson, Miss.

Hot Springs, Ark.—It is stated that plans will be received Nov. 18 by the Co. Bd. for a $25,000 courthouse.

St. Francisville, La.—Bids are wanted Dec. 3 for furnishing material and erecting a courthouse for the Parish of West Feliciana. Andrew J. Bryan & Co., Archts., Jackson, Miss.

Birmingham, Ala.—Bids are wanted Dec. 9 for erecting a stone church for the First Baptist Church of this place. R. H. Hunt, Archt., Jefferson Co. Savings Bank Bldg., Birmingham. Geo. M. Morrow, Chmn.

BUSINESS BUILDINGS.

Binghamton, N. Y.—The Security Mutual Life Insurance Co. is reported to be considering the erection of an office building, to cost about $250,000. Chas. M. Turner, Pres.

Pittsburg, Pa.—Chas. Bickell, 524 Penn Ave., is reported to be preparing plans for a warehouse and business building for the Bindley Hardware Co., to be erected on Morewood Ave., to cost about $200,000. E. J. Lloyd, Secy.

Shamokin, Pa.—The Odd Fellows, of Shamokin, are reported to be considering the erection of an apartment house with lodge rooms, to cost about $15,000.

Sharon, Pa.—The Erie R. R. Co. is reported to have decided to abandon its freight depot north of town and will build one along the Dock St. extension, at a cost of $30,000. C. W. Buchholz, Ch. Engr., New York, N. Y.

Baltimore, Md.—The Brown-Ketcham Iron Wks., of Indianapolis, Ind., are stated to have secured the contract for the structural steel and iron work for the theater to be erected on Franklin and Howard Sts. by Jas. L. Kernan.

The plans of Louis Levy are stated to have been adopted for a $25,000 building to be erected on Fayette and Bond Sts. for the Hebrew Friendly Inn and Aged Home Society.

Buffalo, N. Y.—Louis C. Hohl is about to erect a $12,000 3-story brick store and apartment house at Connecticut and Normal Sts.

W. A. Robb is about to erect a $13,000 brick store and flats at Connecticut and Normal Sts.

The American Express Co. is about to erect a 3-story brick stable at 138 Exchange St.; cost $14,000.

Paterson, N. J.—Capt. Chas. Curie is reported to have decided to erect a 5-story hotel, with all modern improvements.

Allegheny, Pa.—It is stated that plans are being prepared for a 4-story warehouse to be erected on Church Ave. for Wm. P. Lenge & Co., dealers in hides and tallow, at a cost of $30,000.

New York, N. Y.—It is stated that a 22-story hotel will be erected on the site of the old Hotel Brunswick, on 5th Ave. and 26th St. The putting up of the building will be conducted by the Brunswick Construction Co., of which Judge Henry E. Howland is reported as president.

Philadelphia, Pa.—John Fraser & Son, 413 Walnut St., are stated to have prepared plans for a vaudeville theatre, to be erected at 721 to 729 Arch St., by a syndicate, of which Wm. J. Gilmore, former Mgr. of the Auditorium, is the head.

Toledo, O.—John D. Coghlin is stated to have decided to erect a 7-story building on Jefferson and Superior Sts., to cost about $185,000.

Bay City, Mich.—Col. J. M. Wood, with Baxter & O'Dell, associates, are stated to be preparing plans for an opera house to be erected on Washington Ave. and 64th St., to replace the one recently destroyed by fire. It will be of brick and steel, of fireproof construction, having a frontage of 74 ft. x 120 ft. in depth, and will be 65 ft. high; cost $45,000.

Youngstown, O.—The Masons are reported to have purchased a site for the erection of a temple.

Moline, Ill.—The Moline, East Moline & Watertown Ry. Co. is stated to have decided to erect a car barn on 16th St. B. A. Mapledoran, Mgr., Moline.

Owosso, Mich.—The Owosso Elks are reported to have decided to erect a $30,000 lodge building and opera house.

Sioux City, Ia.—Plans have been prepared for a 6-story hotel, 100x150 ft., to be built at 3d and Nebraska Sts., for R. E. Purslow. Estimated cost $90,000.

Sault Ste. Marie, Mich.—Edw. Demar is stated to be preparing plans for a 6-story brick building of steel construction, to be erected on Spruce and Ashman Sts.

Louisville, Ky.—The Louisville Coliseum Co. is reported formed, with a capital of $250,000, to erect a coliseum in Louisville. Incorporators: C. C. Mengel, S. Grabfelder, Frank Fehr and others.

El Paso, Tex.—A press report states that a union station, to cost about $500,000, will be erected here. representatives of the 7 main lines entering this city having agreed here Nov. 6 on the project.

Paducah, Ky.—The Bldg. Com. of the Masonic and I. O. O. F. lodges is stated to have selected the plans of B. B. Davis, of Paducah, for the new joint home of these lodges, to be erected on Bway. and 6th Sts., to cost about $50,000.

Nashville, Tenn.—The Grand Opera House is reported to have been destroyed by fire Nov. 8.

Houston, Tex.—It is stated that plans have been completed for the construction of a freight depot here for the International & Great Northern R. R. Co., to cost about $75,000. A. L. Bowers, Supt. of Bldgs., Palestine.

Winnipeg, Man.—J. H. G. Russell, Canada Permanent Bldg., is stated to have completed plans for a 4-story brick warehouse, to be erected on Princess and Bannatyne Sts., for Sutherland & Campbell.

DWELLINGS.

Boston, Mass.—A. Warren Gould, 1 Somerset St., is the architect for a block of 3 three-family houses, to be built on Centre St., Roxbury. Estimated cost, $21,500. Owner, A. A. Libbey, 79 Milk St.

Cincinnati, O.—It is stated that Geo. F. Otte, the 4th St. carpet merchant, will erect a $35,000 flat on Highland Ave. and Oak St., Mt. Auburn.

Kansas City, Mo.—W. H. Collins is stated to have secured a permit for the erection of an apartment house at Armour Boulev. and Baltimore Ave. to cost $40,000.

SCHOOLS.

Brookline, Mass.—Bids will be received Nov. 25 by the Bd. of School Com. for erecting a school on Boylston St. and Reservoir Lane. Separate bids will be received for the main building, ventilating, heating and plumbing. Peabody & Stearns, Archts., 58 State St., Boston. Address Prentiss Cummings, Chmn.

Newport, R. I.—The citizens are reported to have voted Nov. 4 to issue $100,000 bonds for a high school.

New York, N. Y.—The Bd. of Estimate is stated to have authorized an issue of $2,000,000 bonds for the purchase of sites for schools during the next year.

The following bids were opened Nov. 7 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., for the general construction of school 176, Boro. of Bronx: Patk. Sullivan, $97,000; Francis Sullivan, $114,500; Luke A. Burke, 401 W. 59th St., $90,500.

The only bid received at the same time for installing electric elevators, in Morris High School, Boro. of Bronx, was from the Marine Engine & Machine Co., 1123 Bway., at $11,490.

The lowest bid received for two outside iron stairs in front of school 70, Boro. of Manhattan, was from Patk. Sullivan, 389 Broome St., at $4,690.

Bids are wanted until Nov. 21 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., for installing electric light wiring, fixtures and electric bell system in school 188, Boro. of Manhattan.

Bids will be received Nov. 24 by C. B. J. Snyder, Supt. of School Bldgs., for the sanitary work of addition to and alteration in School No. 89 on Lenox Ave.

Brooklyn, N. Y.—Bids are wanted Nov. 21 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., New York City, for furnishing and delivering plumbers', steamfitters', etc., supplies to the workshop of the Dept. of Educ., in the Boro. of Brooklyn, for the year ending Dec. 31, 1903.

The following bids were opened Nov. 12 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., New York City, for the general construction of School 143, Boro of Brooklyn: Chas. B. Peckworth, $219,000, to complete Sept. 1, 1903; $211,775, to complete Jan. 1, 1904; Wm. P. McGarry, $228,000, to complete Jan. 1, 1904; P. J. Walsh, $231,000, to complete Jan. 1, 1904; Peter Cleary, $231,950, to complete Jan. 1, 1904; Geo. Hildebrand, $259,771, to complete Jan. 1, 1904; Wm. & Thos. Lamb, 99 Nassau St., New York City, $202,962.

Bids opened at the same time for heating and ventilating apparatus in School 138, Boro. Brooklyn, were as follows: Frank Dobson, $29,350; John Neal's Sons, $29,472; E. Rutzler, $30,400; Blake & Williams, 362 W. Bway, New York City, $28,355; United Heating Co., $29,643; Evans, Almirall & Co., $34,640.

Philadelphia, Pa.—The contract for erecting the 21 division school at 57th St. and Haverford Ave., is stated to have been awarded to Wm. J. Smith for $90,949.

It is stated that Bethany College will erect a new building on Broad and Catherine Sts., to cost $300,000. Rev. Dr. Chas. A. Dickey, Pres.

Glenville, O.—The citizens are stated to have voted Nov. 4 to issue bonds for a high school.

Milwaukee, Wis.—The Bd. of Trus. of the Milwaukee Downer College is stated to have decided to erect a new brick and stone building, at a cost of about $30,000.

Chicago, Ill.—Bids are wanted Nov. 21 for the erection, including plumbing and sewerage, of a parental school, stable, icehouse, etc. W. B. Mundie, Archt. Bd. of Educ.

Marion Township, Franklin Co., O.—Bids are wanted Nov. 28 for building 2 schools of 4 rooms. D. Reibel, Eberly Blk., Columbus, is the architect. Lucien Livingston, Clk. of Bd. of Educ., P. O. address, General Delivery, Columbus, O.

Forrest, Ill.—R. Z. Gill is stated to have secured the contract for erecting a school here, for about $25,000.

Cincinnati, O.—Bids are wanted Dec. 15 for furnishing and setting up in the W. H. Morgan school sanitary flush closets. Jacob E. Cormany, Chmn. Com. Bldgs. and Repairs.

Lexington, Ky.—See "Miscellaneous."

Dayton, Ky.—The citizens are reported to have voted to issue $20,000 bonds for the erection of a school.

Jennings, La.—The citizens are reported to have voted to issue $30,000 school bonds.

Sapulpa, Ind. Ter.—See "Water."

New Orleans, La.—Frank T. Howard has decided to present to this city a public school, to be erected on Foucher and Camp Sts. It will be of brick and contain 12 rooms and cost about $50,000. Thos. Sully, 107 Camp St., is the architect.

Los Angeles, Cal.—The citizens on Oct. 29 voted to issue bonds to the amount of $480,000 for public schools and $200,000 for a high school.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids are wanted Nov. 21 for the removal of the snow and ice of the Boro. of Manhattan. John McG. Woodbury, Comr. of Street Cleaning.

The Bronx Architectural Co., 3307 3d Ave., are the architects for a garbage incinerating plant, 50x105, to be built on Rider Ave., near 138th St., at a cost of $20,000. Owners, John and Mary Dalton; lessee, Decarie Mfg. Co., 446 Central Park West.

The Aldermen on Nov. 11 approved the appropriation of $141,000 asked for by Street-Cleaning Comr. Woodbury for the purchase of a new stock and plant for Brooklyn, also an issue of bonds to the amount of $165,000 to enable Mr. Woodbury to replenish the street-cleaning plant of Manhattan and the Bronx.

Philadelphia, Pa.—The estimate of $1,247,720 made by the Bureau of Street Cleaning to run that department next year has been approved by City Councils' Com. on Street Cleaning.

Meadville, Pa.—The Council has accepted the bid of the Dixon Garbage Furnace Co. for a 25-ton furnace. For bids opened recently see The Engineering Record of Oct. 25.

Newark, N. J.—The Street & Water Bd. has adopted Ch. Engr. Van Keuren's specifications for the cleaning of streets and the removal of garbage and ashes during the fiscal year beginning Dec. 1 next, and it is stated that bids will be received soon. The specifications raise the standard price for the removal of garbage and ashes from $20,000 to $25,000.

Chicago, Ill.—It is stated that bids are wanted Nov. 20 for furnishing 12 two-horse street-sweeping machines and 3 sprinkling wagons. F. W. Blocki, Comr. Pub. Wks.

GOVERNMENT WORK.

Portsmouth, N. H.—Bids are wanted at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until Nov. 18 for furnishing at the Portsmouth Navy Yard a quantity of sheet steel, pipe, pipe fittings, valves, electric equipment, etc. A. S. Kenny, Paymaster Gen., U. S. N.

Ft. Greble, R. I.—The following bids were opened Nov. 8 by Capt. Thos. N. Slavens, Constructing Q. M., Newport, R. I., for constructing, plumbing, electric wiring and installing hot water heating system in 12-bed brick hospital at Ft. Greble:

Construction—Darling & Slade, Fall River, Mass., $25,268; A. W. McQuillan, Plattsburgh, N. Y., $23,940; Henry H. Morgan, New London, Conn., $28,500.

Plumbing—Darling & Slade, $1,985; Wm. Kennedy, Fall River, Mass., $1,289; P. J. Murphy & Co., Newport, $1,318; Henry H. Morgan, $2,400; A. W. McQuillan, $1,560.

Heating Apparatus—Herbert Bliss, Newport, $3,650; P. F. Conroy, Newport, $2,750; James J. Lynch, Newport, $2,579; Newport Engineering Wks., Newport, $2,799; Ed. Joy, Syracuse, N. Y., $3,250; Barr & Creelman, Rochester, N. Y., $2,920; Henry H. Morgan, $3,000; Harris & Algor, Camden, N. J., $2,735; Walworth Const. & Supply Co., Boston, $2,573; A. W. McQuillan, $2,223; Berkill & Oakes, Boston, $2,864.

Wiring—Wm. Kennedy, $625; Chas. B. Raub, New London, Conn., $296; A. W. McQuillan, $250.

Newport, R. I.—The following bids were opened Nov. 10 by Maj. Geo. W. Goethals, Corps of Engrs., U. S. A., for dredging harbors at (*a*) Hyannis, (*b*) Woods Hole, (*c*) New Bedford, and (*d*) Fall River, Mass., and (*e*) Pawtucket River, R. I.: Chas. H. Latham, Hartford, Conn., *a*, 19.7 cts. per cu. yd. R. G. Packard Co., 130 Pearl St., New York, *b*, 3.47 cts. per cu. yd. J. S. Packard Dredging Co., 495 Angell St., Providence, R. I., *a*, 22 cts.; *b*, 3.74 cts.; *c*, 21.5 cts.; *d*, 13.1 cts.; *e*, 24.9 cts. per cu. yd. International Contracting Co., 95 Broad St., New York, *e*, 22.3 cts.; *d*, 13.6 cts.; *e*, 27 cts. per cu. yd. Chas. M. Cole, Fall River, Mass., *a*, 24.5 cts.; *c*, 19.5 cts.; *d*, 13.3 cts.; *e*, 25.5 cts. per cu. yd. Eastern Dredging Co., Boston, Mass., *a*, 22.3 cts.; *e*, 21.7 cts.; *d*, 14.7 cts. per cu. yd.

New York, N. Y.—The Secretary of the Treasury, Washington, has awarded to John Peirce, of New York, the contract for the completion of the granite walls, roofing, etc., of the New York Custom House at his bid of $1,809,360.

The following bids were opened Nov. 10 by Maj. W. L. Marshall, Corps of Engrs., U. S. A., for (*a*) removing a ledge in the North River, off Pier A, and (*b*) a small rock north of Governors Island, New York Harbor: R. G. Packard Co., 130 Pearl St., N. Y. City, *a*, $43,000; *b*, $1,750 (awarded). Submarine Contracting Co., 62 Wall St., N. Y. City, *a*, $38,000; *b*, $1,800.

Philadelphia, Pa.—Bids will be received by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until Dec. 6, for removing material from the Delaware water front, League Island Navy Yard; estimated cost, $24,500.

Pittsburg, Pa.—Local press reports state that bids are wanted Nov. 22 for constructing a dam across Allegheny River at Brilliant Station. Address Capt. Wm. L. Sibert, Rm. 409, P. O. Bldg., Pittsburg.

Savannah, Ga.—Contracts have been awarded as follows for work on Savannah and Brunswick Harbors: To P. Sanford Ross, Inc., of Jersey City, N. J., for work in the lower part of the harbor, from Fort Oglethorpe to quarantine station, for about $490,000; to the Atlantic Gulf & Pacific Co., of New York, for the work in upper part of the harbor from the old water works to Fort Oglethorpe and shoals opposite quarantine, for about $559,390, and to Morris & Cummings Dredging Co., of New York, for dredging Brunswick Harbor, on a bid of $77,000.

Ft. Myer, Va.—Bids will be received by Capt. W. E. Clark, Q. M., U. S. A., until Dec. 1 for a fire apparatus building.

Charleston, S. C.—Bids will be received by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., until Dec. 20 for constructing at the Charleston Navy Yard a brick and steel joiner shop building; appropriation, $120,000; also on same date for constructing a brick and steel machine shop building; appropriation, $120,000.

Chicago, Ill.—The following bids were opened Nov. 8, at the Treasury Dept., Washington, D. C., for the interior finish and completion of the Post Office, Court House, etc., Chicago, Ill.: Jno. Griffin & Son, Chicago, $1,239,900 (by May 20, '04); Wm. Grace & Co., $1,273,000 (Oct. 1, '04); Davidson Bros. Marble Co., $1,099,000 (June 8, '04); John Peirce, New York City, $997,500 (Nov. 1, '04).

Bids opened at the same time for the heating plant of above building were as follows: S. Faith & Co., Philadelphia, $99,700; Robt. Gordon, Chicago, $129,779; Edw. Joy, Syracuse, $112,798; Chas. B. Kruse Htg. Co., Milwaukee, $100,590; W. A. Pope, Chicago, $118,811; L. H. Prentice & Co., Chicago, $120,100; Thomas & Smith, Chicago, $99,346.

Bids opened at the same time for electric wiring, switchboard, conduits, etc., for said building were as follows: Chicago Edison Co., Chicago, $80,516; Cuthbert & Black, Chicago, $87,476; Arthur Frantzen & Co., Chicago, $69,838; F. E. Newberry & Co., St. Louis, $77,434; J. P. Buchanan & Co., Philadelphia, $104,000; McCay Eng. Co., Baltimore, Md., $78,440.

Cleveland, O.—Maj. Dan C. Kingman, Corps of Engrs., U. S. A., is reported to have recommended that the L. P. & J. A. Smith Co., of Cleveland, be given the contract for completing the main entrance to the harbor, their bid being $636,480 and that Hughes Bros. & Bangs, of Syracuse, N. Y., be given the contract for completing the eastern extension of the breakwater, their bid being $965,900 for the eastern division and $981,760 for the western division; total, $1,947,660. Bids opened Nov. 6.)

St. Louis, Mo.—The following bids were opened Nov. 10 at the Treas. Dept., Washington, D. C., for the erection and completion of the U. S. Government Bldg., Louisiana Purchase Exposition: Jacob Altheus Co., St. Louis, $374,520; Smith & Eastman Co., St. Louis, $339,879; Ward & Law, St. Louis, $309,517; N. O. & G. C. Burten, St. Louis, $268,980; Goldie Const. Co., St. Louis, $299,440; Rountree Const. Co., St. Louis, $312,900; R. P. McClure Const. Co., $297,285; R. W. Morrison Const. Co., St. Louis, $257,000; Kellermann Const. Co., St. Louis, $334,000; Congress Const. Co., Chicago, Ill., $421,778; Geo. Moore & Son, Nashville, Tenn., $294,850; Strehlow & Phelps, Omaha, Neb., $277,777.

Chattanooga, Tenn.—Bids for the construction of the new army post at Chickamauga were opened Oct. 8 by Capt. H. J. Slocum, Cav. Q. M., and contracts have been awarded as follows:

Construction—A. E. Hawthorne & Co., Nashville, $292,378; Randall Bros., Atlanta, Ga., $86,718; Hunt, Armstrong & Trimby, Chattanooga, $45,159; Lookout Planing Mills, Chattanooga, $46,800. Total, $471,055.

Plumbing—T. S. Wilcox, Chattanooga, $43,505; Fred Fox, Jr., Chattanooga, $4,351. Total, $47,856.

Heating—Harris & Alger, Camden, N. J., $38,332.

Gas Piping—T. S. Wilcox, Chattanooga, $1,550; Fred Fox, Jr., Chattanooga, $943. Total, $2,493.

The construction of the hospital will be changed from frame to brick, and new bids asked as soon as plans and specifications are received from Washington.

Kiowa Agency, Okla. Ter.—Bids are wanted Dec. 3 for labor and material necessary for a complete office building at Kiowa Agency. Jas. F. Randlett, U. S. Indian Agent, Anadarko, Okla. Ter. W. A. Jones, Comr., Indian Affairs, Washington, D. C.

San Francisco, Cal.—Bids are wanted at the U. S. Engineer Office until Dec. 2 for dredging in Oakland Harbor. W. H. Heuer, Lieut.-Col., Corps of Engrs., U. S. A.

Denver, Colo.—The following bids were opened Nov. 12 at the Treasury Dept., Washington, D. C., for safety vaults, vault doors and work incidental thereto in the U. S. Mint, Denver: Diebold Safe Co., Canton, O., $66,000; York Safe & Lock Co., York, Pa., $88,400; Remington & Sherman Co., New York City, $78,000; L. H. Miller Safe & Iron Wks., Bath, $92,750.

Ft. Rosecrans, Cal.—Bids are wanted Dec. 6 for erecting numerous buildings at this post. Separate bids will be received for heating, plumbing, electric wiring and gas piping. Address Capt. R. H. Rolfe, Q. M., U. S. A., San Diego.

San Francisco, Cal.—The following bids are stated to have been received Nov. 1 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of the quay wall at Mare Island: Dundon Bridge & Const. Co., $47,268; Clark & Henery, $54,051.83; W. W. Coneannon, $46,742; Atlantic, Gulf & Pacific Co., $46,147; Wm. H. Healy, $48,243.

MISCELLANEOUS.

Yonkers, N. Y.—Bids are wanted by the Bd. of Park Comrs. until Nov. 20 for the construction of a wrought-iron fence in Irving Park. S. L. Cooper, Supt. of Parks.

Buffalo, N. Y.—Mayor Knight has approved the resolution permitting the Buffalo & Susquehanna Iron Co. to build a canal across Hamburg turnpike.

Chicago, Ill.—By a vote at the recent election bonds to the amount of $500,000 were authorized to be expended by the Lincoln Park Bd. for small parks on the North Side, and $1,000,000 to be expended by the South Park Bd. for a similar purpose on the South Side.

New Orleans, La.—Bids are wanted Nov. 18 for the labor and material necessary for the complete construction of a 900-ft. wharf on the river front at Julia St. Hugh McCloskey, Pres. Bd. of Comrs., Port of New Orleans.

Lexington, Ky.—By popular vote the City Council has been ordered to vote bonds for a public park and school.

Oakland, Cal.—The contract for improving 12th St. dam has been awarded to the Hutchinson, Ransome Co., for $36,000.

Ottawa, Ont.—It is said the Government has in view the erection of a park, national in character, at the eastern end of Ottawa. The scheme is intended to embrace Rideau Hall, grounds, composed of 82 acres, and the Rockliffe ranges, about 350 acres in extent.

Montreal, Que.—Plans submitted to the Government for a tunnel across Montreal Harbor are stated to provide for a double-track tunnel from the south shore into the heart of Montreal, where a central station will be located. The width will be 27 ft. and the height 21 ft. Its grade will be 1½ to 2 per cent., and its greatest depth will be 15 ft. below the mean level of the river bed. The structure will be of concrete and stone masonry with a lining of enamel brick. The course of the tunnel will pass through St. Helen's Island, where there will be a sub-station.

The City Council has decided to appoint a committee to report on the feasibility of building a tunnel under Forsythe St., so as to enable the Terminal Ry. Co. to complete its street car line into the city.

NEW INDUSTRIAL PLANTS.

The Struthers, O., Furnace Co. intends to erect a plant having a capacity of about 500 bbls. of cement made from blast furnace slag. The Osborn Engineering Co., Cleveland, has charge of the erection of the plant.

The H. L. Hurst Mfg. Co., Canton, O., maker of hardware specialties, will erect a new plant and install an additional 15-H.-P. gas engine, 6-H.-P. dynamo for lighting, and sheet metal working machinery.

Jewett & Co., Buffalo, N. Y., makers of stoves and ranges, will erect a new plant, details of which have not been decided.

W. A. Buckner, Sumter, S. C., is organizing a company to develop a kaolin bed for the making of pottery.

The Downington Mfg. Co., Ltd., East Downington, Pa., maker of machinery for paper and pulp mills, is erecting a 40x105-ft. addition to its erecting shop, making it 260 ft. long; a 75x120 ft. machine shop having a 40-ft. span in center containing heavy tools and covered with a 10-ton electric crane, and bays on either side for small tools, and a 40x75-ft. woodworking shop. The erecting shop will be equipped with a 10-ton electric crane. The plant will be driven by electricity and heated and ventilated with steam radiator and fan. A 100-Kw. generator and motors will be installed.

The St. Julien Mining Co., Livingston, Mont., expects to build a 20-stamp mill and cyanide plant. The plant will be run by water power and completed next spring.

The Southwestern Brick & Tile Mfg. Co., Ltd., 512 Macheca Bldg., New Orleans, La., will erect a plant to occupy about 1¼ acres.

The Petoskey, Mich., Rug Mfg. & Carpet Co., Ltd., will install an electric motor.

The Owosso, Mich., Sugar Co. will erect a 70x240-ft. main building and a 70x200-ft. warehouse. The contract for the complete plant has been let to the Kilby Mfg. Co., Cleveland, O.

The Michigan Lumber Co., Aberdeen, Wash., will erect a 220x42-ft. mill. The capacity of the power plant will be 170 H.-P.

The Mayfield, Ky., Brick Co. is in the market for three down-draft kilns and a dry pan.

The Detroit Foundry & Mfg. Co., 195-199 Atwater St., East, Detroit, Mich., has had plans prepared for a 100x185-ft. foundry building of steel construction, arranged so it can be extended to 350 ft., and a 30x35-ft. engine and boiler room. A 100-H.-P. engine, an 80-Kw. generator, cupolas of 10 and about 5 tons' capacity, and a 10-ton electric traveling crane, with a 40-ft. span, will be installed.

The Keever Starch Mfg. Co., Columbus, O., is erecting a 3-story, 120x180-ft. factory, to have a daily capacity of 2,500 bu. corn. The capacity of the power plant will be 300 H.-P.

The Standard Press Brick Co., Lawton, Okla., will install a plant having a daily capacity of 20,000.

The Helena, Mont., Light & Traction Co., whose plant was recently burned, will erect a fireproof structure to contain 600 Kw. in motor generators, with apparatus for distributing and 1,500 Kw. of step-down transformers. The company is now operating from a temporary plant constructed near the old site.

The Springfield, Mass., Printing & Binding Co. has let the contract for a 7-story building, 100 ft. square. A 150-H.-P. engine, a generator and motors connected to each machine will be installed. The building will be steam heated and equipped with automatic sprinklers.

Tenders and specifications for a complete plant for making magnesite bricks, to be addressed to "Brick Maker," care of the International News Co., 5 Breams Bldg., Chancery Lane, London, E. C., England, are asked for, as advertised in The Engineering Record.

BUSINESS NOTES.

The United States Coal Co. is about to equip its soft coal mines at Dillonvale, O., with electrical machinery, and for that purpose recently purchased from the Westinghouse Electric Mfg. Co. two 150-Kw., 550-volt, direct-current generators and two 10-ton mining locomotives. Electric power will be used for the operation of the locomotives and other mining machinery.

At the Dusseldorf Exhibition, which has just terminated, the highest award of merit, the gold medal, was awarded the Hunt conveyor, manufactured by the C. W. Hunt Co., West New Brighton, N. Y.

Notwithstanding the Otto Gas Engine Works, Philadelphia, added 12,000 sq. ft. of floor space to their plant less than two years ago, their ever increasing business is again crowding them, and the last available bit of ground in the block covered by the works is having a building 40x100 ft. erected on it. The demand for large units makes necessary these increased facilities, and the new building will be equipped with the largest and latest types of machine tools. The tools are ordered, and the new shop should be running inside of six weeks.

The Russell & Erwin Mfg. Co., New Britain, Conn., has placed a contract with B. H. Hibbard for the construction of a new manufacturing building, to be 50 ft. wide, 200 ft. long and 7 stories high. The construction will be fireproof throughout, and the floors will have a capacity of 250 lbs. per sq. ft., so that the building can be used for carrying all classes of manufactured goods. It is expected that this building will be completed and ready for use about Feb. 1.

P. & F. Corbin, New Britain, Conn., are making extensive changes in their plant, in order to increase the output. They have just completed a large 7-story fireproof building, to be used for general manufacturing purposes, and are now at work on a new 60x600 ft. foundry building, which it is expected will be ready for occupancy by Jan. 1. These improvements will necessitate the employment of 100 additional iron moulders, 70 brass moulders and 500 extra help in general manufacturing.

The Field Force Pump Co. is occupying a new plant at Elmira, N. Y., which includes a 57x118-ft. foundry, 43x120-ft. machine shop, 50x58-ft. woodworking shop, 24x58-ft. paint shop, 46x58-ft. shipping room, 40x60-ft. storehouse, and several smaller buildings.

Perrin, Seamans & Co., Boston, Mass., have recently secured orders for a number of their new-style stiff-legged derricks, both hand and steam power. This firm is now issuing circulars describing these derricks, which may be had upon application to them.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Nov. 17.	Waukegan, Ill.	Nov. 15
Nov. 20.	New York, N. Y.	Nov. 15
Nov. 24.	Los Angeles, Cal.	Nov. 15
Nov. 25.	Findlay, O.	Nov. 15
Nov. 26.	Newport, R. I.	Oct. 25
Dec. 1.	South St. Paul, Minn.	Nov. 15
Dec. 1.	Ottumwa, Ia.	Nov. 15
Dec. 1.	West Milton, O.	Nov. 8
Dec. 1.	East Dundee, Ill.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 1.	Pumps, Seguin, Tex.	July 26
Dec. 4.	Boston, Mass.	Nov. 15
	Adv., Eng. Record, Nov. 15.	
Dec. 20.	Pumping engines, Louisville, Ky.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 15.	
Dec. 29.	Gillett, Wis.	Nov. 15
	SEWERAGE AND SEWAGE DISPOSAL.	
Nov. 17.	Depew, N. Y.	Nov. 15
Nov. 18.	New York, N. Y.	Nov. 15
Nov. 18.	Anglesea, N. J.	Nov. 8
	Adv., Eng. Record, Nov. 15.	
Nov. 18.	Bessemer, Ala.	Nov. 8
Nov. 18.	Mason City, Ia.	Nov. 8
Nov. 19.	Brooklyn, N. Y.	Nov. 8
Nov. 20.	New York, N. Y.	Nov. 15
Nov. 20.	Bradley Beach, N. J.	Nov. 15
Nov. 20.	Canal Dover, O.	Nov. 1
Nov. 22.	Clinton, Ill.	Nov. 15
	Adv., Eng. Record, Nov. 15.	
Nov. 25.	Paulding, O.	Nov. 8
Nov. 26.	Brooklyn, N. Y.	Nov. 15
Nov. 26.	Cincinnati, O.	Nov. 1
Dec. 2.	Des Moines, Ia.	Nov. 15
Dec. 2.	South Orange, N. J.	Nov. 15
	Adv., Eng. Record, Nov. 15.	
Dec. 7.	Dixon, Ill.	Nov. 8
Dec. 15.	Montevideo, Uruguay	Sept. 13
Dec. 29.	Pumping Station, Washington, D. C.	Nov. 15
	Adv., Eng. Record, Nov. 15.	
	BRIDGES.	
Nov. 18.	Harrisburg, Pa.	Nov. 1
Nov. 20.	St. Joseph, Mo.	Nov. 15
Nov. 20.	Doylestown, Pa.	Nov. 1
Nov. 22.	Manhattan, Kan.	Nov. 15
Nov. 24.	Baltimore, Md.	Nov. 15
Nov. 24.	Sidney, Neb.	Nov. 15
Nov. 26.	Saginaw, Mich.	Nov. 8
Nov. 28.	Wapakoneta, O.	Nov. 8
Dec. 1.	Bigtimber, Mont.	Sept. 27
Dec. 1.	Chehalis, Wash.	Nov. 15
Dec. 1.	Boston, Mass.	Nov. 15
Dec. 9.	Franklin, Pa.	Nov. 15
Dec. 17.	Chicago, Ill.	Nov. 1
———	Jonesboro, Tenn.	Nov. 15
	PAVING AND ROADMAKING.	
Nov. 17.	Syracuse, N. Y.	Nov. 15
Nov. 17.	Silver Lake, N. Y.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Nov. 17.	Boston, Mass.	Nov. 8
Nov. 17.	Cincinnati, O.	Nov. 1
Nov. 18.	New York, N. Y.	Nov. 15
Nov. 19.	Louisville, Ky.	Nov. 15
Nov. 19.	Brooklyn, N. Y.	Nov. 8
Nov. 20.	New York, N. Y.	Nov. 15
Nov. 21.	Ft. Worth, Tex.	Nov. 8
Nov. 22.	Chicago, Ill.	Nov. 15
Nov. 26.	Hoboken, N. J.	Nov. 8
Nov. 27.	Keokuk, Ia.	Nov. 8
Dec. 1.	Toledo, O.	Nov. 8
Dec. 1.	Delphi, Ind.	Oct. 25
Dec. 2.	Des Moines, Ia.	Nov. 15
Dec. 8.	Toledo, O.	Nov. 15
Dec. 11.	Guthrie, Okla. Ter.	Nov. 1
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	
———	Pratt City, Ala.	Nov. 8
	POWER, GAS AND ELECTRICITY.	
Nov. 18.	Superior, Wis.	Oct. 25
Nov. 18.	Washington, D. C.	Oct. 25
Nov. 19.	Elec. wiring, hosp., Middletown, N. Y.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Nov. 20.	Brooklyn, N. Y.	Nov. 15
Nov. 22.	Folsom City, Cal.	Nov. 15
Nov. 22.	Chicago, Ill.	Nov. 15
Nov. 24.	New York, N. Y.	Nov. 15
Nov. 24.	Philadelphia, Pa.	Nov. 15
Dec. 2.	North Amherst, O.	Nov. 15
Dec. 4.	Ft. Monroe, Va.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 6.	Hot Springs, Ark.	Nov. 15
Jan. 15.	Rome, Ga.	Oct. 11
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
	GOVERNMENT WORK.	
Nov. 15.	Washington, D. C.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 15.	
Nov. 17.	U. S. Post Office shed Bufalo, N. Y.	Oct. 18.
	Adv., Eng. Record, Oct. 18, 25.	
Nov. 18.	Portsmouth, N. H.	Nov. 15
Nov. 18.	Tompkinsville, N. Y.	Nov. 8
Nov. 18.	Washington, D. C.	Oct. 25
Nov. 19.	Ft. McRee, Fla.	Nov. 8
Nov. 20.	Post Office Bldg., Rome, N. Y.	Oct. 18
Nov. 20.	Dredging, Norfolk, Va.	Oct. 18
	Adv., Eng. Record, Nov. 8, 15.	
Nov. 22.	Pittsburg, Pa.	Nov. 15
Nov. 22.	Pier and dredging, Boston, Mass.	Nov. 8
Nov. 22.	Dover, N. J.	Nov. 8
Nov. 22.	Ft. Myer, Va.	Nov. 8
	Adv., Eng. Record, Nov. 8, 15.	
Nov. 22.	Lock, etc., Pittsburg, Pa.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 15.	
Nov. 22.	(Ft. Morgan), Mobile, Ala.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 15.	
Nov. 22.	Coal plant, Portsmouth, N. H.	Oct. 18
Nov. 22.	Navy Bldg., Portsmouth, N. H.	Oct. 18
Nov. 24.	Nashville, Tenn.	Oct. 25
	Adv., Eng. Record, Nov. 1, 15.	
Nov. 25.	Ft. Riley, Kan.	Nov. 1
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Nov. 25.	El. wiring Pub. Bldg., Boise, Idaho	Oct. 25
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Nov. 26.	(San Diego Harbor) Los Angeles, Cal.	Nov. 8
Nov. 26.	Storehouse (Ft. Greble), Newport, R. I.	Nov. 1
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Nov. 29.	Storehouse, Norfolk, Va.	Nov. 8
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Nov. 29.	Machine shop, Boston, Mass.	Nov. 8
Nov. 29.	Htg. & Vent. Pub. Bldg., Boise Ida.	Oct. 25
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Advice to Young Engineers.

It is commonly said that it costs nothing to give advice, but when a busy consulting engineer will give up the greater part of a week for the purpose of addressing a body of young men it does not need exceptional wisdom to realize that the advice costs a considerable sum to the giver. And when an extended and varied practice is drawn upon to furnish illustrations of the speaker's main topics, there is apt to be a number of points of general interest in the remarks, although addressed primarily to engineers in the embryo. This is certainly true of an address which Mr. J. A. L. Waddell delivered before the last graduating class of the Rose Polytechnic Institute. Not the least interesting feature about it is the clear statement of a few views concerning current engineering practice which The Engineering Record considers just as misleading as they are interesting.

As an example of what is meant by misleading views a single quotation may be made from the portion of the address on the desirability of different specialties. "Believe me," the speaker stated, "I would prefer a position as boss-grader on a dump to that of city engineer, and I would rather work as a navvy with a pick and shovel than accept a subordinate position in the engineering department of a city." It may be safely stated that most members of the profession would select the duties of city engineer to the job of boss-grader, and it is hard to believe that many assistant city engineers will seize the first opportunity to resign for the honor of doing day labor in a trench. In fact, it is questionable whether the speaker's own feelings might not experience a change were he actually confronted with the necessity of making a choice.

Such disparagement of the very important field of municipal engineering is particularly unfortunate because to-day there is a greater demand for young graduates for this class of work than for any other. The consulting specialists in municipal engineering are men of as high standing in the profession as those whose work is along railway or structural lines. The salaried engineers engaged in municipal engineering are probably as well paid and as well treated as men on salaries in other engineering specialties, while they certainly average fewer hours of work per week. Moreover the public appreciation of the value of good municipal engineering is growing by leaps and bounds, as taxpayers learn that a competent city engineering department will earn many times its expense—even when paid very liberally—by saving their money from both useless waste and costly parsimony.

The great objection to municipal work has been an alleged insecurity of the tenure of office. "It degrades a man, in his own estimation at least," Mr. Waddell told his hearers, "to feel that he is at the mercy of every log-rolling, wire-pulling ward-politician, who may for any reason take offence against him." This is only true in a limited sense. It degrades no man to know that he is unpopular with vicious persons, but it by no means follows that a log-rolling, wire-pulling ward-politician is vicious. Many men who are eminently successful political managers are working with only the public welfare in view, and many men who have the name of being political hogs are really public benefactors. Everyone poses as a judge of public affairs, yet very few have any qualifications for forming a reliable judgment. Politics is a hobby with many people of the highest character, yet the acts of such men are criticized by their fellow citizens with a savageness which a reputable judge would not use to a convicted criminal. Municipal work of all classes has come to have a bad name that it does not deserve, and while too many changes are made in municipal offices for other causes than the public good, it is but fair to point out that in other branches of engineering, tact, a good presence, business ability and family influence are often more important than strictly engineering qualifications.

Another statement in this address which is misleading was the following: "The services of a newly-fledged engineer are, as a rule, of little or no account." This is literally true in some cases, yet the implication that technical education is not of much value in practical engineering is very far from the case. In fact, Mr. Waddell, practically denied the statement a little later in the same address by mentioning that fair salaries can be obtained by young graduates in a number of lines of work. What he really meant is better indicated by another quotation: "In our office we figure that it takes three months to bring the value of the recent graduate's services up to zero, and three months more to recoup the office for its loss on his instruction; so it is not until after six months his work really begins to become remunerative." This last quotation is what might be expected by anyone familiar with the character of the work that is done in the speaker's offices; and the fact that it takes six months to train a graduate to the work of this office does not mean that, without such training, the young graduate's business value is nil. It simply means that the requirements of that particular office are so special that it takes time to learn to meet them.

It is just the same in any business, and the fact that the man to be trained is a young fellow with only a technical school training has nothing to do with the principle involved. It is unfortunate, therefore, that just at a time when the most encouragement should be given such young men, their ambition receives a chilling blow of this sort. The nature of young graduates is the same as that of older men; some of them dream vain things and to others a spade is always a spade. Some are willing to step from the school into the office of chief engineer of any old thing, but how many of us with gray hair are without a half-dormant consciousness that we could, for instance, have settled the anthracite coal strike with celerity and equity had we only possessed the power? Every business has its special features, and every house in that business has its special practices, and the most experienced man could not pass from one house to another without spending some time in becoming acquainted with his surroundings. In passing from one business to another, more time is needed. In the same way, in passing from a technical school to an engineering office, a young man makes a purely business change and his employer must expect to be at some expense while the ropes are being learned.

It must not be thought that because The Engineering Record cannot agree with some of Mr. Waddell's views that his address did not contain advice of much value. Many portions were excellent, for example: "In dealing with people, a cultivation of policy and tact is a virtue. Because you think a man is a fool, that is no reason for telling him so. When you see that an individual is cherishing some set notion which is erroneous, it is far better to lead him gently to a recognition of his error than to tell him imperiously that he is wrong or does not understand the matter." Probably no piece of advice to young engineers can equal this in value. The professional duties of the engineer are concerned with applied science; with utilizing natural laws and material substances. But success is impossible without something more than knowledge and skill in applying it. Success can only come with the ability to delegate work to others, each receiving that best suited to his attainments, and ability to convince busy men without technical knowledge of the importance of the engineer's advice. The successful engineer must understand how to handle men as well as to apply science.

Subordinate Engineering Positions in New York Departments.

Recent statements in several New York newspapers indicate that it has been impossible for some city departments to obtain as many transitmen and topographical draftsmen as are needed to carry on their engineering work, the salary paid, $1,200 per annum, not being sufficient inducement. When a borough president appeared before the Board of Estimate, which is the guardian of the city treasury, to ask that he be allowed to engage additional draftsmen at a salary of $1,500, it is reported that the Comptroller objected on the ground that the salary at present allowed was greater than transitmen were given by several railroads that he mentioned; notably the Pennsylvania and New York Central roads. Permission was finally obtained to engage a few men at $1,500 per year until January first, when the pay for transitmen is to be fixed at $1,200. It is but fair to the engineering staff of the city to state that the salaries paid by railroad companies and private corporations cannot be directly compared with those paid by a large municipality, especially New York. The transitman in the employment of a railroad company, if he is a capable man, has a greater opportunity for advancement than he would have in the engineering staff of a great city. Furthermore, experience with a private corporation would be apt to have a wider range. Again, the living expenses of a transitman are much greater in New York than they would be on railway work, in which he would be located along the line of the road, much of the time in small communities. Advancement from a transitman's position in the departments of the City of New York is particularly difficult because of the manner in which assistant engineers, the next higher grade, are appointed and the infrequency of these appointments. Many transitmen in the employ of the departments are doing work of an importance that should entitle them to larger compensations than their present salaries, but even these, it seems, are considered to be too large.

In these times of activity the demand for engineering talent is greater than the supply and in the competition to secure this talent, be it that of a transitman or chief engineer, the City of New York can much better afford to pay what is necessary and in other ways make the position more attractive to good men, rather than to let its public works suffer for the want of a proper engineering staff to complete and maintain them.

A New Reservoir at New London, Conn.

The water-works of the city of New London, Conn., are at present being extended under the direction of W. H. Richards, engineer, so that the supply will be practically doubled. The reservoir which will be the means of effecting this addition will soon be completed and presents a number of interesting features. The reservoir is formed by an earth dam approximately 1,200 feet long with a concrete core wall, and a supplementary dam about 400 feet long, entirely separate from the main structure, was necessary at one end. The height of the main dam above the natural surface does not much exceed 20 feet, but at the center of the structure a fine, wet sand was struck which made it necessary to sink the foundations much deeper than had been anticipated—a total of about 62 feet below the surface at the deepest part. At the upper end of the reservoir a so-called filter dam has been constructed across the main brook, through which the water will percolate from a section of the reservoir which it was deemed inadvisable to strip as thoroughly as the main basin.

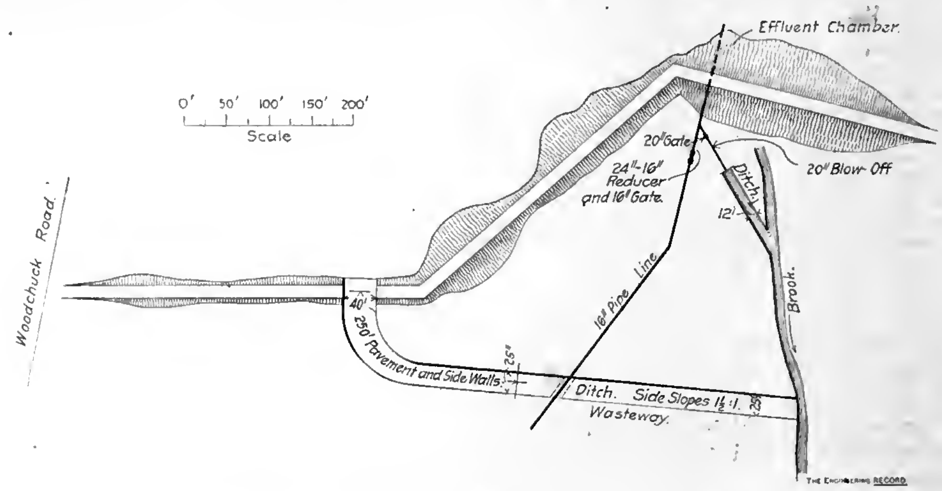
The principal water supply of the city has, up to the present time, been drawn from a body of water known as Konomoc Lake, about six or seven miles from the city, which furnishes about one and one-half million gallons per day. The surface of the original pond was raised by means of a dam so that its total capacity is now between six hundred and six hundred and fifty million gallons. The water from this lake passes to the city through two mains, 20 and 16 inches in diameter. As there is both a high service and a low service the draft of water for the latter is utilized to raise the quantity required for the high service to a tower in the higher portion of the city. The supply from Konomoc Lake having become inadequate for the needs of the city, it became necessary to obtain a further supply at once.

The new supply, which it is estimated will also furnish one and one-half million gallons of water daily, is drawn from a watershed of about 2 square miles area just beyond the old one, and the two reservoirs are connected by a 16 and 20-inch pipe line, a branch being left for connection with a proposed third reservoir when needed. The distance between the new dam and the head of Konomoc Lake is about 3 miles, making the former about 10½ miles from the city. It should be stated that the arm of Konomoc Lake nearest the new reservoir, while of considerable area, is shallow and marshy, and this portion is cut off from the main body of the lake by a filter dam or embankment of coarse gravel. This simple expedient is very effective in decolorizing the water, the difference on the two sides of this embankment being at times very marked. The new supply will all pass through the old reservoir, and it is proposed to build that part of the connection which passes through the old watershed in the form of an open channel so as to intercept a large part of the water which now flows into the shallow arm of the reservoir just mentioned.

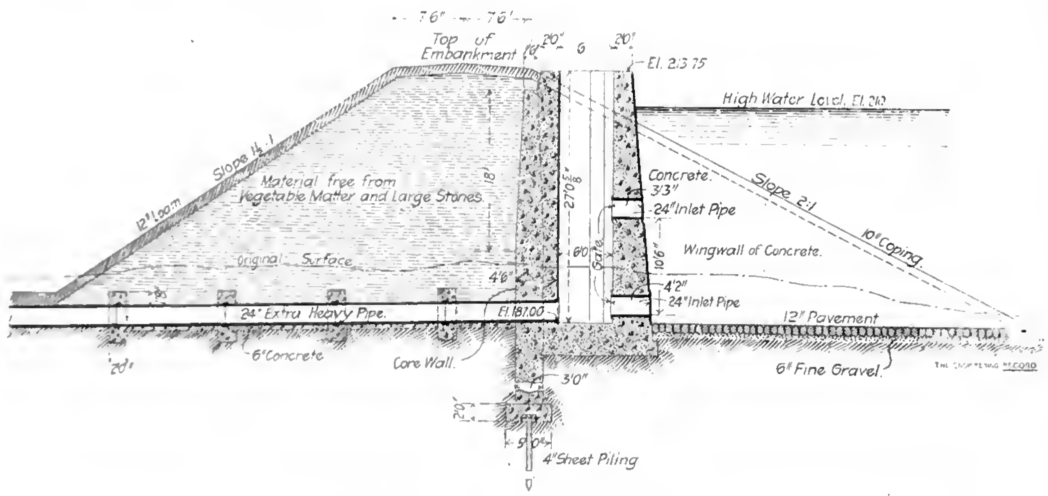
The new dam is irregular in plan, this arrangement having been chosen in order to utilize several natural mounds in the valley, which, while making the excavation for the core wall deeper in places, reduced the amount of necessary embankment. In making the preliminary studies, test pits were sunk along the line of the proposed dam, and these seemed to show that a fairly good foundation for the core wall would be reached at a reasonable depth. The soil of the whole region is of a gravelly nature, so much so that it was impossible to obtain any clay for puddle in the dam. Underlying the superficial gravel formation in the valley is a layer of hard, compact clayey gravel containing some boulders, and it was supposed from the indications of the test pits that this layer was at a fairly uniform depth across the valley. This, however, proved not to be the case, for near the center of the dam a pocket of fine running sand was struck, which, at the deepest part, was about 30 feet wide and extended to a depth of 62 feet below the surface. Although not exactly what would be called a quicksand, it was necessary to confine this material very carefully in order to carry on the work. On one side of this pocket the hardpan rose almost perpendicularly to within 19 feet of the surface, but on the other side it rose to about 44 feet from the surface and then sloped fairly regularly for 275 feet to a point where it was 35 feet from the surface and rose abruptly.

This unexpected condition of the foundation added greatly to the difficulties and cost of construction. The sides of the trench for the core wall had to be protected with sheeting and carefully timbered. In the bottom of the trench, for a distance of about 400 feet, 4-inch matched and splined sheet piling was driven down to hard bottom. This was a rather delicate operation on account of the material encountered and the depth of the trench, and it was found that comparatively light blows on the piling gave the best results. The maximum depth of trench was 40 feet below the surface and the piling was driven 22 feet below this. At first an ordinary rock drill with a 20-pound weight in place of the drill was used to drive the piles, and, as far as the driving was concerned, it gave good satisfaction. The rapidity of the blows gave the pile no time to stop or jump back, and it was driven as though by a steady pressure. However, as the drill had not been designed for such a purpose as this there were several breakdowns, and an ordinary pile driver was finally used. This was operated so as to give very light blows, it being found that otherwise there was a tendency to disturb the sheeting on either side of the trench. A 1,700-pound hammer was used, with a fall not exceeding 5 feet. A couple of heavy wale pieces were bolted along the top of the sheeting and the footing course of the concrete core wall was laid around them.

The core wall is 3 feet thick at the base and 1½ feet at the top. The specifications called for a concrete of 1 part cement, 3 of sand, 2 of fine gravel and 4 of stone not larger than 2½ inches. It was found that in several places on the work a sandy gravel could be obtained without screening, which answered this description very closely and uniformly, so that all that was necessary was to mix the one part of cement with nine parts of this gravel, care being taken of course to remove all large stones. Nazareth Portland cement was used for



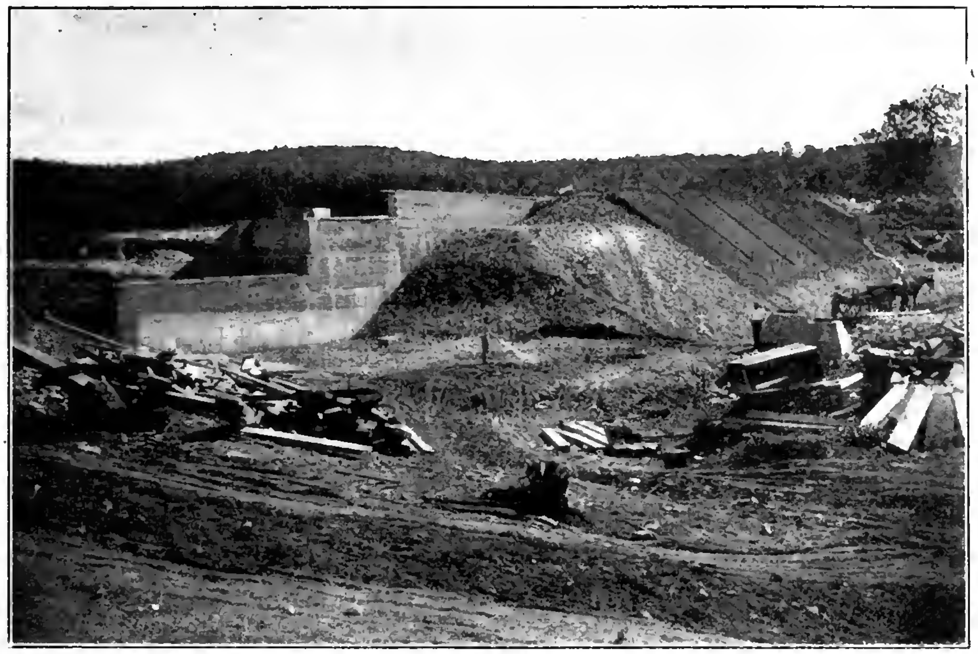
PLAN OF MAIN PART OF DAM, NEW LONDON, CONN.



SECTION THROUGH EFFLUENT CHAMBER.

most of the work, although Atlas was used to some extent. The concrete was mixed so wet that no tamping was required to consolidate it. The water face of the core wall was plastered with ½-inch of one to one mortar and brushed over with a cement wash.

The results seemed to bear out the expectation that in spite of the thinness of the wall it will be practically water-tight. The concrete presented a solid, compact appearance, entirely free from the voids which might, perhaps, have been expected from such a lean mixture. The forms were made of ordinary rough planking and the large cracks



Down-Stream Face of Dam at Effluent Chamber.

and knot-holes were plugged up inside with mortar before the concrete was laid, so as to prevent the mortar of the concrete from running out of the cracks. In order to thoroughly bond new work to that already laid, short lengths of timber were half buried longitudinally in the top and end of a section as it was finished, thus making recesses when the blocks were removed.

The effluent gate chamber, about 6 feet square inside, is also built of concrete, but for this work large boulders were placed in the walls, care being taken that they did not come too near the surface. There are two 24-inch sluice gates opening into this chamber, 10½ feet apart vertically. The wing walls of the approach to the effluent chamber are entirely of concrete and are perpendicular to the center line of the dam. A small gate house will surmount the effluent chamber, and its walls of rough cobbles will be in keeping with the wildness of the surrounding country.

The bottom of the gate chamber is 9 feet above the level of the water in the old reservoir, which determines the minimum head for the three miles of pipe line connecting the two. There is a [illegible]-inch pipe line for about a third of the way and a 20-inch line the remainder. At the lowest point it is 50 feet below the level of the old reservoir. It has been estimated that with a head of 15 feet above the old reservoir, or 6 feet above the bottom of the gate chamber, the discharge will be one and one-half million gallons per 24 hours. The level of high water in the new reservoir will be 32 feet above that in the old one, or 210 feet above tide water at New London.

As it was found impossible to get any clay for the water side of the embankment, selected loam was used. It was placed in 6-inch layers and thoroughly rolled, and it is thought that the result will be in every way satisfactory. The water face of the dam is paved with 12-inch cobble-stones on 6 inches of sand, and the finished work presents a very smooth and compact appearance. There were about 4,200 yards of this paving. The accompanying photographs show the two sides of the dam near the gate chamber as they appeared early in August, when nearing completion.

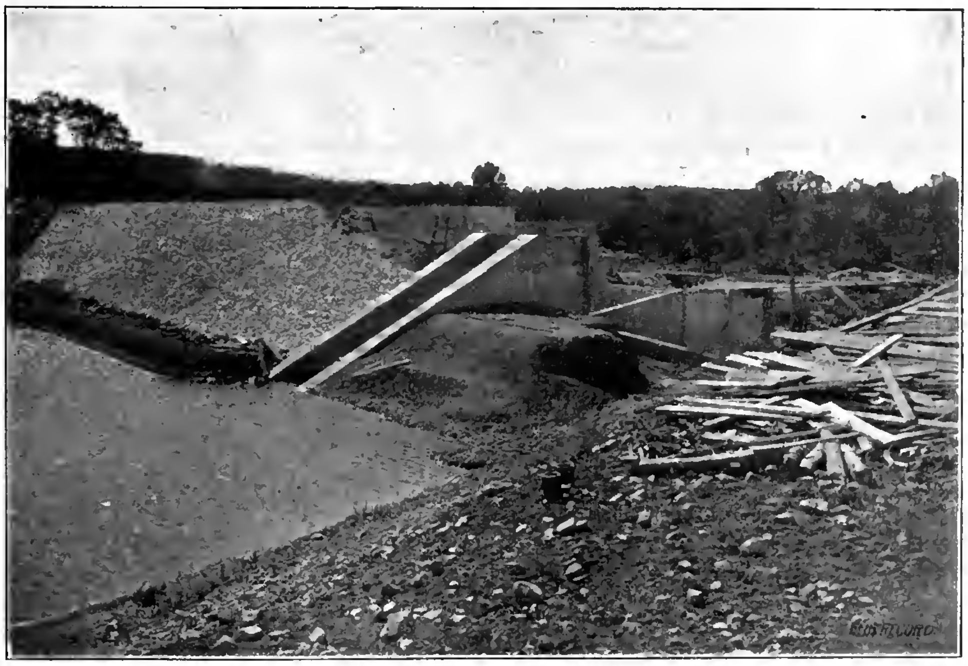
The portion of the embankment on the down-stream side of the core wall was made, according to specifications, of material free from vegetable matter and large stones, thoroughly watered as deposited. This was almost entirely gravel. In addition to the watering it was further compacted by the passing of teams over it. It will be observed from the section that the core wall was placed well toward the water face of the dam. This was done in the belief that the impervious part of the dam should be placed as near the water face as possible, consistent with stability, and that the gravel filling behind the core wall gives the necessary weight. The down-stream face of the dam is to be grassed over.

The spillway is 40 feet wide and is built of rubble stone masonry, with a coping course of dressed stone. In passing over this spillway, the water will fall about 3 feet vertically and then flow down a wasteway with a slope of 12 in 100, about 250 feet long, with dry rubble side walls and a paving of 15-inch cobbles placed on end. In planning this wasteway, the natural slope of the land was utilized so as to necessitate as little filling and excavation as possible.

One portion of the reservoir site was covered with hardwood timber before the work began, and this was utilized for fuel, both for domestic purposes and for making steam. In the bed of the reservoir proper all top soil, muck and roots were grubbed out, leaving, as far as practicable, a clean gravel surface. Some 17,500 yards of this material was removed. Above the filter dam the surface was only cleared off, not grubbed; and in some parts of the reservoir bottom a layer of gravel was placed over the natural surface after removing large roots and stumps.

The filter dam just mentioned is about 400 feet long, 10 feet wide on top and 20 feet high, with side slopes of 2 to 1. It is composed entirely of gravel. There is a 24-inch pipe through the bottom of this dam, through which the brook has flowed during construction. An overflow is arranged so that when the water reaches a certain level it will flow directly into the main body of the reservoir. It is estimated that the capacity of the reservoir will be one hundred and seventy-five million gallons. It will cover 50 acres and have an average depth of 20 feet.

The new reservoir is located practically in the wilderness, there being but two buildings of any kind on the whole watershed, and all the materials had to be carted over 10½ miles of hilly road in very poor condition, from New



Up-Stream Face of Dam at Effluent Chamber.

London. The carting of 3,500 barrels of cement over this road was by no means a small item. A telephone line was built to give ready communication with the city. The work done included about 28,000 cubic yards of embankment and 3,700 cubic yards of concrete. The original contractors threw up the work after it was begun, and The C. H. Eglee Company, of Boston, has performed nearly the whole of the contract. The assistant engineer who has had direct supervision of construction is Mr. Robert W. Chaffee. The cost of the completed reservoir will probably be about $80,000.

The Maignen Preliminary Filters for the Preparation of Water for Sand Filtration.

The rate, and consequently the cost, of operating a sand filter, as well as the quality of its effluent, are materially influenced by the nature of the applied water. The method heretofore commonly in vogue for preparing turbid or muddy waters for filtration has been subsidence for a longer or shorter period in settling basins, with or without the addition of coagulants. Another scheme has been suggested within the last few years by Mr. P. A. Maignen and has been made the subject of experimental research in Philadelphia. Instead of using a settling basin, a device known as a scrubber is used for removing a considerable portion of the turbidity from raw river water before applying it to the surface of the sand filters. At the same time, a scrubber also removes a large percentage of the bacteria. The Maignen Filtration Company is to erect a number of these scrubbers, or preliminary filters, at the Lower Roxborough filtration station of the Philadelphia water-works. The description of the scrubbers and the discussion of their efficiency and economy given below have been condensed from a report made by Messrs. Rudolph Hering and George W. Fuller, of New York, to the Maignen Filtration Company. This report is based on experiments conducted at two stations in Philadelphia, one supplied with Schuylkill River water after settling for several days in East Park Reservoir, and the other supplied with raw water as pumped from the same river.

The Maignen system in general consists of the double filtration of water, two or more kinds of filtering materials being used in each filter. The first filtration takes place at a rapid rate in an upward direction through coarse-grained material, like broken stone, coke or slag, supplemented at the top by a layer of "elastic material," such as sponge or peaty fiber. In these preliminary filters the rate of filtration is nominally sixty million gallons per acre daily. In the event that for long periods at a time the raw water should be very turbid, consideration would be given to "scrubbing" the water more than once, or to some other preparatory treatment preceding the regular scrubber. Scrubbers are cleaned by occasionally reversing the flow of water through them, and less frequently by removing the materials, cleaning and replacing them.

The following advantages are claimed: Scrubbers are much cheaper to install, per unit of water treated, than subsiding reservoirs; are especially well adapted for sites where land is very limited in extent and expensive, because of the relatively small area required per unit of capacity; and are capable of preparing river water for filtration without the use of coagulants up to higher limits of turbidity in the raw water than are ordinary settling basins. Scrubbers are capable of giving more thorough clarification to ordinary water than it is possible to obtain by subsidence. The smaller amount of turbidity in the water, when leaving the scrubbers, as compared with that leaving the subsiding basins, causes a considerable reduction in the cost of operating the final filters, and so the scrubbers are to be credited with the saving in filter charges. Scrubbers can be cleaned economically, and in total cost are cheaper for the preparatory treatment of moderately turbid river water than plain subsiding reservoirs.

When a scrubber is operated under reasonably favorable conditions, it is very noticeable that it yields a water for final filtration which contains only very little turbidity, and which is much clearer than that obtained by means of sedimentation, for, say, one to three days. The scrubber effluent is, also, purer from a bacterial standpoint, as the percentage removal of bacteria in the river water by sedimentation and by scrubbing is about 40 and 80, respectively, on an average. Thus the purity of the scrubber effluent would be three times as great as that of the settled water. In other words, it would require, on this basis, a removal of 60 per cent. of the bacteria in the settled water to yield a product equal in quality to that of the scrubber effluent.

In a number of places it has been found that when a water has been filtered once, under ordinary conditions as to rate and materials of filtration, a second filtration is sometimes of very little or no benefit. The reason assigned for this experience is that the first filtration removes those constituents which are necessary in order to "ripen" a filter, through the establishment of gelatinous films around the sand grains, and of certain biological processes. This aspect of the matter has received very careful attention, and the evidence shows that excellent results may be regularly obtained from the filtration of the Philadelphia water after it passed through a scrubber. The construction of the latter and its rate of filtration do not seem to impoverish the local water prejudically as to those constituents needful for developing and maintaining the final filter in a well-ripened and efficient condition.

Experience shows that as a general proposition the cost of operating large gravity filter plants is proportional to the amount of clogged material removed per unit volume of water treated. This statement assumes, of course, comparable conditions as to facilities and wages of laborers, and disregards such special features as removal of ice from open filters. The cost of executive and laboratory control is also excluded, as this is not directly related to the character of the water after it has been prepared for final filtration.

Experience at several places also shows that, approximately speaking, the amount of clogged material to be removed from filters, other things being equal, is proportional to the turbidity (within ordinary limits) of the applied water. At many, and perhaps most, filter plants, this principle is not readily apparent from the records, because there are not obtained continuous periods of sufficient length to show what can be done with a given narrow range of applied turbidity. Frequently quite a wide range of turbidity is noted during a single run between clearings, and occasionally a larger yield is obtained with a high than with a low average turbidity. These are largely explained by differences in the condition of the sand layer at the beginning of the run. Where raw water is applied to filters, complications also arise in some instances from algae growths and suspended organic (amorphous) matter, which clogs a filter to an excessive degree in proportion to its turbidity. Notwithstanding the obscuring of data by a variety of causes in practice, this principle is a correct one. From the foregoing it follows that the cost of filter operation is approximately proportional to the turbidity of the applied water, and upon this principle rests one of the principal merits of the scrubber.

Available evidence indicates that settled water at Philadelphia would average about 20 parts of turbidity per million. With filters operated at a six million rate and a 4-foot loss of head, the yields between cleanings would probably average about seventy million gallons per acre, and the average depth of scraping about ¾ inch. This makes the amount of clogged material to be handled about 1.5 cubic yards per million gallons of water filtered. The average turbidity of a scrubber effluent would probably be between 5 and 10 parts, so that there is every reason to believe that the average filter yield between cleanings would be about twice as great as with settled water, other things being equal. Hence it is concluded that a scrubber effluent as compared with settled water would reduce the cost of filter operation by about 50 per cent. Furthermore, from the evidence presented up to this time it is to be gathered that a scrubber could give additional stability to a system of purification in which a high rate of filtration is employed; and, therefore, it is entitled to certain financial credit by making feasible these relatively high rates of filtration.

The term "muddy water" is a relative one, and conveys different impressions according to the associated conditions. For present purposes in discussing the local river waters we may draw the line between muddy and non-muddy water at about 75 parts of turbidity. Of course, this limit represents a water which is far from clear, as in it one could see a pin in bright daylight only through a depth of about three inches. This purely arbitrary method of classifying the local river waters is based on the evidence that when such water is given an ordinary preparatory treatment by settling or scrubbing, it can be purified by properly constructed and operated filters of the slow type satisfactorily as to appearance and bacterial removal. To be sure, the lower the turbidity, the cheaper and safer will be the filtration, as already stated, but the point here made is that with this limit the turbidity of itself does not preclude obtaining a filtered water of high grade.

Between the limits of about 75 and 200 parts of turbidity in the river water, preparatory treatments such as here considered permit a filter ordinarily to be operated so as to yield for some days a water of satisfactory bacterial quality, but of an appearance somewhat opalescent, or cloudy. So far as known, such turbidities in the filtered water, due to fine clay particles, are not prejudicial to health. With these limits of turbidity the frequency and cost of cleaning the filter are of course materially increased. Beyond about 200 parts of turbidity in the river water, the influence of this factor in connection with the processes here considered becomes more marked if continued for a number of successive days. When such turbidities prevail for one or two weeks, it is likely that the filtered water might contain so many clay particles that the consumers would call it muddy. Under such circumstances the functions of the filters become more or less deranged, and it is possible that there would be interference with the ordinary capacity for bacterial removal.

On the turbidity basis of 75 parts per million, the Delaware is "not muddy" for about 90 per cent. of the time and the Schuylkill for 85 per cent. These figures are obtained by excluding those periods when for two or more days at a time the turbidity was 75 parts or more. The limit of 200 parts turbidity is not reached in the Delaware during more than 96 per cent. of the time and in the Schuylkill 94 per cent. With regard to the character of the turbidity of these two river waters, it is to be said that the suspended particles are very fine in character. This is shown both by the behavior of the water in settling basins and in filters, and also analytically. The turbidity coefficient, that is, the ratio between the silica turbidity and the weight of the suspended matter, 0.60, is unusually low, as judged by the general information now available upon this subject.

The Schuylkill River water adds a possible complication to its treatment by reason of the coal dust or culm which it contains from time to time. While this factor is a decided detriment to the character of the raw water if used without further treament for a public supply, it does not seem to add serious complication to processes for complete clarification and purification, because the culm is less difficult to remove than the large quantities of exceedingly minute clay particles which are suspended during heavy floods.

When water approaches quiescence the matters suspended in it are to a greater or lesser degree deposited. The rate of deposition depends upon the remaining velocity of the water in connection with the subsiding value of the suspended particles. Velocities are affected by relative temperatures of water and air, and by the degree of baffling which exists in a basin to prevent water from passing from the inlet to outlet, and thus putting a portion of the basin out of service, practically speaking.

General experience indicates that as a rule it is not economical or advisable to continue plain sedimentation in water purification works to more than about 24 hours. Exceptions of course are to be found where this factor has to be considered with reference to other portions of some works. Where river water receives occasional treatment with coagulants, and is later applied to filters of the slow type, experience shows that after coagulation the water should be settled for at least 24 hours. This is necessary in order to remove the coagulated matters so that they will not accumulate at the surface of the sand layer and quickly clog the filter. Taking everything into consideration, it may be concluded that where settling reservoirs are still unbuilt it would be advisable to build basins holding about 24 hours' flow. With plain sedimentation it is estimated that the removal of turbidity and bacteria would average about 30 and 40 per cent., respectively. As it is the heavier particles which subside, the removal of suspended matter would be greater than the turbidity removal.

On the preparation of Philadelphia water by means of scrubbers, on the other hand, the following observations may be made:

Filtration should take place in an upward direction, at a rate not exceeding 100,000,000 gallons per acre daily. Sudden fluctuations should be avoided. The net yield is estimated at 60,000,000 gallons per acre daily. As to the materials in the Maignen scrubber it has been found that the original device may be improved somewhat by placing one or two feet of finer material between the elastic layer and the necessary bottom layers. The elastic layer should be about eight inches in thickness, suitably compressed. Piping connections need no comment, except to state that, for purposes of frequent cleaning by reverse flow of water, sewer connections should be provided. In order to remove readily the dirty wash water and the air in the pores of the pebbles upon refilling, it is well to have outlet pipes just below the elastic layer.

Regarding the best kind of elastic layer to use, it has been found that sponge clippings are somewhat more efficient than peaty fiber. So far as can be ascertained, there is available a sufficient quantity of sponge clippings to serve all needs in view. Should prices become excessive for this commodity, peat or similar material might be substituted temporarily. As to the life of sponge clippings in a scrubber, there is no evidence of chemical decomposition, owing to the mineral nature of the product. There is some physical disintegration during washing. Although some sponge is disintegrated in washing, it appears that the smaller pieces can be used for some time. At each washing it is estimated that the net loss of sponge would average not over 2.5 per cent., and probably considerably less than this.

The conclusions as to the efficiency of scrubbers in removing turbidity on a strictly physical basis are as follows:

The work of scrubbers, in treating a water having a fairly wide range of turbidity, is characterized by effecting a certain percentage removal, and not by maintaining a fairly constant turbidity of the scrubbed water regardless of the applied. The percentage removal ranges under different conditions from about 35 to 90; ordinarily the range is from about 50 to 80, and the average which might be expected in practice is in the vicinity of 65. When the local water becomes more turbid than is ordinarily the case, the percentage removal is somewhat more liable to fall below than above the average.

As to the removal of bacteria, the percentage seems to be rather higher than for turbidity. The average is estimated at 80 per cent. A scrubber does its best work when the applied water has a turbidity of 50 parts or somewhat less. When a turbidity of more than about 75 parts is applied, it begins to fail somewhat in its purpose when working on a strictly physical basis. In the case of scrubbers dealing with excessively muddy water, normal operations can be maintained only by giving to the water a preliminary treatment. Should such treatment involve coagulation, it would be necessary to provide settling capacity of about six hours' flow in order not to overtax the scrubber.

Regarding the operating charges, it is estimated that 1 per cent. of the water would be used for cleaning by occasionally reversing the flow. This figure seems very liberal, and it is quite likely that a part of this charge could be applied to better advantage to "working over" and rearranging the sponge layer. When receiving a water which they could properly treat, it is estimated from the available evidence that the scrubbers would yield on an average about 6,000,000,000 gallons per acre, with a maximum loss of head or about 2.5 feet, between the periods of removing the sponge layer washing and replacing it. At the stated rate this means about four sponge cleanings a year. It is further estimated that the granular material would have to be washed about once a year, in addition to flushing whenever the sponge layer is cleaned. A moving platform would be provided above the space between the scrubbers, upon which the sponge could be washed in a machine operated by electric or hydraulic power.

The available evidence indicates that the average removal of turbidity from the local river waters by settling basins (24 hours' capacity) and scrubbers would approximate about 30 and 65 per cent., respectively, and of bacteria, 40 and 80 per cent., respectively. As to the residual turbidity of the treated water, during all ordinary conditions in the river, it is estimated that it would be about 20 and 10 parts, respectively. The probabilities are that a scrubber effluent is much more likely to average less than 10 parts than is a settling basin less than 20 parts. During muddy water the scrubber effluent would be about one-half as turbid as a settling basin effluent, should both be operated on a strictly physical basis. Should both receive special preparatory treatment, the results would be kept approximately within the general averages above stated.

Concerning the cost factors, there are two aspects of this case. One refers to the items which can be estimated quite closely, and the other is less definite, dealing with the question of higher rates of filtration which are permitted by the better preparation afforded by the scrubber. As stated, this item throws the advantage decidedly in favor of the scrubber, were all other factors a tie.

The final conclusions are that where settling reservoirs already exist, scrubbers will reduce the cost of operating the final filters sufficiently to save their own total cost, in addition to the saving effected by the smaller area of the filters; and where settling reservoirs are not yet built, scrubbers will effect a saving in addition to the saving effected by the smaller area of the filters.

Typhoid Fever and a Pure Water Supply do not naturally go together. A striking illustration of this was mentioned by Mr. P. Byrne in a paper presented to the Engineering Association of the South last June. The supply of a Mississippi town of 1,200 inhabitants was obtained from surface wells. During a canvass for and against water-works, one August, there were 64 cases of typhoid. The advocates of the water-works won, and the system was constructed a few months later. In August of the next year there was not a case of typhoid fever within the corporate limits.

The Re-inspection of all Water Fixtures in the city of Philadelphia, begun by directions from Mayor Ashbridge, is summarized as follows in the 1901 report of Wm. C. Haddock, director of the Department of Public Works: The total number of inspections amounted to 248,226, and 40,418 properties were discovered having appliances for which no water rents were being paid. The total number of delinquent appliances revealed by the inspection was 70,660. The water rent chargeable to these fixtures amounted to $146,057. The cost of the inspection was $26,448, showing a net revenue to the city of $119,609. Each succeeding year the city will gain the gross amount.

The New England Water-Works Association held the first of its winter meetings at Hotel Brunswick, Boston, on November 12. There was a good attendance. The following persons were elected to membership in the Association: Robert E. Horton, hydraulic engineer, Utica, N. Y.; John W. Alvord, consulting engineer, Chicago, Ill.; George A. Sanborn, superintendent, Essex Company, Lawrence, Mass.; Harry E. Barnard, chemist to New Hampshire State Board of Health, Concord, N. H.; D. A. Heffernan, superintendent of Water Works, Milton, Mass.; David Dexter Clarke, engineer to Water Commissioner, Portland, Ore.; J. H. Ince, assistant to president, Western New York Water Company, Buffalo, N. Y.; William P. Conard, Burlington, N. J., and R. O. Wynne-Roberts, engineer of Water Works, Capetown, South Africa.

The following members were appointed by President Frank E. Merrill to serve as a "Committee on Private Fire Protection:" F. H. Crandall, Burlington, Vt., R. J. Thomas, Lowell, Mass., and Elbert Wheeler, Boston, Mass. A communication was read from Mr. Alphonse Fteley, expressing his appreciation of the honor conferred upon him by the action of the Association at its September meeting in electing him to honorary membership. A paper on "Economy in the Use of Coal for the Production of Power" was read by Prof. Ira N. Hollis, of Harvard University, and a paper entitled "Waste Heat Engines" was presented by Prof. Edward F. Miller, of the Massachusetts Institute of Technology. We regret that in a previous issue it was erroneously stated that the election of officers would take place at this meeting. The report of the nominating committee was made public, but additional nominations will be received up to December first. The official ballot will be sent out about the middle of December and the vote will be canvassed at the annual meeting, in January.

The Hibernia Building, New Orleans.—I. Foundations.

The new Hibernia building, adjacent to the St. Charles hotel, at Carondelet and Gravier Streets, New Orleans, La., is an 82x128-foot steel cage structure with a basement, twelve stories and an attic, rising to a height of about 200 feet above the pavement. Messrs. D. H. Burnham & Company, Chicago, are the architects and Mr. J. G. Glaver is the structural engineer. The 2,000-ton framework has 34 steel columns arranged in four longitudinal and seven transverse rows, which, with the beams and girders, are designed in conformity with the steel office building construction in northern cities, which has been frequently described in The Engineering Record. There are some special features in the detailing of the steel work of the superstructure, but the principal ones are in the foundation, which is built on very wet, soft ground and carries a much taller and heavier structure than many others in the vicinity, which have settled seriously. In this building any serious distortion would be detrimental to the masonry fronts, and great care has been taken to avoid its occurrence. It is not expected to absolutely prevent settlement, but it will be limited to a small amount, and that amount is expected to be regular so as not to cause any relative displacement or dislocation of different parts of the building.

The soil is the natural, sedimentary deposit of the Mississippi delta, is very fine and soft, and saturated with water to within about 3 feet of the surface. Ordinary buildings which have loads of not more than 1,500 pounds per square foot on their foundations a few feet below the surface have, in many cases, settled deeply and irregularly and a foundation load of 1,000 pounds on the surface of the soil is considered as much as is desirable. The column footings in the Hibernia building are each supported on a group of from 16 to 36 15-inch piles driven about 30 inches apart and loaded to a maximum of about 30,000 pounds each. These piles are about 50 feet long, have square ends and are driven by a 5-ton steam hammer. The retaining walls are carried on piles which have much smaller loads. All piles are cut off below water level, from 6½ to 13 feet below the basement floor. In each column footing the piles are driven in even or staggered rows in a rectangular area, and have their heads cut off in the same horizontal plane. The earth is excavated 1 foot below the pile tops, and concrete is rammed in around the tops to a height of 18 inches above them and to a distance of 6 inches beyond the outer rows.

The top of the concrete is covered with a grillage of steel I-beams set close together, and the concrete is built up to a level of 4 inches above their upper flanges so as to enclose them on all sides. The grillage beams are 9, 10, 12 and 15 inches high according to their lengths, which vary from 6½ to 15 feet. Those for the heaviest interior columns have 18 15-inch 40-pound I-beams 14 feet long on a footing 15 feet square and receive their column load through five 20-inch 95-pound I-beams 14 feet long seated across them at right angles on the center line of the pier. The other grillages have similar distributing girders which vary from 15 to 24 inches in depth and receive at their center points the cast-iron column bases. In all cases the tops of the bases are set below the basement or first floor level, and the concrete is carried up continuously from the tops of the grillages with a sufficient width and thickness to enclose them and the distributing girders and the joint between the foot of the column and its base.

Only about 50 per cent. of the area of the lot is excavated for the basement and this feature brings the retaining wall well within the lot line. Correspondingly, the foundations for nearly all the wall columns are carried up to a level several feet above those of the interior columns and no more excavation was made around them than was necessary for their construction, after which the earth was back filled around them up to the first floor level, as shown in the vertical sections of the substructure. The retaining wall carries the ends of the first floor beams but does not support any portion of the main walls of the building and has a uniform cross-section throughout, as shown.

Special floor construction in the basement was necessary to resist the upward hydrostatic pressure from the ground water and to prevent its leakage into the basement. This is shown, together with the relative position and arrangement of the wall columns outside the retaining wall and the interior columns inside it, by the general sectional elevation parallel to columns 7, 30, 22 and 23. At the piers the excavation was made 5½ feet below the basement floor level; between them it was made 3 feet below the same level, and 12 inches of broken brick, cinders, etc., were tamped thoroughly over the surface and covered with an 8-inch layer of concrete, a 1-inch sheet of asphalt water-proofing, 6 inches of concrete, another inch of asphalt water-proofing, 7 inches more of concrete and a cement floor finish, one inch thick. This construction interposes a double barrier to the percolation of ground water and a thickness of 21 inches of concrete to resist upward pressure.

The upper water-proofing layer is carried through under the bases of the retaining walls and flashed up outside them on their battered slopes to within 10 inches of the finished first story floor, where it is turned down horizontally and carried between the upper and lower layers of concrete to make a continuous impervious surface enclosing the whole basement below grade. Outside the retaining walls, where the first floor is laid on the earth, it is similar to the basement floor except that it is thinner, with one water-proofing layer and one thickness of concrete omitted. It is built with 7 inches of cinders tamped on the rolled earth, then 6 inches of concrete, one inch of asphalt water-proofing, 8 inches of concrete and a one-inch wood floor nailed to cross strips keyed into the concrete. The water-proofing of the first floor extends under the spandrel wall between piers, and the latter is seated on it on a course of thin full width stones.

Close to the outer walls of the building there is a pipe trench with inside width and height of 3¾ feet and 3 feet. It has a 6-inch concrete bottom at the level of the top flanges of the grillage beams and 9-inch concrete vertical walls and is accessible through a removable cover supported on 3x3-inch transverse T-bars, on top of the side walls, below the basement floor. The asphalt water-proofing is carried around both sides and under the bottom of the pipe trench.

The adjacent buildings on both the inner sides of the lot have, in some places, the same party wall with the Hibernia Building; in other places the position of the light courts makes separate walls necessary. At one point next the St. Charles Hotel where the wall columns are about 38 feet apart, the party wall is carried (up to the second story wall girders which support the upper part of it) on a concrete footing with two rows of staggered piles. At other places in this wall and in the street fronts, the masonry, up to the second story girders is carried on pairs of I-beams spanning the spaces between piers and having their ends supported on the pier grillages. These beams are 8 to 12 inches deep and are completely enclosed in concrete. They have the backfilling well rammed up under their lower flanges, but are assumed to impose no pressure on it, but to carry all loads directly to the main piers across spans of from 4 to 10 feet.

On one side of the lot there is a light court between the Hibernia and the adjacent building and opposite it it was necessary to carry the wall columns outside the retaining wall down to the level of the basement floor. The excavation here was therefore made almost to the maximum depth, and the old adjacent wall was temporarily supported on needle beams while its footings were undermined, new ones built in the bottom of the trench and a concrete foundation wall carried up to the lower side of the old footing to underpin it. After this the space outside the retaining wall was backfilled around the column which, as in other similar cases, was enclosed in a solid rectangular mass of concrete extending from 4 to 6 inches beyond the metal in every direction. At this place the lower story of the spandrel wall is carried on a pair of 12-inch I-beams which are bracketed out from the columns the same as the upper wall girders. Some of the spandrel beams for this wall are, however, carried at one end on the columns and at the other end rest, as previously described, on the grillage beams of columns which have their footings just below the basement floor level.

The smoke stack weighs about 120,000 pounds and has an asbestos lined oval steel shell 4½ feet wide and 7½ feet long. It is seated on a horizontal cast-iron pedestal which has an I-shaped cross-section with top and bottom flanges of unequal width, as shown in the cross-section of the foundation. The pedestal is bedded in the concrete floor with its upper flange just clear of its surface; below it there is a grillage of 6-inch I-beams, 7 feet long, which are carried on two pairs of 8-inch longitudinal I-beams, 9 feet long, set on the center lines of and 18 inches clear of the tops of four piles. This foundation is peculiar in that the cast-iron base does not rest directly on the grillage but is seated on the lower layer of the basement floor concrete which is continuous and here merely acts as a filler above the grillage. The water-proofing course is carried over the lower flange of the cast base and fitted close to its vertical web.

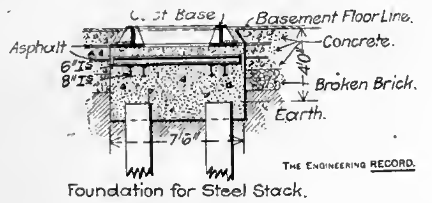
In several places steel tanks are set below the basement floor for sumps, catch-basins, blow-offs, etc. The catch-basin has a steel cylinder 6 feet in diameter and 3 feet deep bedded in concrete and surrounded by the lower layer of water-proofing, as shown in the cross-section. The upper layer of water-proofing is fitted over a special outside flange angle. The tank is lined with 6 inches of concrete on the sides and bottom, contains a concentric cylinder, 3 feet in diameter and 30 inches deep, and is covered by a steel plate flush with the basement floor.

In one corner of the first story there is a massive fire-proof vault with steel and masonry walls, which weighs about 200 tons. It has a foundation about 16½ feet wide and 49 feet long, with nineteen piles arranged in seven transverse rows of three piles each except at one end where they intersect the column piers, and have only two each. The rows of piles are capped with concrete beams 3 feet wide and 5 feet deep and the ends of the caps are connected by similar concrete beams under the side walls of the vault, thus forming a rectangle of concrete 5 feet thick with six open panels 4 feet wide and 8½ feet long. The panels were filled with sand flush with the top of the concrete and on it and the caps was built a solid, continuous floor 23 inches thick, flush with the basement floor. The floor consists of an upper and a lower layer of concrete, 9 and 13 inches thick respectively, with the regular 1-inch layer of asphalt water-proofing between them.

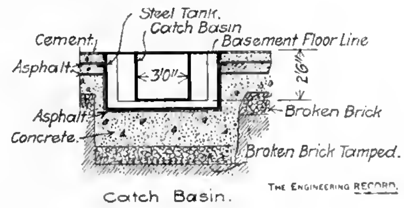
In one corner of the building the footings for three wall columns had to be kept entirely within the lot line which in other places they were permitted to overrun. The columns are accordingly supported on cantilever girders just clear of the under side of the first story floor. The short ends of the cantilevers overhang by about 5 feet the centers of their supports on the distributing girders above the grillages of the high-level footings close to the lot line. The long ends are riveted to the sides and faces of interior columns which are carried down to seats on piers below the basement floor with their grillages about 11 feet lower than those of the wall column piers. Although column 2 which supports the inner end of cantilever girder 1-2 is outside the retaining wall, its footing was carried down below the basement floor level, the same as columns 22 and 25 at the inner ends of the other cantilevers, and the excavation for it was made so as to receive the footing for the underpinning of the adjacent wall of the next building, as indicated by the dotted lines in the general elevation of girder 1-2. This cantilever, like all the others, was encased in a solid rectangular mass of concrete 3 inches thick beyond all sides. The column was protected by a similar casing up to the basement floor, and the excavation was back-filled as shown.

Cantilever girder 1-2 has two full length webs, which, as shown in the detail, are connected at the end of the long arm to the reaction column 2 by transverse horizontal angles across the top and bottom flanges. The lower angles are merely shelves for convenience in supporting the weight of the cantilever during erection. The upper angles receive all the upward reactions and are reinforced in the usual way by vertical angles fitted to their horizontal flanges, and having sufficient rivets through the column cover plates to distribute all the stresses there. The two main girder webs are connected only by top and bottom flange tie plates and by a vertical transverse diaphragm near the center which receives the end of a third web extending to the extremity of the short arm to help carry the wall column. The cantilever thus consists essentially of three separate plate girders, two of them full length and one, half length. The other foundation cantilevers are similar to the one here illustrated except in their dimensions and in their connections to the reaction columns. Girder 22-23 is 30 inches deep and girder 24-25 is 36 inches deep, both being 30 feet long. The long arms of both are connected, as shown at interior column 22, with the end of their two long webs engaging the column and completely covering both its faces with 2 or 3 inches clearance and no web riveted connection. All the stress is transmitted through the flanges to the standard reinforced brackets which cover the full widths of the column faces.

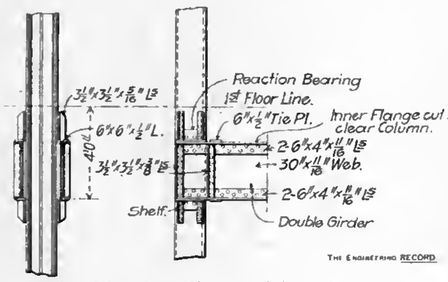
(To be continued.)



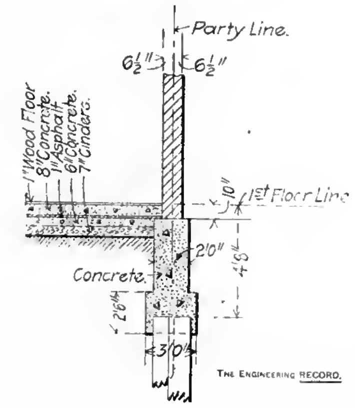
Foundation for Steel Stack.



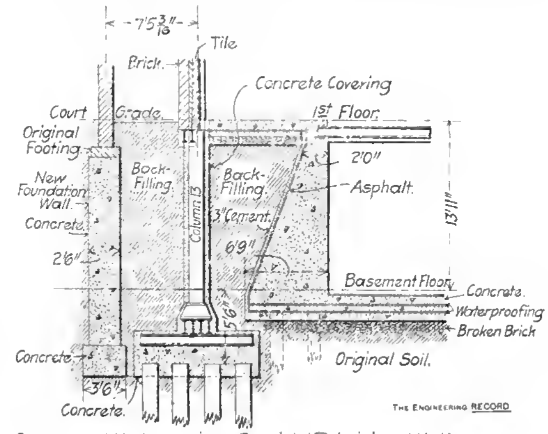
Catch Basin.



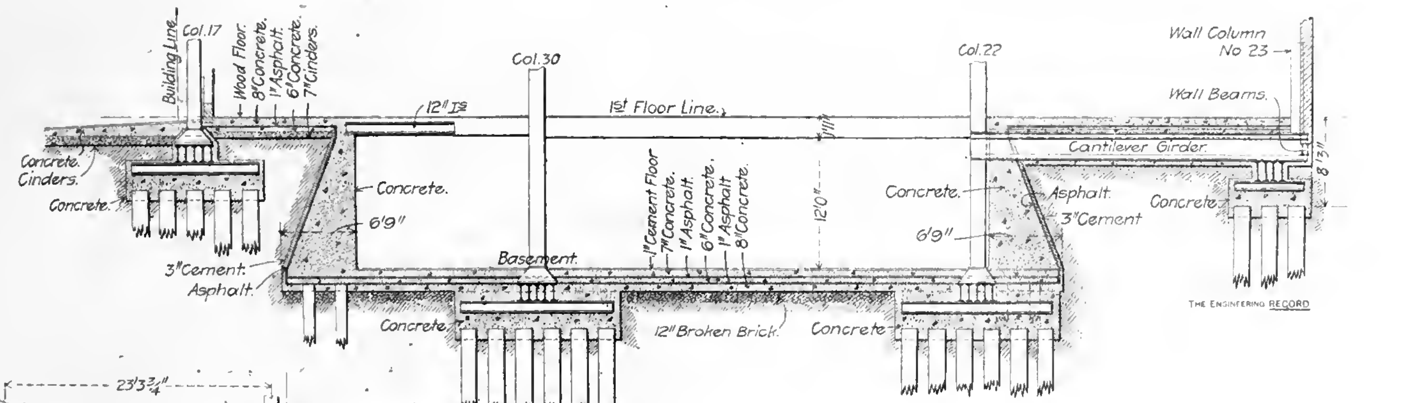
Connection of Cantilever Girder to Column 22.



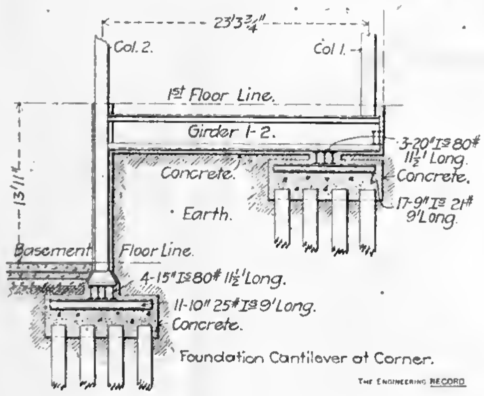
Foundation of Party Wall.



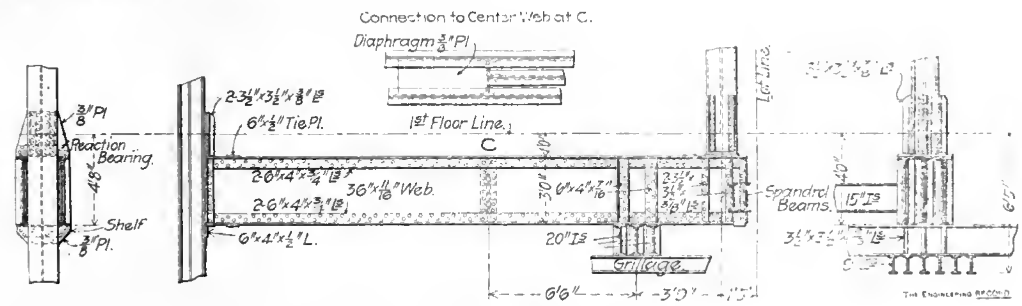
Column and Underpinning Outside Retaining Wall.



General Cross-Section.



Foundation Cantilever at Corner.



Connection of Cantilever Girder 1-2.

DETAILS OF FOUNDATIONS OF THE HIBERNIA BUILDING, NEW ORLEANS.

Comments on Technical Education.

Extracts from an address by Prof. John Perry before the Engineering Section of the British Association.

Mathematics.—It seems probable that at the end of another five years no average boy of fifteen years of age will have been compelled to attempt any abstract reasoning about things of which he knows nothing; he will be versed in experimental mathematics, which he may or may not call mensuration; he will use logarithms, and mere multiplication and division will be a joy to him; he will have a working power with algebra and sines and cosines; he will be able to tackle at once any curious new problem which can be solved by squared paper; and he will have no fear of the symbols of the infinitesimal calculus. When I insist that a boy ought to be able to compute, this is the sort of computation that I mean. Five years hence it will be called "elementary mathematics." Four years ago it was an unorthodox subject, called "practical mathematics," but it is establishing itself in every polytechnic and technical college and evening or day science school in the country. Several times I have been informed that on starting an evening class, when plans have been made for a possible attendance of ten or twenty students, the actual attendance has been 200 to 300. Pupils may come for one or two nights to a class on academic mathematics, but then stay away forever; a class in practical mathematics maintains its large numbers to the end of the winter.

Hitherto the average boy has been taught mathematics and mechanics as if he were going to be a Newton or a Laplace; he learnt nothing, and became stupid. I am sorry to say that the teaching of mechanics and mechanical engineering through experiment is comparatively unknown. Cambridge writers and other writers of books on experimental mechanics are, unfortunately, ignorant of engineering. University courses on engineering—with one splendid exception, under Professor Ewing, of Cambridge—assume that undergraduates are taught their mechanics as a logical development of one or two axioms; whereas in many technical schools under the Science and Art Department apprentices go through a wonderfully good laboratory course in mechanical engineering. We really want to give only a few fundamental ideas about momentum and the transformations of energy and the properties of materials, and to give them from so many points of view that they become part of a student's mental machinery, so that he uses them continually. Instead of giving a hundred labor-saving rules which must be forgotten, we ought to give the one or two ideas which a man's common-sense will enable him to apply to any problem whatsoever, and which cannot be forgotten. A boy of good mathematical attainments may build on this experimental knowledge afterwards a superstructure more elaborate than Rankine, or Kelvin, or Maxwell ever dreamt of as being possible. Every boy will build some superstructure of his own.

Laboratory Instruction.—The professors were given a free hand at Finsbury, and there were no outside examiners. I need not dwell upon the courses in chemistry and physics; some critics might call the subjects "rational chemistry" and "applied physics;" they were as different from all other courses of study in these subjects as the courses on rational mathematics and mechanics differed from all courses elsewhere. The course on mechanics was really one on mechanical engineering. There were workshops in wood and iron, not to teach trades, but rather to teach boys the properties of materials. There were a steam engine and a gas engine, and shafting and gearing of many kinds, and dynamos which advanced students in turn were allowed to look after under competent men. There was no machine which might not be experimented with occasionally. Elementary and advanced courses of lectures were given; there was an elaborate system of tutorial classes, where numerical and squared paper exercise work was done; there were classes in experimental plane and solid geometry, including much graphical calculation; boys were taught to make drawing-office drawings in pencil only, and tracings and blue prints, such as would be respected in the workshop, and not the ordinary drawing-class drawings, which cannot be respected anywhere; but the most important part of the training was in the laboratory, in which every student worked, making quantitative experiments. An offer of a 100-ton testing machine for that laboratory was made, but refused; the advanced students usually had one opportunity given them of testing with a large machine, but not in their own laboratory. I consider that there is very little educational value in such a machine; the student thinks of the great machine, and not of the tiny specimen. Junior students loaded wires and beams, or twisted things with very visible weights, and saw exactly what was happening, or they studied vibrating bodies. Many hours were devoted to experiments on a battered, rusty old screw-jack, or some other lifting machine, its efficiency under many kinds of load being determined, and students studied their observations, using squared paper, as intently as if nobody had ever made such experiments before. There was one piece of apparatus, an old flywheel, bought at a rag-and-bone shop, to which kinetic energy was given by a falling weight, which I remember occupied the attention of four white-headed directors of electric companies in 1882 (evening students) for many weeks. A casual first measurement led on to corrections for friction and stiffness of a cord, and much else of a most interesting kind. At the end of six weeks these gentlemen had gained a most thorough computational acquaintance with every important principle of mechanics, a knowledge never to be forgotten. They had also had a revelation such as comes to the true experimenter—but that is too deep a subject.

Perhaps teachers in the greater colleges will smile in a superior way when they hear of this kind of experimental mechanics being called engineering laboratory work. True, it was elementary mechanics; but is not every principle which every engineer constantly needs called a mere elementary principle of mechanics by superior persons? I find that these elementary principles are very much unknown to men who have passed through elaborate mathematical studies of mechanics. Students found out in that laboratory the worth of formulæ; they gained courage in making calculations from formulæ, for they had found out the extent of their own ignorance and knowledge.

At Finsbury there was an excellent one-cylinder engine with vaporizing condenser. It drove the workshops and electric generators. On a field-day it drove an electric generator only, and perhaps thirty students made measurements. Each of them had already acted as stoker and engine-driver, as oiler and tester of the machinery, lighting fires, taking indicator diagrams, weighing coals, opening and closing cocks from seven in the morning to ten at night, so that everything was well known to him. They maintained three different steady loads for trials of three hours each. They divided into groups, one from each group ceasing to take a particular kind of observation every ten minutes and removing to another job. All watches were made to agree, and each student noted the time of each observation. These observations were: Taking indicator diagrams, checking the speed indicator, taking temperature of feed water, quantity of feed by meter (the meter had been carefully checked by gauge-notch, and every other instrument used by us had been tested weeks before), taking the actual horse-power passing through a dynamometer coupling on the shaft, taking boiler and valve-chest pressures and vacuum pressures on the roof and in the engine-room, weighing coals (the calorific value had already been tested), taking the horse-power given out by the dynamo, counting the electric lamps in use, and so on. Each student was well prepared beforehand. During the next week he reduced his own observations, and some of the results were gathered on one great table. One lesson that this taught could never be forgotten—how the energy of 1 lb. of coal was disposed of. So much up the chimney or by radiation from boiler or steam jacket and pipes; in condensation in the cylinder; to the condenser; in engine friction; in shaft friction, etc. I cannot imagine a more important lesson to a young engineer than this one taught through a common working engine. The students had the same sort of experience with a gas engine. I need hardly say how important it was that the professor himself should take charge of the whole work leading up to, during, and after such a field day.

Teachers.—Mathematics and physics and chemistry are usually taught in watertight compartments, as if they had no connection with one another. In an engineering college this is particularly bad. Every subject ought to be taught through illustrations from the professional work in which a student is to be engaged. An engineer has been wasting his time if he is unable to answer the questions of an ordinary examination paper in chemistry or pure mathematics. The usual mathematical teacher thinks most of those very parts of mathematics which to an ordinary man who wants to *use* mathematics are quite valueless, and those parts which would be altogether useful and easy enough to understand he never reaches; and, as I have said, so it is also in chemistry. Luckily, the physics professor has usually some small knowledge of engineering; at all events, he respects it. When the pure mathematician is compelled to leave the logical sequence which he loves to teach mechanics, he is apt scornfully to do what gives him least trouble—namely, to give as "mechanics" that disguised pure mathematics which forms 90 per cent. of the pretence of theory to be found in so many French and German books on machinery. As pure mathematical exercise work it is even meaner than the stupid exercises in school algebras; as pretended engineering it does much harm, because a student does not find out its futility until after he has gone through it, and his enthusiasm for mathematics applied to engineering problems is permanently hurt. But how is a poor mathematical professor who dislikes engineering, feeling like Pegasus harnessed to a common wagon—how is he to distinguish good from evil? He fails to see how worthless are some of the books on "Theoretical Mechanics" written by mathematical coaches to enable students to pass examinations. An engineer teaching mathematics would avoid all futilities; he would base his reasoning on that experimental knowledge already possessed by a student; he would know that the finished engineer cannot hope to remember anything except a few general principles, but that he ought to be able to apply these, clumsily or not, to the solution of any problem whatsoever. Of course, he would encourage some of his pupils to take up Thomson and Tait, or Rayleigh's "Sound," or some other classical treatise as an advanced study.

Not only do I think that every teacher in an engineering college ought to have some acquaintance with engineering, but it seems to me equally important to allow a professor of engineering, who ought, above all things, to be a practical engineer, to keep in touch with his profession. A man who is not competing with other engineers in practical work very quickly becomes antiquated in his knowledge; the designing work in his drawing-office is altogether out of date; he lectures about old difficulties which are troubles no longer; his pupils have no enthusiasm in their work; even when he is a man distinguished for his past work, his students have that kind of disrespect for his teaching which makes it useless to them. If there is fear that too much well-paid professional work will prevent efficiency in teaching, there is no great difficulty in applying a remedy.

A Slide-Rule for Field Topographic Work.

Of making slide-rules for special purposes there seems to be no end, and the novel features of most of the new designs are too minute to be of general interest. For several years, however, Mr. Gerard H. Matthes, of the U. S. Geological Survey, has been using a metal rule for reducing stadia observations in the field, which merits general notice. It is made of German silver and thus is unaffected by temperature or humidity, and in plane table work has made it unnecessary to employ more than one man, a rodman, to assist in the survey. It has proved particularly useful in windy weather when books of tables or diagrams are blown about so as to be very troublesome. The instrument is 10½ inches long and was made by Kern & Company, of Aarau, Switzerland. The following account of it and its use is abridged from the "Technology Quarterly" for September. As the plane table work of the Survey must be understood in order to appreciate the value of the rule, a few notes on the operations are first given.

The operations may be classed under two heads: Vertical angle or intersection work, and stadia work. In the former, prominent features are located on the map by intersection from two or more known points, vertical angles being determined in each instance. The vertical difference of elevation between each point of observation and the new point is then computed by multiplying the horizontal distance (scaled from the map directly) by the tangent of the angle, and applying corrections for the effects of curvature of the earth, refraction of the atmosphere, and the height of the telescope above the ground. Computations of this character are made for each observation, thus affording a reliable check upon the elevation of the new point. It will be noticed at once that these computations are not simple. The distance scaled from the map is obtained in terms of miles. The difference of elevation required must be in feet. Effects of curvature and refraction are variable quantities. It is essential that the correct functions be used in computing these corrections, for no rule of thumb or approximate method can be relied upon to give accurate results.

The other class of work referred to above, in which distances and elevations are determined by the stadia method, is too well known to require description here. In the general topographic work of the Survey its use is chiefly confined to stadia traversing and large-scale surveys of reservoir sites or mining districts. The reduction of stadia observations is also performed with the aid of tables. The formulæ involved are as follows:

Vertical difference of elevation $= 100\,R\,\dfrac{\sin 2A}{2}$

Correction to distance for inclination of line of sight $= 100\,R\,\cos^2 A$

where R is the rod reading in feet, and A the vertical angle read to a point on the rod at a height above the ground equal to the height of the instrument. These formulæ do not take into account the corrections for focal length and the distance of the objective from the center of the instrument, but these are so small as to be negligible.

In intersection work distances occur from a fraction of a mile up to 15 miles or more; distances exceeding 10 miles are avoided, however, since an error of one minute in the vertical angle will affect the elevation 16 feet at a distance of 10 miles, and 23 feet at a distance of 15 miles, while the uncertainty of refraction for such distances becomes very great. The vertical angles are usually small, except in canyon or high mountain topography.

In stadia work distances are short, rarely exceeding 2,500 feet, while, on the other hand, the vertical angles are as a rule larger than in intersection work, though seldom exceeding 30 degrees.

The slide-rule is capable of making all the operations described, and while it is not expected that it will entirely replace the tables now in use, it is believed that many topographers will prefer it as being more rapid and serviceable than any existing tables. In canyon and high mountain topography, however, where vertical angles of great amplitude are frequent, tables will be found more satisfactory.

Following is a description of the graduated scales of the rule:

Scale A contains the logarithms of common numbers from log 1 up to log 100, plotted from left to right to a scale of log 10=12.5 c.m., and is to be used as a scale of distances in *feet.*

Scale B contains the same graduations as Scale A, the difference being that the initial point is at a different place. The arrangement of the two scales with respect to each other is such that distances on Scale B in terms of *miles*, correspond with their equivalents in terms of *feet* on Scale A, thus providing a convenient means of conversion from one unit of length into the other. Scale B commences with a distance of 0.19 mile and ends with 19 miles.

Scales C and D, marked "Vertical Angles," are provided with graduations corresponding to the logarithmic tangents of angles, and are plotted from right to left, being negative quantities. Scale D commences on the right with 00° 03′ 30″ and ends with 05° 40′; Scale C duplicates these angles from 00° 35′ to 05° 40′, and carries the graduations up to 30° 00′. Asterisks have been placed opposite indices used for reading the differences of elevation on Scale E; their use will be explained further on. They are of importance in another connection, however, as they indicate the angles for which the differences of elevation are respectively 0.001, 0.01, and 0.1 times the horizontal distance, taking them in order from right to left; and if imagined projected on Scale C they represent the angles for which the differences of elevation likewise are 0.01, 0.1, and 1 times the horizontal distance. In this manner they are a valuable aid in determining the location of the decimal point when reading difference of elevation.

Scale E is identical in all respects with Scale A, and is to be used for obtaining the vertical difference of elevation between the point occupied by the instrument and the point sought, as hereinafter explained.

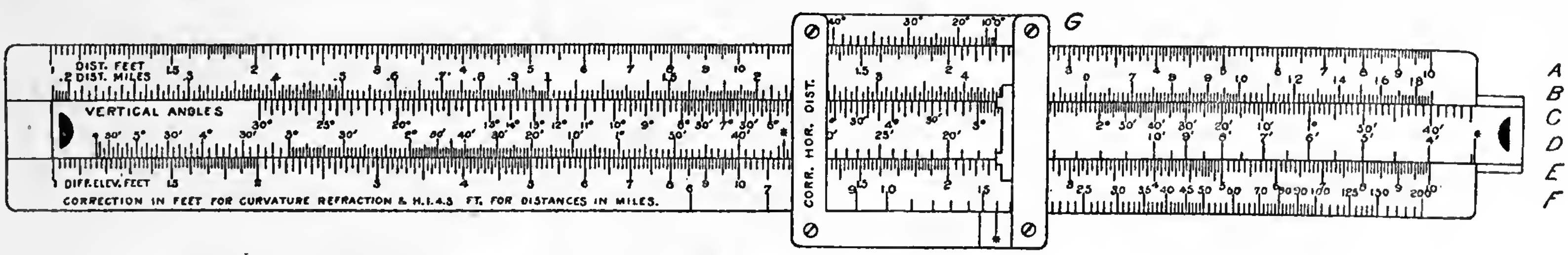
Scale F. In the construction of this scale use was made of the formula

$$D_m = \sqrt{\frac{C - R + 4.5}{0.574}}$$

in which D_m is the horizontal distance in miles, C and R the corrections in feet for curvature and refraction, respectively, while the quantity 4.5 is a constant positive correction for the height of the telescope above the ground, the assumption being that as a rule this height is in the vicinity of 4.5 feet. The second member of the equation is always positive. The graduations on Scale F are merely the logarithmic distances in miles corresponding to corrections in even feet, and are plotted on the same basis as the distances in miles on Scale B. Scale F, therefore, gives the correction for curvature, refraction, and height of instrument combined, for any distance (in miles) on Scale B, commencing with a correction of 6 feet for a distance of 1.62 miles, and ending with a correction of 200 feet for a distance of 18.45 miles. For any distance less than 1.5 miles, the correction may be taken as + 5 feet.

Scale G (on the rider) contains the logarithms of the squares of cosines of angles from 0° to 40°. Being negative, they are laid off from right to left. The first graduation to the left of the 0° mark represents an angle of 4°; the succeeding ones stand for 6°, 8°, 10°, etc., up to 20°, from which point on the graduations represent single degrees.

Scales H and I, marked "Stadia Angles," are on the reverse side of the slide and do not appear in the illustration. They are similar in character to Scales C and D described above, and contain the logarithms of ½ sin 2*A*, where *A* is the vertical angle in stadia observations. The statements made in regard to Scales C and D apply equally to Scales H and I, except that the graduations on Scale I extend from 00° 03′ 30″ to 05° 45′, and on Scale H from 00° 35′ to 40° 00′. The asterisks are placed as before, and will also be found useful in determining the position of the decimal point in obtaining the difference of elevation.



German Silver Slide Rule for Field Use in Topographic Surveying.

The 0° mark of Scale G, the pointers of the rider, and the index on the lower portion of the rider are in line with one another. This line is at right angles to the axis of the rule, and serves to project readings from any one scale to any other.

1. Given the distance to a point in *feet*, to convert the same into *miles*, or *vice versa.* To convert feet into miles, set the 0° graduation of the rider opposite the distance in feet, 2,350 feet in the illustration, and read the answer 0.445 mile on Scale B, opposite the pointers. The same result could also have been obtained by using the left portion of the rule. In either operation the position of the decimal point is determined mentally.

2. Given the distance to a point in *miles*, required the correction for curvature and refraction, and for height of instrument. Set the pointers of the rider opposite the distance in miles on Scale B, and read the desired correction on Scale F opposite the index on the lower limb of the rider. Thus in the illustration, for a distance of 4.45 miles the correction is

found to be nearly 16 feet. The graduations on Scale F hold good only for distances in miles using Scale B without shifting the decimal point.

3. Given the distance to a point in *miles*, and the vertical angle, required the difference of elevation in *feet*, neglecting corrections for curvature, refraction, and height of instrument. The pointers of the rider are brought opposite the given distance in miles on Scale B. The slide bearing the graduations marked "Vertical Angles" is then moved until the desired angle is brought opposite the pointers of the rider, as for instance in the illustration, a distance of 4.45 miles on Scale B, and an angle of 17 minutes on Scale D. The difference of elevation in feet, 116, is then obtained from Scale E by reading opposite any one of the asterisks of Scale D. It will be noticed that with the same position of the slide, the angle 2° 50′ is brought opposite the pointers. The difference of elevation for this angle and the same distance is therefore read the same way, only the result is ten times as large, or 1,160 feet, which is within 2 feet of the computed answer. The topographer will rarely be in doubt as to the position of the decimal point in obtaining his answer, as a glance at the topography will determine whether the result should be 116 or 1,160 feet. However, should a doubtful case arise, the correct reading may be determined readily by remembering that for any angle between 00° 03′ 30″ and 00° 34′ the difference of elevation will range from 0.001 to 0.01 times the distance in feet; likewise for angles between 00° 34′ and 05° 43′ it will range from 0.01 to 0.1 times the distance in feet, and for angles between 05° 43′ and 45° 00′ the range will be from 0.1 to 1 times the distance in feet. The positions of the asterisks will be found a great aid in remembering these points.

Attention is called to the fact that the correction for curvature, refraction, and height of instrument for the distance in question may be read off as explained under (2), without further manipulation of the instrument.

4. Given the stadia rod-reading in *feet* and the vertical angle to a point, required the difference of elevation in *feet*. The 0° graduation of the rider is brought opposite the stadia rod-reading in feet on Scale A. Reversing the slide and having the side marked "Stadia Angles" uppermost, use it in precisely the same manner as before, reading the difference of elevation on Scale E, opposite any one of the three asterisks of Scale I. As in the preceding case the angle may occur either on the upper or lower scale of that side of the slide. The position of the decimal point may be determined again by noting that for vertical angles between 00° 03′ 30″ and 00° 34′ the difference of elevation will range from 0.001 to 0.01 times the rod-reading; for angles between 00° 34′ and 05° 46′ it will range from 0.01 to 0.1 times the rod-reading, and for angles between 05° 46′ and 45° 00′ it will range from 0.1 to ½ times the rod-reading.

5. Given the stadia rod-reading in *miles* and the vertical angle to a point, required the difference of elevation in *feet*. The problem is the same as the preceding, except that the stadia rod-reading is in terms of miles and Scale B is to be used instead of Scale A, the remainder of the process being the same.

6. Given the stadia rod-reading and the vertical angle to a point, required the correct horizontal distance. This problem usually occurs in connection with either of the preceding cases and may be solved without further manipulation of the rider after the latter is set for their solution.

When the rod-reading is in feet, read Scale A opposite the vertical angle in question on Scale G of the rider, marked "Cor. Hor. Dist.," the result being the *correct horizontal distance*.

When the rod-reading is in miles, note the point on Scale A opposite the vertical angle on Scale G and move the 0° graduation to it, when in so doing the pointers will be brought opposite the correct horizontal distance in miles on Scale B.

The graduations on all the scales, with the exception of the one for curvature, refraction, and height of instrument, being logarithmic quantities plotted to a certain unit scale, the distances between graduations vary from point to point, requiring changes in the manner of subdividing in order to maintain clearness. The consequent result is that the precision is different for different parts of the scales, varying with the spacing of the graduations. An inspection will prove, however, that the resultant degree of precision for any particular operation of the instrument is always greatest where most required, *i. e.*, for cases of most frequent occurrence, while it is less for cases of rare occurrence. Thus, for a distance of 5.78 miles scaled from a map, and an angle of + 01° 02′, a common observation in topographic work such as is daily being done by topographers of the United States Geological Survey, the rule will give a difference of elevation of 550 feet at a point on the scale where single feet may readily be estimated, and a correction for curvature, refraction, and height of instrument of 24 feet, readily obtained without interpolation, from which the resulting difference of elevation of the point sought becomes 574 feet, *i. e.*, a result the correctness of which to the nearest foot leaves no doubt. Again, for a distance of 0.85 mile and an angle of — 6° 04′ the rule gives a difference of elevation of 477 feet, which corrected for height of instrument by the amount of 5 feet, the effect of curvature and refraction being very small for that distance, reduces the final difference of elevation to — 472 feet, a result reliable in all respects to the nearest foot.

On the other hand, cases may occur, though the exception rather than the rule, where a distance is observed of say 3.65 miles and a vertical angle of 20° 10′. The computed difference of elevation, neglecting effects of curvature and refraction, in this instance, is 7,078 feet, but the slide-rule will give the result to only the nearest 10 feet, 7,070 or 7,080 feet, according to estimation. In other words, in observations of this character the rule can not be relied upon to give the answer within less than 10 feet. An error of this magnitude, however, in an observation of the kind mentioned, can not be considered serious, as the very nature of the observation is not conducive to anything more than approximate results; and it may safely be said that any topographer who carries on work of this character is doing very well if his elevations will check to within 10 feet by means of tables or by direct computation.

Residential Septic Tanks seem to have been in use some time ago in King's Lynn, England, according to a statement made by Mr. E. J. Silcock, of Leeds, at the recent meeting of the Association of Municipal and County Engineers, at King's Lynn, as reported in "The Surveyor." He stated that they were not actually septic tanks, but rather decomposing chambers, each house having one. Each chamber was a brick structure, 4x2 feet, with an outlet dipping down into the sewer. Usually it was outside, but sometimes in the house. The object was really to form a trap between the sewer and the house. As a matter of fact it did form a septic tank, and practically nothing but liquid came away from the chamber. Mr. Silcock had seen many of them opened and said that they had a great effect in liquefying the sewage. Similar tanks at Bowling Green, O., and Zion City, Ill., are discussed in this and previous issues.

City Bench Marks in Hartford, Conn.

Mr. Frederick L. Ford, city engineer of Hartford, Conn., has compiled information relating to an extensive new system of bench marks established throughout the city and has published it in convenient form in a book 3½x6¾ inches in size. The book is neatly bound in flexible Morocco covers and has several leaves of blank ruled paper at the back for additional notes. The style of the records is illustrated by a portion of a page, which we reproduce:

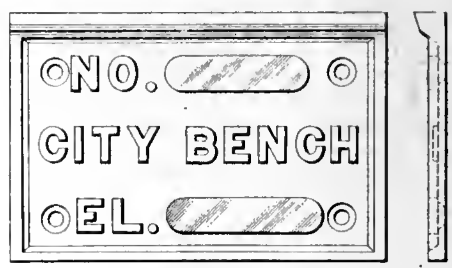
CLARK STREET.

Capen Street—El. **97,509.** S. W. cor. next to bottom stone step 62-64 Capen Street 2nd house E. of Clark St.—No. 221.

Elmer Street—El. **98,.62.** Bench plate S. E. cor. 47 Clark Street, opposite N. line of Elmer Street—No. 222.

Nelson Street—El. **97,619.** Stone water table S. W. cor. 104 Clark Street opposite N. line of Nelson Street—No. 223.

According to Mr. Ford, this book represents the labors of two seasons of very careful leveling work, great pains being taken to produce a most reliable system of benches covering the entire city. In executing the field work an 18-inch Buff & Berger Y level and a Philadelphia Rod with patent rolling angle target were used. The city was divided into sections, and two sets of levels run around the limits of each, one in each direction, the levelman and rodman changing places in each second circuit, to eliminate as far as possible personal errors. After each main circuit of elevations was determined by careful adjustments, benches were established on all intermediate streets by carefully checking the elevations with those of the main circuit as often as convenient.



HARTFORD BENCH PLATE.

As it proved to be a difficult matter to find permanent and convenient objects on which to establish benches in the outskirts of the city, most of the buildings being wooden structures, bench plates were prepared of cheap composition metal and screwed securely to the base boards of houses where benches were to be located. Many of these plates were put on corners of houses standing at street intersections so that they are available from either street. The plates are 2⅝x4 inches in size and are of the design shown herewith, the letters and the spaces for the figures raised. The top is nearly ⅜-inch wide and overhangs the lower part of the plate.

As some of these benches will be destroyed by the removal of buildings upon which they are located and as new ones will be established in their places, and on newly opened streets, engineers receiving a copy of this book were advised to compare their book with the "Official Copy" at the City Engineer's office at least once a year and make the necessary corrections on the blank pages in the back of each book. Every engineer in the vicinity of Hartford has been presented with a copy by the city engineer and they will no doubt prove of great benefit to all and at the same time reduce all leveling work in Hartford to a uniform basis and avoid the necessity of ever using assumed elevations to work from.

Economy in the Use of Coal for the Production of Power.

Abstract of a paper read by Prof. Ira N. Hollis, of Harvard University, at the meeting of the New England Water-Works Association, November 12. The complete paper will be published in the forthcoming number of the "Journal" of the New England Water-Works Association.

A pound of good coal is capable of yielding from 14,000 to 15,000 heat units during combustion, equal, if all transmitted into work, to between 10,892,000 and 11,670,000 foot pounds. When used for heating purposes, as in reducing and blast furnaces, a very large percentage of this heat is lost at once; and when used in a boiler to drive a steam engine, a still larger percentage is lost, first in the boiler and next in the cylinders of the engine. Under the most favorable conditions in practice, only 1,320,000 foot pounds are recovered from each pound of coal, more than 88 per cent. of its heat value being wasted. For every ton that is burned in a power house, nearly 7½ tons are thrown away.

The total possible saving in the steam boiler would be about 34 per cent. of the heat of the coal. This reckons the boiler at 66 per cent. efficiency. Of the 34 per cent. referred to, we cannot hope to get back more than half, as fully 17 per cent. is required for draft, even when using an economizer. This leaves as the maximum possible efficiency of a boiler 83 per cent. In the case of the steam engine, the efficiency is governed by the thermo-dynamic law that the work is proportional to the range of heat. If, therefore, the upper temperature of steam be taken at 900 absolute, and the lower at 600, the ideal efficiency would be 33 1/3 per cent., which is rarely even approached. The highest mechanical efficiency that the author has ever been able to find between the steam cylinder and the power to which it is applied is in the Cambridge pumping engine, designed by Dr. E. D. Leavitt, in which the work done in the pump was slightly over 96 per cent. of the power developed in the cylinders, an efficiency of 96 per cent. Multiplying these three efficiencies together, the maximum attainable efficiency under ideal conditions is 26½ per cent. That is, nearly three-fourths of the heat of the coal must be thrown away, even under ideal conditions, for the working of a steam engine. With the most economical of modern engines, a horsepower has been obtained from 11 pounds of steam, or even slightly less. This gives about 12 per cent. efficiency. What is sought, therefore, is the remaining 14½ per cent., and it must be remembered that under no conditions is it practicable, with the present materials for engines and boilers, to gain more. Engineers may well strive to strike out on a new path. We are struggling with the steam turbine and with other inventions to save a few pounds of coal, while wasting tons. Compare the efficiency of a steam plant with that of a battery using zinc, in which the greater part of the heat is turned into current and thus utilized at once as power.

One of the axioms of modern engineering is that the condition most favorable to economy is the regular and constant demand for power. Where an engine is to be run at its designed maximum power for twenty-four hours a day, the entire plant can be made to realize a much higher efficiency than would be the case with a fluctuating demand for work. Where this fluctuating demand prevails, the plant must be designed for the greatest output, and yet used for long periods at much lower rates. This is like employing a man to do the work of a small child, because at times there are weights to be lifted that require a man's strength. Furthermore, paradoxical as it may seem, there are many cases in which economy would be obtained only at too great a cost, a good example of this being found in steam engines for small powers. It would not pay to build a 1-horsepower engine with a steam jacket and condenser and air pump. The first cost would be too great, and the skill to render the design effective would be far beyond the ordinary rate of wages. The line of improvement in the use of small powers is clearly pointed out: a central station which can be kept working at a constant rate, and some efficient method of distribution to motors of such simplicity that cheap labor can be employed to run them. This may be called the problem of the twentieth century, inasmuch as there are many demands for small quantities of power to a comparatively few for power in large quantities.

Economy in the use of coal is thus divided under three heads:

1. Efficiency in the recovery of heat after combustion.
2. Efficiency of the medium by which the heat is transmitted into work.
3. Efficiency in the work developed in the prime mover of the machine which applies it directly to the useful result.

When we consider that under these three elements of efficiency, exhaustive experiments, extending over a hundred years, have enabled us to transform under ordinary conditions less than 10 per cent. of the heat of the coal into a useful work, we realize the great field still open to engineers.

In a steam plant, the boiler forms, naturally, the first element for study. Its efficiency is so much a question of the men who run it that we have arrived at no final type which may be expected to give the highest results. Any well-designed boiler will recover from the coal about 75 per cent. of its heat, under the most favorable conditions. This fails to 40 and 50 per cent. with bad management, and it may rise to 85 per cent. with the addition of some device, usually separate from the boiler, for utilizing the waste heat. The following table taken from a boiler trial reported in 1894 and republished in Mr. Bryan Donkin's book, "Heat Efficiency of Steam Boilers," may serve a useful purpose in indicating the heat utilized and lost. The data was obtained from two Lancashire boilers and a Green economizer, and it is sufficiently near the average fair practice to serve as a type. A slight modification has made possible the placing of all the data in one table:

	British thermal units.	Per cent.
Heat transmitted to water in boiler	8,271	55.2
Heat transmitted to water in economizer	1,637	10.9
Heat lost in products of combustion	1,127	7.5
Heat lost in excess air	985	6.6
Heat lost in moisture from coal	23	.2
Heat lost in air leaking through brickwork of economizer	259	1.7
Heat lost in unburnt coal	342	2.3
Heat not accounted for, including radiation	2,342	15.6
Total	14,985	100.0

The third item in the table represents an unavoidable loss in one form or another. Combustion is produced by the contact of oxygen with combustible material at a temperature which causes a chemical combination. The continuous combustion of coal is possible only with a regular supply of air and an equally regular withdrawal of waste products. Work is required to provide this constant current or draft, either in the form of heat supplied directly by the fuel or indirectly by means of power obtained from the steam. Under either condition a considerable amount of heat is lost which, apparently, can never be saved by any inventions affecting the steam boiler. Usually both losses occur when blowers are used, as it is never possible to discharge the products of combustion at the temperature of the air. In the case of a boiler without a feed water heater, they can never be below the temperature of the steam. The table shows that 1,127 heat units are thus lost even with an economizer. Without it, the quantity would have been above 2,000. Complete combustion is not possible without an excess of air, and thus the gain brings with it a considerable loss, as the heated air is discharged at the same temperature as the products of combustion. With blowers, this excess is likely to be greater than with a natural draft. The regular supply of air is an absolute essential of economy when the supply of coal is also constant. Air entering irregularly signifies loss of efficiency. It is in this respect that the various forms of mechanical stokers have the advantage of firing by hand. The total heat lost up the chimney from a furnace would appear by the table to be about 2,100 heat units, or 18 4/10 per cent. Two methods have been worked out for recapturing some of this heat, and of these the feed water heater has played by far the more important part. It has taken on various forms, but the Green economizer is that which has seemed most effective. Any arrangement by which the feed pipes are placed in the paths of the products of combustion, will add to the economy of the boiler; although it may also add to the repair bill.

Attempts have been made to heat the air supplied to the furnace by means of the waste products, and the Howden system has proven successful in this respect. A fan is necessary for its operation, and work is thus expended by the blowing engine in the production of draft. One point worthy attention in connection with all hot air blasts is that the amount of oxygen in one cubic foot of air is inversely proportional to the absolute temperature. Consequently at a high temperature a greater volume of air must be supplied to consume a given weight of coal. It is therefore more difficult to drive hot air in burning coal than cold air. There is much to be said on the subject of the location of a blower, whether it be in the fire room and used to force draft by pressure in the ash-pan, or in the uptake, where it creates a vacuum to induce draft. In the latter case, the temperature of the products of combustion must be kept comparatively low in order to prevent an injurious change of shape of the fan.

Intimately connected with the economical combustion of coal is the prevention of smoke, the latter meaning only so much unburnt carbon passing off into the air, to drop on everything in the neighborhood. In the main, it may be said that devices for smoke combustion lead to economy in the use of coal, but they often increase the total expenditure of money per year. The cost of coal is only part of the total expense, and repairs to smoke consumers and patent furnaces are often large. Unless a plant is of considerable size and is run continuously, they are of doubtful value. The various forms of mechanical stokers have the advantage over firing by hand both in economy and in smoke prevention. Much might be accomplished by better laws in regard to licensing firemen. It has always seemed to me that a first rate fireman with the ordinary grate is equal to any form of patent furnace, especially where there is a fluctuating demand for heat. There is a vastly greater difference between a good fireman and a bad fireman than there is between a mechanical stoker and a good fireman. A good school for teaching firemen would be more fundamental than mechanical devices of any kind. Yet it is only fair to add that the cheaper grades of coal can be burned on patent stokers, where the feed is regular. This is a decided advantage, and, furthermore, the extensive use of soft coal must of necessity develop a good smoke consumer. Some are now satisfactory. A few years ago the author ran a series of tests with a patent furnace in order to compare its results with those obtained from an ordinary grate in a boiler alongside of it. The patent furnace was something like the Murphy automatic furnace, only it had a broader plate in the bottom. The coal was fed in on the sides, and a warm blast was thrown down over it throughout the length of the furnace. This blast was caused by an ordinary Sturtevant blower. A dozen or more tests were run with the boiler, which was of the ordinary underfired type, and it was found that on the whole it was not so economical in the production of steam as the ordinary grate. In the reduction of smoke it was very effective, by diluting the products of combustion with air to such an extent that the smoke seemed to be only a small percentage of the discharge from the chimney. The neighboring boiler with the plain grate discharged into the same chimney and was watched very carefully, when run by a first-rate fireman. The amount of smoke was undoubtedly in excess of that discharged from the patent device, even when great care was exercised in the firing, but not to the extent usually seen in the ordinary factory chimney. The amount of steam produced per pound of coal was fully up to the very best practice.

It seems strange that up to the present time no satisfactory method of keeping the heating surfaces of boilers clean has yet been devised. The loss of heat chargeable to this account is very great, and the loss of money is still greater. It is found necessary to provide heating surface thirty-five or forty times the grate surface to attain any kind of efficiency, yet an effective method of cleaning the surfaces would permit reducing them very materially, and thus lessening the amount of material put into a boiler of given horse power. The tubes of ordinary boilers are always more or less dirty and the water side of the tubes is almost continuously coated with some non-conducting substance. The author had seen a ship gain a knot's speed simply by blowing through the tubes with steam, and that without the expenditure of a pound more coal.

The small losses, shown in the table, from moisture, and leaks through the brick-work, and unburnt coal are sometimes serious, but they are simply matters of care. If a fireman is allowed to turn the sprinkler on coal, he is likely to cost his employer dear in the course of a year. The same may be said of too frequent cleaning of fires. The leaks through the brickwork are greater than usually reckoned, and they are avoidable only by constantly plastering up the outside. It has sometimes seemed to me that a sensible gain in economy would result from plastering the outside of a brick setting so that every crack would appear at once upon its development. In the table the loss "not accounted for," as in radiation, requires some study, as it appears to be quite a large percentage. There is always this unaccountable deficiency, greater or less according to the care exercised in the test which has been made.

When we turn to the steam engine we find greater losses than in the boilers. The first and most serious loss in a steam cylinder is from initial condensation. Although the steam jacket has done much to mitigate this loss, it should still be used with judgment. The author lately ran a test which showed that there is such a thing as over-jacketing an engine and losing heat by too much jacket steam. The case is of a triple-expansion engine which developed about 533 horse-power. The steam was supplied to the high pressure cylinder at 181 pounds, and it passed successively through the high pressure cylinder, the working side of the first reheater, the intermediate cylinder, the working side of the second reheater, and the low pressure cylinder, into the condenser. Every cylinder and reheater was thoroughly jacketed with high pressure steam from the boiler, and the exhaust from the low pressure cylinder passed into the condenser with steam superheated 100 degrees. The record of economy was about as follows:

Without any steam on the jacket or reheaters, the steam supplied to the engine was 12.19 pounds per indicated horse power.

With full pressure on all jackets, the steam used was 12.09 pounds per indicated horse power. No substantial gain.

With steam on only the high pressure and intermediate jacket and on the first reheater, the amount of steam supplied to the engine was 11.47 pounds per indicated horse power.

Calculations on initial condensation seem very inaccurate excepting where a careful test has been made of the tightness of all valves. Gridiron valves seem, on the whole, most satisfactory. They are far preferable to piston valves, as their tendency is to become tighter with wear, while the tendency of piston valves is to become looser.

Extent of Damage to Williamsburg Bridge Cables.

Mr. Gustav Lindenthal, M. Am. Soc. C. E., Commissioner of Bridges, has appointed a special commission to examine into the extent of damage and the methods by which repairs can best be made to the main cables of the Williamsburg Bridge, which were affected by the fire of November 10. The members of this commission are Mr. George S. Morison, consulting engineer, Mr. C. C. Schneider, vice-president of the American Bridge Company, and Mr. Leffert L. Buck, consulting engineer of the Williamsburg Bridge, all members of the American Society of Civil Engineers. The fire was fully described in last week's issue of The Engineering Record, and some of the more apparent damages to the bridge noted. In his weekly report to Commissioner Lindenthal, Mr. O. F. Nichols, M. Am. Soc. C. E., engineer in charge of the bridge, presents a statement of the results of tests of some wires cut from the endangered cables, which we have abstracted as follows:

Five pieces of wire were taken from cables A and B, over the saddles on the south side of the Manhattan tower at the point most exposed to the fire. These pieces were tested in the engineer's office, the results showing minimum and maximum strengths of 80,400 and 125,200 pounds per square inch respectively, the average being 98,040. One piece tested for elongation gave 2 1/10 per cent. in 50 inches.

These tests show that the breaking strength of these wires has been reduced about 50 per cent., and it is reported that lengths of about 10 feet will have to be replaced in some 250 wires in all, in the two cables on the south side of the tower, which were most exposed to the fire. As mentioned last week, all the wires in the cables are spliced on account of their great length; hence the ultimate weakening of the cables resulting from the repairs necessitated by the fire will be infinitesimal. About 100 men are employed in removing wreckage and it is expected that it will all be removed and the new platforms in readiness for resumption of work on the cables by December 1.

Anchor Ice accumulated around the inlet of the gate house at the New London, Conn., storage reservoir last January, in such quantities as to stop the passage of water, the screens being broken and the gate chamber blocked. Engineer W. H. Richards states that only by strenuous exertions was a supply maintained through the 16-inch pipe outside the chamber.

The Control of Non-Navigable Streams by the National Government.

A Discussion by Rudolph Hering at the Washington Convention of the American Society of Civil Engineers; reprinted from "Proceedings," August, p. 572.

This topic does not allude to the questions of diverting water from a water-shed, of silting up or of polluting streams; yet these are quite as important, and are pressing for solution. As they are also intimately connected with the damming and regulation of streams, it seems but natural that they should be considered in connection therewith, and the speaker accordingly takes the liberty to do so.

As civilization spreads over a country, changes take place in the physical character of the land surface by the decrease of forest areas and the corresponding increase of cultivated areas, allowing the soil to be more readily washed into watercourses, and, in populated centers, by the addition of surfaces more or less impervious to water. Changes take place also in the character of the water as it flows in the streams, and in the size and shape of the beds themselves.

The water when flowing is likely to change, both in quality and in the distribution of quantity. The more soils are exposed to washing by rain-water, the more soil particles will be brought into it, and carried in suspension by it, causing it to become more or less turbid. The sites of habitations and manufactories in city or country, and the application of manure to cultivate fields, cause every rain storm to bring into the streams organic matter which causes them to become more or less polluted, if not directly offensive, and injures the water, either for domestic consumption, for fish life or for manufacturing purposes.

The quantity of water flowing in a stream is changed by the growth of population in a way that flood flows tend to increase, and dry-weather flows tend to diminish. Flood heights increase by the reduction of forest areas and of water-retentive vegetation, which causes more rapid run-offs and greater velocity in the streams. Dry-weather flows decrease in consequence thereof, because there is less time for percolation into the ground, and therefore less storage of ground-water to feed the streams in time of drought. The use of water for irrigation purposes still further reduces the stream flow, both by direct diversion of the water and by evaporation on the surface of the land.

The beds of streams, so far as they are alluvial, change in accordance with the added amount of suspended matter carried by them, and also with greater floods and their consequent scour and re-deposit of material in lower stretches of the stream.

New causes therefore appear which tend to increase deposits when velocities become less, and to increase scour when these become greater. As both effects will not exactly compensate each other at the same points, the bed of an alluvial river is constantly undergoing changes, which have increased since the advent of civilized man.

Stream beds are still further and arbitrarily changed by man when he endeavors to develop the usefulness of the watercourse, and builds dams across it, either for slack-water navigation or for power and irrigation purposes; and again when he builds or fills material into the stream, or in some way encroaches upon its natural flood section, contracting it without attention to other consequences.

All these alterations in the original conditions of a stream become the more annoying, sometimes even disastrous, by causing other results than those desired, the more a community becomes settled and developed. The objectionable results are due, perhaps, to the higher floods which now destroy more developed property, perhaps to the lower dry-weather flows which deprive water users of some of their original ownership, and perhaps also to greater pollution of the water, tending toward unfitness for ordinary domestic, manufacturing or farming uses.

The multiplicity, as well as the seriousness, of effects upon large public and private interests caused by the streams both in their natural and artificial conditions, due to a large growth of population, is clear; some of the effects relate to sanitation, some to property rights for domestic, farming and power purposes, and some to commerce.

The National Government now controls the streams of our country, as far as they are navigable. It can regulate, dam and improve them for commerce alone. It has no control of the streams for the purposes of sanitation, irrigation or farming, for domestic and power supplies, or for any purpose of damming or contracting those that are non-navigable; nor, perhaps most important of all, has it control over the regulation of streams to prevent disaster from floods. And yet, in a developed community, these effects, while of small consequence in its early life, become of great consequence in its later life.

Reports are becoming more numerous of the ill effects of floods caused by the improper construction of dams or the change in the physical conditions upon the water-shed surface, of disasters caused by a narrowing of the flood channel or by accumulated deposit therein, or of polluted streams which have become injurious to the health and life of man and cattle.

The subject has become so aggravated in a few States that official bodies have been appointed and instructed to grapple with it in one or another of its phases.

State commissions will answer perfectly when the causes and effects are within the State. There is a clear difficulty, however, in having a single State endeavor to regulate the natural and artificial conditions of one of its rivers, when this originates in another State and is received in an injured condition, perhaps polluted, perhaps with its dry-weather flow seriously diminished or its floods increased. The other State may exhibit very little interest in the matter, and its legislature may decline to effect either the desired remedy or any remedy that had so far been suggested.

It is palpably unjust to a State, as it is to an individual, to permit a change to be made by one party to the injury of another, in the enjoyment of the natural privileges granted us by the land where we live, without a careful, impartial examination of the facts and an impartial solution of the difficulty.

While the United States Supreme Court is a proper final authority in many such cases, no court can ever be constructive, in a physical sense, and therefore will not answer the purpose now before us.

We need for this purpose in our country some Board or Commission of Waterways, which should have supreme authority over matters relating to the physical conditions of a river from its source to its mouth, irrespective of State boundaries, consistent with and resembling the authority already placed in national hands for regulating navigable streams for commerce; an authority which can make a thorough investigation into the physical conditions, not only collecting and applying information now in the hands of various public departments, but supplementing the same with local information of special value; to study the entire subject relating to floods and droughts, and pollution and diversion of the water; to establish official profiles and cross-sections for both dry-weather and flood conditions, to which all private interests should conform; and to establish limits for the pollution and diversion of water.

The engineering work of such a body would be considerable, yet the lines along which it should be undertaken would be clear, and the results like those of similar engineering enterprises. The organization of such a body, from a legal and political standpoint, is equally important, and is a factor, perhaps, more difficult of solution. It will not be touched upon here.

The programme of the topic under discussion asks whether non-navigable streams should be under the control of the National Government. In this opening the speaker desires to take a broader view, and would add: "or of Joint State Commissions, each one controlling the water-shed of at least one large stream?" The speaker does not in the least feel opposed to a control by the National Government; in many ways it would appear to be most satisfactory. There are also good and practical reasons for having, instead, a separate commission for each large water-shed, or group of smaller ones. A local commission would be better informed concerning local conditions, which are or may be highly important, than if most all of its members resided elsewhere. In either case, it would be desirable to place upon such a board a member of the United States Engineer Corps, and a member from each of the Departments of Agriculture, the Coast and Geodetic Survey, and, perhaps, also from a Bureau of Commerce.

It seems sufficient at this time to call attention to the importance of a proper regulation of our non-tidal streams, of the physical practicability of doing this, and of the necessity of having such regulation undertaken by a body whose authority must extend over the territory of at least one entire water-shed; our whole country being divided into as many water districts for this purpose as may seem best.

As precedents for such an undertaking we may consider the following:

The Mississippi River Commission is a body which has authority over the regulation of our largest river, extending through several States. Its authority, however, is less broad than it appears, from what was said above, might properly be given it.

Recently, a Flood Commission was established in the State of New York to report on flood preventions. The work of such a commission must be hampered to some extent by its limitations, and, unless it takes a broad view, and has authority and means to make comprehensive investigations and carry out recommendations, its usefulness to the State cannot be of the extent which is here contemplated.

In England, due partly to the more uniform and smaller rainfall and stream flows than ours, and partly to the previous attention that has been given to the question of damage by floods, these matters do not now receive very serious attention. The large industrial development, on the other hand, has compelled the enactment of laws for the government of streams, prohibiting the introduction into them of solid matter not carried in suspension, such as earth, ashes, building rubbish, sludge and solid sewage, also all liquid sewage and polluting liquid from manufactories, provided that remedies are reasonably practicable and available under the circumstances of the case. The carrying out of these laws is placed in the hands of River Conservancy Boards and Joint River Committees, each of which has control of one or more water-sheds, and in some matters acts in conjunction with the Local Government Board, which has general charge of such matters.

In France, for many years there has been a special bureau in the Department of Public Works called the Hydrometric and Flood Announcement Service (*Services Hydrométriques d' Annonce des Crues*). This bureau has studied the general conditions of each river basin, the means to prevent inundations and to regulate and equalize the flow, and sends advices when floods are expected. The water-sheds for which special Boards were instituted under the direction of the Chief Engineer of Bridges and Roads (*Ingénieur en Chef des Ponts et Chaussées*) are: Seine, Canal de la Sambre, Escault ét Yser, Rhône, Muerthe et Mosel, Aune, Téch et L'Agly, Garonne, Dordogne et Adour, and Loire. Among these, the Seine, Rhône, Garonne and Loire are the most important. Quite recently, a law has been passed authorizing the Department of Hygiene to inquire into the pollution of rivers, and provide remedies. It also authorizes the protection of all sources of water supply, and imposes fines for polluting the same.

In Germany, the regulation and correction of streams is in the hands of Provincial Governments in Prussia, and the State Government in Bavaria. The smaller states agree to the treatment of interstate rivers by the adjoining countries before work is done.

Each of the Prussian provinces has a Stream Building Commission (*Strombaudirection*), with a Chief Engineer (*Oberpraesident*) at its head, which controls design, construction and operation for each river flowing through several districts, and even into adjoining provinces, so as to obtain uniform results for the entire river. Such Commissions are located in Dantzic for the Vistula, in Breslau for the Oder, in Magdeburg for the Elbe, in Coblenz for the Rhine, in Munster for the Dortmund-Ems Canal, and in Potsdam for the Havel, Spree, Oder-Spree Canal, etc. The mouths of the rivers are controlled by another branch of the government, for political reasons. The rivers pollution questions are under the control of a Minister of the Government, advised by the Imperial Board of Health.

For information concerning European countries the speaker is indebted to Ernest Pontzen, Cor. M. Am. Soc. C. E.; Theodor G. Hoech, M. Am. Soc. C. E., and R. A. Tatton, M. Inst. C. E.

In some respects, it will seem better to have separate authorities to regulate the questions of quantity and quality of the water, speaking broadly. On the other hand, there are many intimate connections which point to a preference for a single commission controlling both hydraulic and sanitary questions. In Europe these questions are now in the hands of different bodies, both, however, branches of the general government.

With many of our larger rivers, flowing from one State into another, it seems proper and timely to obtain, as early as possible, a harmonious and intelligent treatment of their profiles and sections, and also of the questions of diverting and polluting their water. Official profiles should be established for the entire river, which will regulate the velocities, both at high and low stages, so that they will not cause disastrous results. Normal cross-sections should be established for the ordinary and also for the freshet flows. No obstructions whatever should be allowed within them, although the territory rarely flooded, but lying within the flood sections, might be used for agricultural purposes, as is sometimes done in Europe, with the risk of occasional destruction of crops. As it may often be necessary to protect wide expanses of adjoining property, some flood sections would have to be diked; and, to prevent interruption of the crossing traffic, the entire flood section between dikes would have to be bridged at the proper height. In many cases it would be advisable to alter the alignment of the stream more or less, to straighten and shorten it, where now there is meandering. In adapting such changes to the special soil of the bed, it is often also necessary to construct special submerged dams, so as to maintain the original and natural regimen of the streams.

An important duty would also be the establishment of storage reservoirs where found expedient, for the purpose of reducing flood discharges and increasing low-water flows, both of which may benefit the riparian owners by preventing damage in one case and ensuring greater usefulness in the other.

The diversion of a part of a stream should be regulated in such a manner that the water, in accordance with its value, could be properly and justly distributed among the respective States within its water-shed, and deprive no State of water to which it has a natural right.

Where works of industry, and particularly of ore-washing, load a stream with matter that is first carried in suspension and then deposited lower down, thus raising its bed, proper means should be proposed to prevent injury to any riparian rights without unjustly interfering with important industries.

And lastly, such an authority as above suggested could establish regulations regarding the pollution of water from source to mouth, and thus protect it for the benefit of all users alike, whether in one State or another. It would devolve upon the same authority to determine the proper uses to which the waters of certain rivers could be put. In some cases it would be practicable, and even necessary, to reserve them for the domestic supplies of future populations; in others, manufacturing interests may abound to such an extent that certain streams should not be devoted to domestic use, but reserved for other uses, and protected only to the extent of not becoming objectionable to sight or smell.

Regarding the important matter of payment for the work herein considered, it may only be said that whether the National Government or Joint State Commissions undertake the same, it would manifestly be unfair to pay for it entirely from funds of the General Government, in districts where it is not itself a large landowner, because the benefit would accrue generally to the water-shed affected, and particularly to the riparian property owners. Payment, either by the State at large within which the improvement is made, or by the assessment of benefits against the counties or the private individuals affected, would seem more equitable.

All the subjects here suggested, and but briefly touched upon, are more or less effectively solved in the countries of Western Europe. They are now becoming more and more urgent of solution in our own country. It is to be hoped that we will not be long in arrears in crystallizing the method of handling this important subject in non-tidal streams as well as it has been handled in tidal rivers, in part by the United States Corps of Engineers, and that the results may be at least as beneficent as those accomplished across the Atlantic.

Shortening the Working Day to conform to the eight-hour law will increase the cost of the work remaining to be done under the contract for the New Croton Dam, New York, it is estimated, $305,000, the contract having been based upon a ten-hour day.

A Letter to the Editor.

Residential Septic Tanks.

Sir: It was with much regret that the writer was unable to attend the Rochester meeting of the American Society of Municipal Improvements so that he might have a part in the interesting and profitable discussion of the paper which was to have been read there on the above subject, but it is gratifying to know that some points have been brought forth in the excellent letter of Mr. Benjamin H. Flynn, Columbus, Ohio, published in your issue of October 25th, which brings out the economics involved in the universal installation of such residential septic tanks as were described in the writer's paper.

We are free to admit that perhaps the weakest point in the whole proposition is the difference between the combined cost of the residential tanks and the cost of a municipal septic tank plant of the same capacity. We hinted at the possibility of obtaining sufficient purification of the effluent of the residential septic tanks during the flow through the open channels in the low, flat district between the outlet of our sewers and Lake Michigan, a distance of about ¾ mile. The land where the city proper is now being built lies at an elevation of from 30 to 100 feet above the low territory, and if necessity for a municipal plant should arise, it might be met by converting these open drains into irregular ditches and using the effluent for irrigation purposes upon the land which these open drains intersect, or by creating bacteria beds, which have been so successfully installed and operated in England and elsewhere. The unpurified effluents could, also, be combined and taken to the southward a distance of one mile and emptied into a low, wet territory, from which a dead river finds an outlet into the lake some two miles beyond. Municipal purification works could be obviated by one of these four possibilities. The initial installation of residential septic tanks at Zion City seems to have been a growth rather than the result of enactment, as the original article stated. Farm drains were available, and some kind of sewerage privilege was everywhere demanded, but only in places where these drains were available could any sewerage privileges be had. The excellent results we had obtained with our own residential septic tanks, during a period of twelve years, led us at once to institute the building of tanks which are but little more than ordinary catch-basins in construction, wherein the solid matters of the house wastes could be converted at least into fluids. This would produce an effluent which common farm tile with slight grades could care for without much possibility of choking up. Residents everywhere were willing to do anything that would enable them to obtain these privileges, which privileges the very laws of good health would prevent any capable person from granting except where good health and cleanliness would not be impaired. In further support of the construction of these septic tanks as far as cost is concerned, it may be said that the work done in Zion City seems to be but a step in advance of what Mr. Flynn suggests in his example of the scheme adopted at Bowling Green. If the catch-basins at Bowling Green are not constructed upon a plan which will conduce to septic action within, then the cost to that city or any city adopting such a scheme, would be an almost total loss in view of the fact that a purification plant must be built eventually. The cost of the residential tank is but little greater than that of the ordinary catch-basin and it is but a slight modification of the catch-basin, so constructed as to induce the desired septic action and to pass an effluent free from adhesive solid. Hence we believe we have improved upon the suggestion as exampled by the Bowling Green scheme in that we are making the catch-basin something more than a catch-basin and making it so permanently. We also propose, instead of drawing upon the future water system for a supply for flush tanks at the dead ends of such laterals as would require them, to collect the daily discharges of the future residences at the upper ends of such laterals into a single flush tank, which would empty as often as the combined wastes would fill it, thus effecting a saving in water consumption.

To the average citizen special taxation is odious and he would willingly expend a few more dollars upon his premises for something that would become all his own than to pay his money into the public treasury and become a co-partner in a large unprofitable plant, as it would doubtless seem to him, quite beyond his personal control. Why should the householder raise any objection to building a residential septic tank, on this simple pattern, when in all probability he would have a catch-basin to construct anyhow? The objection raised because of the possibility of misconstruction can be raised against any part of the sewerage system, and we do not see why so simple a tank cannot be well made. Common brick, Portland cement mortar, two vitrified pipe elbows, a common white-wash brush to do the interior coating with, and almost any kind of a top make the sum total of the materials needed. It is not more necessary to make the tanks water-tight than to make the sewers water-tight. Careful, conscientious workmen will do this in either case and careless workmen probably would not. If the masonry of the tank should not be as thoroughly constructed as it ought to be, much possible leakage is easily prevented with a four coat wash of Portland cement on the inside.

As to the occasional cleansing, we hope to be able in the very near future to so perfectly gauge the size of these tanks to the requirements that cleansing would be infrequent; and construction could be introduced which would permit the entire drainage from the house roof to be occasionally turned into the tank so as to stir up a large amount of sludge that might have collected in the bottom and cause it to pass off. We do not see why these tanks cannot be made equally effective in septic action to a tank, with two filter bed purifiers, recently referred to by a well known engineer who found that 95 per cent. of the solids which had passed into the tank in one year had been converted into an effluent which, after the second filtration, was pure enough to be drunk by the workmen about the premises. If, for any reason, the sewer connection to any residence should get out of order, the incentive to the ordinary individual would be sufficient to induce him to put such part of his sewer service into as good condition as he is able without the aid of the plumber, and, as in the case of the cleansing of the septic tanks, it need not take more than 15 or 20 minutes, judging by our personal experience, once every three or four years. Very respectfully,

Burton J. Ashley,
City Engineer.

Zion City, Ill., November 10.

Sanitary Inspection at Charleston, S. C., is done by four men appointed annually by the Board of Health. They are required to examine fifty premises a day, and as proof of inspection, obtain the signatures of the occupants. They are required to examine into the sanitary condition of the yards, and report as to the condition of the privy vaults and drains, and see that all garbage has been removed and that the premises are in good condition. They have also to keep a watch on the 17 hydrants, placed about the city in convenient localities, where the poor may obtain water.

Sea Mills Sewage Disposal Works, Near Bristol, England.

The Sea Mills sewage disposal works were designed to replace a sewage farm that had become insufficient and was badly situated for the accommodation of recent building extensions, and also to treat the sewage from Stoke Bishop that formerly ran direct into the River Avon. The works are placed in a narrow valley about ¼ mile from the River Avon. They are designed to accommodate a population of 10,000, the present population being nearly 7,000, and are so arranged that extensions upon the same lines may be made up to a population of 30,000.

The effluent discharges by a brick culvert, 3 feet 6 inches by 2 feet 4 inches internal dimensions, into the tidal portion of the River Avon at a point below low water, but the Local Government Board, in giving their saction, required the discharge to be only between high tide and an hour and a half before low tide. They stipulated that the sewage should be capable of being treated with chemicals, and after such treatment, together with subsidence in tanks, should be stored, except during the hours above stated. The method of automatically regulating the flow from the storage tank is especially interesting, and is brought out in a paper by Mr. A. P. I. Cotterell, Assoc. M. Inst. C. E., in a recent issue of "The Surveyor," from which the following description of the works has been condensed:

The 24-inch sewer from Westbury and the 18-inch sewer from Stoke Bishop, which is carried across the valley on an aqueduct, join at a gauging chamber, where brass plates indicate at any moment the rate of flow through either sewer in gallons per minute and gallons per hour. Immediately after junction the sewage flows through a revolving screen of large mesh automatically driven by a water-wheel, the sewage itself being used as a motive power.

Provision is made for the addition of a precipitant to the sewage before passing over the water-wheel, so that thorough mixing may take place. The liquid thence flows into two grit chambers, placed underneath the engine-house floor. The grit chambers are formed with tapered sides and a discharge valve at the bottom, so that all sludge or grit can be forced into a sludge tank placed underneath the press-house without emptying the chamber. To assist in the disposition of the sludge, and to keep the sides of the grit chambers clean, a large number of nozzles are arranged in rings, through which air or water can be discharged under pressure, and thus sweep the whole of the chambers clear of all deposit.

From the grit chambers the sewage passes through a distributing channel, and thence into three covered tanks, each 171x12 feet in size, capable of being used for subsidence or for anærobic action. The clarified effluent from the septic tanks passes off in the usual way through a slotted pipe, and thence down a slide into the large covered storage tank, which is capable of holding 600,000 imperial gallons. The discharge from this tank into the brick culvert is controlled by a hydraulic penstock, 36 inches in diameter, worked automatically by a tidal clock, and so arranged that a final effluent is discharged into the Avon during the hours when such may be allowed.

In the septic tanks are large V-shaped scrapers, which can be made to work slowly on an endless rope throughout the tank and draw off any sludge or debris into a V-shaped discharge notch at one end, whence it passes into a sludge chamber without emptying the tanks. Both sludge chambers are provided with floating arms, for drawing off supernatant water and also with suction pipes connected with the sludge ram, from which the sludge is forced into a 27-inch square Johnson's sludge-press containing twenty-four chambers.

The clock controlling the automatic discharge is the joint invention of Mr. A. M. Hunt and Messrs. Kemp Brothers on suggestions made by Mr. Cotterell. It is designed upon the alarm principle, with five faces, and is so arranged that it actuates the penstock both for opening and closing twice every day. The hydraulic accumulator contains sufficient water for four actions of the penstock. It is charged each day by the attendant, who at the same time sets the clock for the two tide discharges of the day, and has no further trouble about this part of the works. The periods of discharge are adjusted to correspond as closely as possible with the periods on the tide table. By means of this clock, which cost less than $750, there is no need of a night staff, the discharge taking place with even greater regularity than the most efficient manual labor would probably afford.

Computation of the Stability of High Chimneys.

Recently the Prussian Minister of Public Works has acted on a recommendation of the Prussian Building Academy and has issued a set of regulations governing the design of high chimneys. As reported by the "Deutsche Bauzeitung," these regulations are essentially as follows:

The regulations generally prescribe an assumed wind pressure of about 26 pounds per square foot on a plane perpendicular to the direction of the wind. Any possible suction on the leeward side is assumed to be included in this pressure. The wind area of the chimney is taken to be its vertical section, and, if the chimney is polygonal, its greatest diametral section is to be used. The point of application of the resultant of the wind pressure is to be assumed to coincide with the center of gravity of the section, which is equivalent to assuming a uniform distribution of the wind pressure over the full height of the chimney. For circular chimneys the total wind pressure area is to be reduced to two-thirds, and, for octagonal chimneys to .71 of the value for rectangular chimneys.

To determine the greatest pressure at the edges the wind should be assumed to act in a diagonal direction. The specifications allow the theoretical opening of the joints to the center of gravity of the section, thus neglecting the tensile stresses. The compressive stresses should be determined for wind pressures of 26 and 31 pounds per square foot. The weight of the material per unit of volume should be that of the actual material used. The allowable unit stresses were fixed as follows: For common brick-work laid in lime mortar (1:3), 100 pounds per square inch; for hard burnt bricks, having a compressive strength of at least 3,160 pounds per square inch, laid in cement-lime mortar (1 cement, 2 lime, 6 to 8 sand), 171 to 214 pounds per square inch. For the stronger stones and mortar richer in cement, higher stresses are allowable, but a factor of safety of 10 must always be provided for, and in no case should the greatest pressure exceed 316 pounds per square inch for a wind pressure of 26 pounds per square foot. If higher unit stresses be deemed allowable, they should be justified by tests on blocks of masonry. The allowable compressive stress on the foundation is, for unrammed concrete, 85 to 114, and, for rammed concrete, 142 to 214 pounds per square foot. The allowable bearing pressure on the soil for the assumption of 26 to 31 pounds per square foot wind pressure is, as a rule, 61 pounds and, exceptionally, 82 pounds per square inch, equal respectively to very nearly 4½ and 6 tons per square foot.

Ventilation in the Pratt Institute High School, Brooklyn, N. Y.

An interesting example of a method of providing improved facilities for ventilation in an existing building without necessitating much reconstructon is afforded in the high-school building of Pratt Institute, on Ryerson Street, Brooklyn, N. Y. The original arrangements for supplying and distributing air were found to be inadequate. They comprised the delivery of air into the building by means of a fan which, located in the top story, discharged through a central shaft and by setting up a plenum pressure was depended on to force an outflow through windows, doors and other points of egress. The problem involved the establishment of a more extended system of fresh-air distributing passages and the provision of special openings for the vitiated air, without resorting to the expense of constructing vertical flues throughout the building. The accompanying drawings will show how the work was done, which was proportioned on more generous proportions than usual in schoolhouse work.

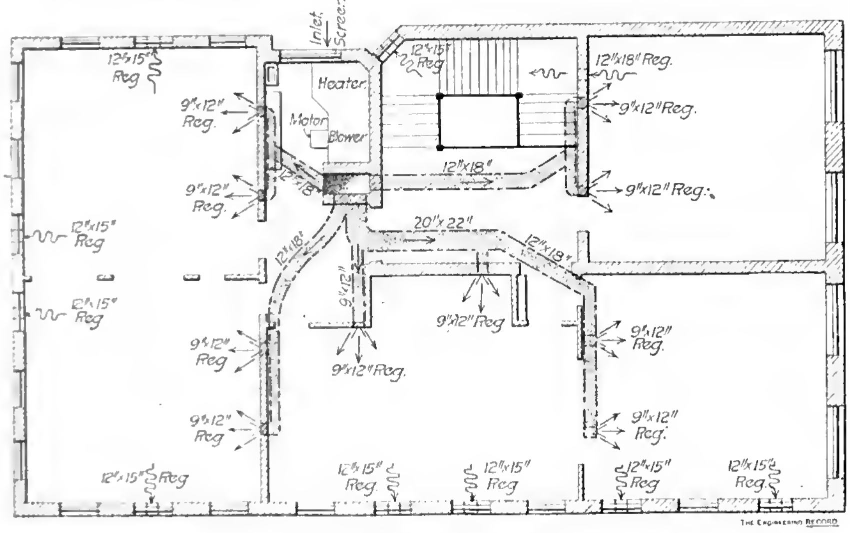
The building was erected in 1890 to provide recitation rooms, a director's office and a small gymnasium for the technical high school department. Its three stories and basement, covering a ground area of 3,700 square feet, are sufficient for these purposes, as all laboratories and shops are in the main Institute building. As originally constructed one fan was installed in a small room on the third floor and connected to a single shaft, about 2x4 feet in area, with openings on each floor, from which the fan exhausted the impure air. The fresh air was not given any special inlet but was left to enter through windows, doors and by general leakage. It was found impossible, however, to get a proper amount without opening the windows which sometimes caused discomfort to the pupils in the winter.

The next scheme was the reversal of the first; the fan was driven in the opposite direction so as to force fresh air down the shaft to the various floors and heater coils were installed to temper the air on its admission. This plan proved to be an improvement over the first, because the windows could usually be opened wider with less danger than before. Nevertheless, the great distance of some of the rooms from the shaft and the direction of the air outside often made it impossible to open some of the windows without an inrush of cold air, and generally speaking the building was without a positive system, offering at all points the desired degree of ventilation.

During the last year it was decided that the old plant must be completely revised and a modern system installed. This work of reconstruction was done during the last summer. The same air shaft has been used and it is fortunately well located so that it affords an excellent center of distribution. At the second floor a horizontal diaphragm has been placed in the shaft to divide it into two parts. Through the upper half, the old fan supplies the second and third floors; and through the lower half, a new fan installed in the basement supplies that floor and the first floor. If one fan should become disabled, an opening in this diaphragm will permit the other fan to supply the entire building. Both fans may be run faster than their normal speed, so that either can temporarily supply the entire building.

The new fan is a steel-plate blower, manufactured by the B. F. Sturtevant Company, of Boston. It has a wheel 60 inches in diameter, running at 300 revolutions per minute and capable of discharging 15,000 cubic feet of air per minute. It is direct-connected to a General Electric motor of 7½ horse-power. The heater is roughly 6½ feet high, 4 feet wide and 3 feet deep and consists of three sections of 1-inch pipe with a total heating surface of 550 square feet. The section first encountered by the entering air is controlled by a thermostatic valve which is opened when the temperature of the outside air falls below 35 degrees Fahrenheit. The other two sections are supplied under the control of a thermostatic valve which is governed by the temperature of the air leaving the heater and is designed to maintain that temperature at about 70 degrees. The thermostatic valves are operated on the Johnson system. Beyond this valve the pipe branches to the two sections and each branch contains a hand valve to open or close that section to steam at will. The steam is supplied through the regular Institute heating system, which is operated with a vacuum of about 10 inches on the air valves and uses the exhaust of the engines. All condensation is returned as feed to the boilers.

The old fan on the third floor is also of Sturtevant make, has a 48-inch wheel and a capacity of 6,400 cubic feet at 250 revolutions per minute, and is direct-connected to a 3½-horse-power General Electric motor. The heater for this system is supplied with steam and dripped in the same manner as is the other heater. The air is tempered with thermostatic valve regulation to abont 70 degrees and is found to reach the most distant rooms with practically no loss in temperature.



Plan of Third Floor.

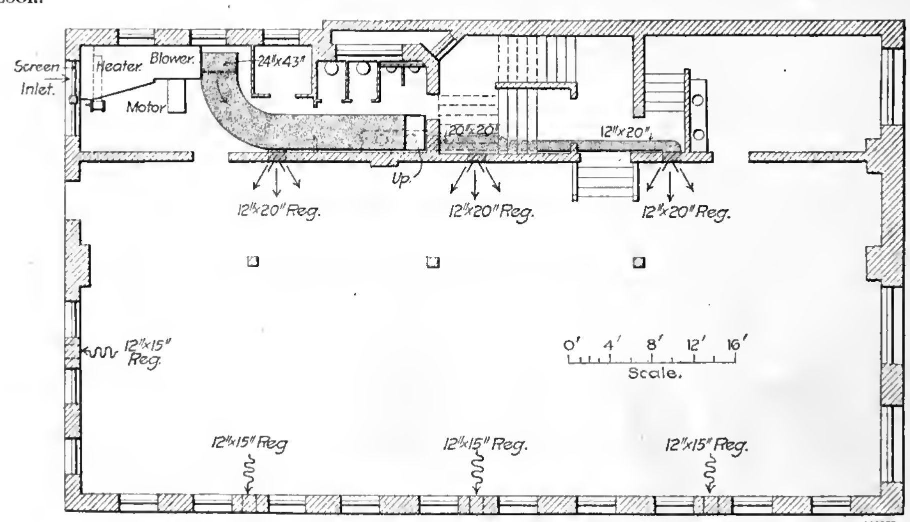
The arrangement of the ducts and the location of the registers for the ventilation of the first, second and third floors are practically identical to those shown on the third floor plan. The air inlets to each room are about 9 feet from the floor and are located in the side nearest to the main air shaft, so that the ducts are as short as possible. The class rooms have in general, two inlet registers each, which, to diffuse the air to all parts of the room, are provided with deflector plates set at an angle of 60 or 45 degrees with each other, according to the distance to the opposite wall. The air outlets are the same in number but have an area about 50 per cent. greater than the inlets and are located in most cases under windows. These outlets are of special construction, as shown in the accompanying perspective sketch. On the inner face of the wall there is an ordinary cast-iron register, on the back of which are hung four or five horizontal overlapping flaps of rubber cloth. These separate only when the pressure within the room exceeds that without and thus prevent a back draft of cold air from the outside. When the pressure condition is the reverse, a wire screen beyond the register limits the outward swing of the flaps and obviates their becoming disarranged. The opening is protected from rain on the outside by a hood having a wire screen across the opening in its lower side for the purpose of keeping birds or debris from getting inside and choking it up.

Where possible the rooms have outlets in two sides, with the exception of the front rooms. Here, rather than deface the front of the building, the exits are placed in the side wall or into the stair well, as the plan of the third floor indicates, the stair well itself having in that case an outside vent opening.

The horizontal ducts connecting the registers with the main air shaft have been concealed in the ceiling space so that the drop legs to the registers form the only visible part of the piping. These have been neatly designed so as not to render their exposure objectionable.

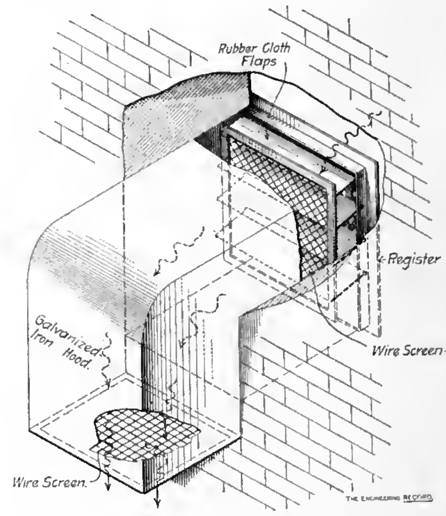
The velocity of the air into the rooms is calculated to be about 500 feet per minute, but is reduced, where it leaves the room, by using outlets which are larger than the inlets, to prevent injurious drafts on the occupants near these points. It is intended to change the air of the rooms once in every 10 minutes with an average allowance of 3,000 cubic feet of air per hour per person.

The basement ventilation is particularly simple, as shown on the plan of the basement. The fresh air is admitted at one side of the single large room through three registers, each having an opening of 240 square inches area and located 9 feet above the floor. One of these is taken directly from the large duct connecting the fan and the air shaft, the other two are supplied through a small branch duct from the main shaft. The air outlets are four in number, 12x15 inches each, so that their combined area is 760 square inches, that is 40 square inches more than the combined area of the inlet openings. The velocity of the outgoing air is, therefore, practically equal to that of the entering air and is allowed in this case because in the ordinary usage of the room no one sits near the outlets.



Basement Plan.

The entire system was designed by Mr. Joseph Foster, the chief engineer of Pratt Institute, and was installed under his direction.



Detail of an Air Outlet.

The galvanized iron work was made and erected by Mr. William Spencer, of Brooklyn.

A Foggy Weather Signaling System in connection with the block system of railway operating, that might be adopted to great advantage in the United States is used in Great Britain by the North-Eastern Railway Co. The following brief description of this system was sent from Edinburgh by a correspondent of The Engineering Record: At both the distance and the home signals there is, in addition to the semaphore arm, a part that is set simultaneously with the arm. When the semaphore is set at danger, the auxiliary part is brought into position for striking and knocking backward a lever on the engine. This lever, when knocked backward or down, sets a whistle to blowing in the cab. The engine driver is thus warned of a train on the block although unable to see the sight signal; and not only is the driver warned, but the guard as well, which is a point not to be lost sight of in view of sudden sickness or incapacity of the engineer. The apparatus can be simply made and readily applied. Fogs occur with sufficient frequency in some parts of the United States to warrant the adoption of such a device; and tunnel and subway accidents might be obviated by its use.

The Circular Dam at Lake Cochituate.

By Charles W. Sherman, Assoc. M. Am. Soc. C. E., Division Engineer, Metropolitan Water Works, Boston.

At the southern end of Lake Cochituate, the original source of Boston's water supply, and from which something like 15 per cent. of the water for the Metropolitan Water District is still taken, is an area of shallow water covering about 80 acres, known as the "Peat Meadows." This is now a part of the lake, but more than sixty years ago, before the water had been raised by dams, there were at this place meadows whose surface was but slightly above the water in the lake. By successive raisings of the lake, made first by owners of mills upon the outlet, and later by the Boston Water-Works, the elevation of high water was raised 7 feet, so that when the lake was full there was a depth of 5 or 6 feet over the meadows.

More than half of the total watershed of Lake Cochituate is tributary through these meadows, which, it should be noted, are divided from the lake by the Central Turnpike and by the embankment of the Boston and Albany Railroad. Realizing that water over "shallow flowage" deteriorates and that the meadows were unsightly, if, indeed, not prejudicial to health, when exposed by the annual drawing down of the lake, the Boston Water Board constructed a regulating dam at the point where the water flows under the Central Turnpike. This dam, a view of which is shown in the accompanying

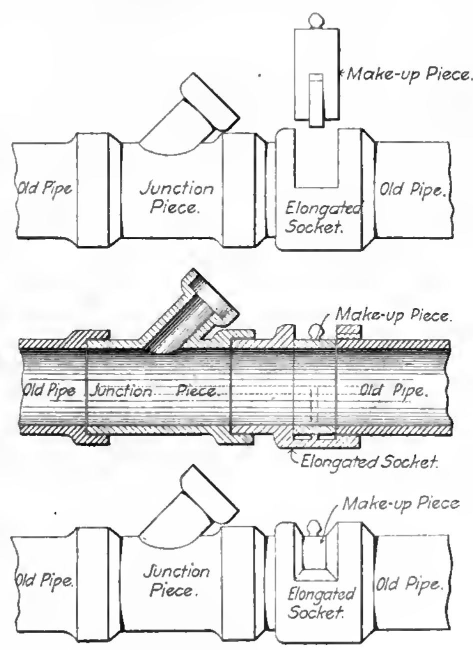
Circular Dam, Lake Cochituate.

illustration, was built in 1879, and is semi-circular in plan, in order to obtain a great length of overfall and thus avoid backing the water up too high. It has a core wall of 6-inch tongued and grooved sheeting, driven on a circle of 30 feet radius. On the upstream side the sheeting is backed with gravel, having a slope of 2 to 1; while the downstream side is filled with stone, heavily paved on the surface. A sluice 6½ feet wide was built through the dam, containing stop-planks by which the water may be retained at any desired height. When the water stands at high-water level, the dam is entirely submerged, but when the lake is drawn down the dam retains the water upon the meadows, as shown in the view.

This dam was the forerunner of the circular regulating dam in Sudbury Reservoir, built in 1896 by the Metropolitan Water Board. This latter dam is nearly a complete circle in plan, leaving only a sufficient opening for the culvert through the road embankment which retains the water. Both of these dams were built under the direction of Mr. Desmond FitzGerald, M. Am. Soc. C. E., who was superintendent of the Western Division of the Boston Water Works when the dam at Lake Cochituate was built, and who is now engineer of the Sudbury Department, Metropolitan Waterworks. Mr. F. P. Stearns, M. Am. Soc. C. E., is chief engineer of the Metropolitan Water Works.

A Device for Inserting Lengths of Pipe in an Old Drain.

A patent device for inserting junctions or new lengths of pipe in an old drain or pipe sewer was described recently at a meeting of the Incorporated Association of Municipal and County Engineers, by its inventor, Mr. H. J. Weaver, borough surveyor of King's Lynn, England. According to the report of the meeting published in "The Surveyor," the device consists of a short length of ordinary pipe or a junction, as the case may be, and a short piece of special deep socket pipe in which a slot is cut half-way round, giving room for the insertion or withdrawal of the specially prepared ring of pipe, or making-up piece. The method of setting is as follows: The old pipe in the sewer where the junction, or Y branch, is required to be fixed is broken and taken clear away, and the earth removed for a distance back of about 6 inches, all round the spigot-end of the old sewer pipe in order that the elongated socket may be telescoped on it as far as it will go. This having been done and the socket telescoped as directed, the junction piece is next fixed in position, the spigot-end of the elongated collar is drawn into the collar of the junction pipe, and the whole operation completed by inserting the ring, or



Patent Insertion Pipe.

making-up piece, into the slot provided in the elongated collar. In the case of a blocked drain or sewer the pipe is invaluable. It is made without the junction, for which is substituted a piece of straight pipe, and is strongly recommended for making good the drain or sewer after it has been cleared. By this method it is only necessary to break and remove one pipe, and the usual risks of broken collars, improper gradients and leaky joints are entirely obviated. A true invert is obtained all through by pieces which are made inside the deep socket to receive the spigot-end of pipe, and also a piece on the bottom side of the ring. The joints can then be made good with cement or clay, so as to be reliable and watertight. The arrangement is adaptable to replace either 2 or 2½-foot pipes in the sewer by the simple alteration of length in the junction piece, and has been found in practice to work admirably.

Personal and Obituary Notes.

Mr. J. F. Kieser has been elected superintendent of public works of Little Rock, Ark.

Mr. Gerald S. Griffin has been appointed assistant engineer to the Aqueduct Commission of New York City and Mr. Clifford B. Moore, transitman.

Mr. A. S. Tuttle, M. Am. Soc. C. E., read a paper on engineering work in Hawaii before the Brooklyn Engineers' Club, November 13, illustrated by lantern views.

Mr. Louis Hatch has been appointed city surveyor of Wilmington, N. C., Major W. F. Robertson, whose appointment was noted last week, having decided not to accept.

Lieut.-Colonel William R. Livermore, Corps of Engineers, U. S. A., has been directed to proceed to Ft. Monroe, Va., to prepare for taking part in the West Indian naval manoeuvres.

Daniel Pratt, for over 50 years actively engaged in civil engineering, died November 17 at Uxbridge, Mass., aged 82 years. He was first employed in construction work for the Norwich & Worcester Railroad in 1839.

Lieut. Andrew L. Harrison, a retired chief engineer of the U. S. Navy, died at his home near Bristol, Conn., November 16. He was born in 1829 in Southington, Conn., and was retired from the Navy in 1894 after 35 years' service, commencing when the Civil War broke out.

Prof. J. H. Kinealy, formerly professor of mechanical engineering at Washington University, and Mr. Andrew G. Paul, formerly of the Paul Steam System Co., have organized the Paul-Kinealy Co., Pemberton Building, Boston, for the practice of engineering in power, heating, ventilating and drying work.

The Cienfuegos, Cuba, Municipal Council has authorized Mr. H. J. Reilly, Jr., of New York, to prepare plans and specifications for a system of water-works and sewers, which, it has been estimated, will cost about $4,000,000.

A Civil Service Examination for Topographical Draughtsmen, first to fourth grades, salary not exceeding $1,200, will be held at 10 A. M., Thursday, December 11, at 61 Elm Street, New York City, as advertised in another column of this issue.

Public Buildings, the more pretentious private edifices and other structures of architectural worth may be so located, correlated and grouped as greatly to enhance the beauty and dignity of the *ensemble* effect of a municipality or of an individual street, if skilful oversight be given to the esthetic element in the appearance of the community. The value of such structures, however, as means of municipal adornment, is all too frequently wasted, partly from lack of appreciation, false ideas of economy and civic indifference. The sentences quoted below from the presidential address of Mr. Ashton Webb, at a recent meeting of the Royal Institute of British Architects, seem to apply with equal force to the conditions obtaining in America. "The Government is largely engaged in the erection of public buildings; local authorities all over the country are busy with the erection of town halls, asylums, schools, technical institutions, etc., while the buildings, residential and commercial, in our great towns continue to increase at almost an alarming rate. What, I think, must strike most of us in all this activity is that while minute control is exercised by public authorities over the details of these buildings, such little control is exercised over the laying out of our cities that, to a great extent, they seem to be left to lay out themselves. How often we see a really noble and costly building hidden away in some inconvenient and cramped site, without any approaches worthy of the name, simply because the land was easily obtainable or happened to be vacant at the time, or could be obtained cheaply, or to improve the value of adjoining property; reasons we have heard put forward repeatedly, but nearly always resulting in the loss of a great opportunity of ennobling and beautifying the town; while, instead of money being saved, as is foolishly supposed, money is really wasted and thrown away."

The Storage of the Water from the Thames and Lea Rivers is considered to be of much importance in improving the quality of the London water supply, according to the annual report of the Local Government Board. Commenting on this report "The Surveyor" says: Dr. Thorpe, the analyst, admits that under ideal conditions the use of water subject to such regular pollution as that indicated by the presence of organic matter in the raw Thames and Lea waters would be avoided; but he discounts this admission by the general conclusion that, given the exclusion of certain flood waters and the provision of proper storage and filtration, the risk to public health is reduced to a minimum, if not to zero. Certainly it must be admitted, even by those who, on various grounds, support the introduction of a long-distance supply, that the practical immunity of London from anything that can be regarded as a water-borne epidemic gives strong support to the conclusion. It is pointed out that the organic matter present in the Thames and Lea waters, as delivered to the metropolis after storage and filtration, is to a relatively large extent of vegetable origin; and in this connection attention is drawn to the importance of storage reservoirs, especially when the rivers are in bad condition. It would appear that, generally speaking, the companies which last year delivered the best water were those having the greatest storage capacity.

The Pierce County Improvement Company is about to commence the improvement of one of the largest water powers on the Pacific coast. The scheme contemplates the use of power to be derived from the Puyallup River, which has its origin in the glacier of Mount Ranier, State of Washington, and flowing northwest empties into Puget Sound near Tacoma. A dam will be thrown across the river, the water diverted and carried by flume and ditch a distance of 10¼ miles to a forebay, from which will be taken steel pipes leading to the power house, and giving a net head on the wheels of 850 feet. The present development will be for 20,000 horse power. The flume will be built with a section 8 feet wide by 5 feet high, the height to be increased later to 7 feet to provide for the ultimate development of the plant. The ditch will be slightly larger. The forebay will be not less than 500x300 feet and 14 feet deep, holding water enough to carry the full load of the plant for two hours. The design providing for the location of the storage pond above the station eliminates chance of interruption to the operation of the plant by reason of accident to the flume. Two steel pipe lines, approximately 1,700 feet long, will convey the water to the power station, which will be of brick and will contain four impulse wheels, each directly connected to a 3,500-kilowatt generator. Alternating current will be generated at 2,300 volts, stepped up to 40,000 to 50,000 volts, and then transmitted to the cities of Tacoma and Seattle, distances respectively of approximately 30 miles and 40 miles from the power station. The very latest improvements in hydraulic and electrical engineering will be embodied in the new plant. Plans and specifications for the work are well under way, and contracts for the electrical apparatus will be awarded within a week. Men are now in the field making necessary locations and surveys. It is hoped that the plant will be in operation shortly after the first of January, 1904. We are indebted for the above information to Messrs. Stone & Webster, of Boston, who are the engineers for the project.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

Brockton, Mass.—City Engr. Chas. R. Felton writes that the following bids were opened by the Water Comrs. on Nov. 8, for furnishing and erecting complete, on foundations furnished by the city in an engine house to be provided, 1 vertical, triple expansion, condensing, crank and fly wheel pumping engine of 6,000,000 gal. daily capacity, 150,000,000 foot pounds duty, to work against a 350-ft. head: Kilby Mfg. Co., Cleveland, O., $40,800; Barr Pumping Engine Co., Philadelphia, Pa., $43,500; Holly Mfg. Co., Lockport, N. Y., $43,800 and $35,200 short stroke; Snow Steam Pump Wks., New York City, $45,093; R. D. Wood & Co., Philadelphia, $62,000; Allis-Chalmers Co., Chicago, Ill., $64,000, and $68,000 for self-contained type.

Norwalk, Conn.—City Engr. C. N. Wood writes under date of Nov. 18 that a city meeting had been called for Nov. 21 to see if the citizens are in favor of laying a 16-in. supply main from Grupe storage reservoir, in New Canaan, to the distributing reservoir in Norwalk, at an approximate cost of $75,000.

Waterbury, Conn.—Property owners have petitioned the Bd. of Aldermen to provide a high service supply of potable water.

An appropriation is reported to have been asked for the purchase of meters.

Haydenville, Mass.—At a citizens' meeting held Nov. 16 the Joseph Wright brook was considered as a possible source of water supply for Haydenville and Williamsburg. Estimated cost, $35,000.

Dover, Me.—The Dover and Foxcroft Fire Dist. has taken the works of the Main Water Co. at Dover and Foxcroft, the appraisal of which by Comrs. appointed by the Supreme Court of Maine, was $135,600. A new reservoir and additional pipe lines are proposed. The present pipe system is 8.87 miles in length, composed of 10, 8, 6 and 2-in. pipe, with 35 hydrants all on 6-in. lines or larger.

Worcester, Mass.—Plans for the dam to be constructed by this city on the site of the Mann reservoir on Kettle Brook, in Leicester, have been filed with the County Comrs. by City Engr. Frederick A. McClure. The dam is to be built at a cost of $120,000.

Wilmington, Del.—A correspondent writes that the Water Dept. will proceed at once to have plans prepared for the construction of a reservoir which will probably contain about 200,000,000 gal., and also provide for filtering this supply.

Saratoga Springs, N. Y.—Bids will be received Nov. 25 by the Village Sewer, Water and Street Comn. for $40,000 water and sewer bonds. H. F. Thomas, Clk. of said Comn.

Schenectady, N. Y.—City Clk. Alex. Femirek writes that it is expected to lay a quantity of water mains in the near future. Chas. Trumbull, Engr. in Charge.

Penngrove, N. J.—John P. Leap, Chmn. of Water Com. writes that no contracts for water works or electric lighting (bids opened Nov. 12), have been given out, and that it is proposed to increase the appropriation for said work.

Brooklyn, N. Y.—The Bd. of Aldermen has authorized the expenditure of $48,000 for the construction of 2 new pumping stations at Greenpoint.

North Hempstead, L. I., N. Y.—The Town Bd. has established the Port Washington water supply district and bids will probably soon be asked for the furnishing of not less than 40 fire hydrants; new bids will be asked by said Bd. for the Great Neck water supply district.

Atlantic City, N. J.—The Water Comrs. are considering the question of recommending to Council the building of a filtration plant at the main entrance near Absecon.

Bayonne, N. J.—The City Council has sold $22,000 water bonds.

Pittsburg, Pa.—The Council on Nov. 17 passed an order appropriating $215,000 for water pipe extensions in the downtown district.

Rochester, N. Y.—According to local press reports the Rochester & Lake Ontario Water Co., which is to be incorporated at once, proposes to construct a system of water works, the pumping station to be located at Greenleaf farm; an intake pipe will take water from Lake Ontario, 3,500 ft. from the shore, water to be piped in 20-in. mains along the N. Y. C. R. R. to the factory district. Capacity of pumping engines to be installed 8,000,000 gal. per day; proposed reservoir to have a capacity of 8,000,000 gal. S. Q. Mingle, of Phila., Engr. in Charge. Geo. K. M. Clark, of Buffalo, is said to be promoter.

Troy, N. Y.—The Jefferson Water Works Co. has increased its capital stock from $3,000 to $15,000. Among the stockholders are H. Avery, H. D. Vaughn and Chas. Nichols.

Atlanta, Ga.—The bill which provides for an election looking to the issue of $800,000 bonds by this city for the improvement of the water works and sewerage system, has been passed by the House of Representatives.

Arcadia, Fla.—This city is reported to have voted affirmatively on the proposition to issue $20,000 bonds for the construction of water works.

Tocco, Ga.—This town is said to be considering the construction of a system of water works.

Richmond, Va.—The Water & Finance Com. has recommended to the City Council the issuance of bonds to the amount of $405,000, $350,000 of which is to be used in the construction of a settling basin and the balance placed to the credit of the Auditor, to be expended in erecting a stand pipe in the West End.

Whiteville, N. C.—Local press reports state that Oscar High will construct water works.

Marietta, O.—Supt. J. S. H. Torner writes that it is proposed to lay a new main from the pumping station on Ohio River to the new settling reservoirs, but bids have not yet been asked.

Platteville, Wis.—City Clk. Phil. D. Hendershot, Jr., writes that $15,000 water works extension bonds have been sold, and the city may engage Julius Fix, of Watertown, Wis., to prepare plans, etc.

Bellaire, O.—Supt. and Trus. of Water Works M. L. Blackburn, writes that at the election held recently, it was voted to issue $50,000 bonds to refund the 6 per cent. bonds and improve the pumping station.

Jacksonville, Ill.—City Clk. Sam. B. Stewart writes that this city has turned its water works over to W. T. Mayhon & Co., of Chicago, to operate for a term of 30 years.

Grand Rapids, Mich.—Local press reports state that for the purpose of purifying the Grand Rapids water supply and preventing contamination of Grand River above the intake at Coldbrook St., the city may extend sewers along the east and west sides of the river to the city limits, and ask the State to further extend the east side mains to the Soldiers' Home.

Lancaster, O.—City Engr. John N. Wolfe writes that bids are being received for $25,000 bonds for water works improvements. Geo. Cunningham, Clk. and Secy. of Water Wks. Trus.

Lansing, Ia.—A site is reported to have been selected for the pumping station of the water works system which, it is estimated, will cost $13,000.

Youngstown, O.—According to press reports the Council has decided to submit the question of issuing $250,000 filtration bonds to a vote of the people.

Milwaukee, Wis.—City Engr. Poetsch is planning to carry the city water mains under the river and under the depressed tracks of the 18th Ward through brick conduits 7 ft. in height. Seven conduits are planned to cross the river at different points, as soon as the deepening of the river makes it necessary to lower the water mains now in position.

Burlington, Ia.—The Citizen's Water Co., of Burlington, has been incorporated with a capital of $330,000, for the purpose of acquiring, operating, maintaining and extending the existing system of water works in Burlington. Incorporators: Jas. A. Guest; Seymour H. Jones; Edw. Hageman and others.

Detroit, Mich.—The Water Bd. has authorized the issue of $50,000 bonds to be sold in Jan. to pay for the new intake tunnel.

Clayton, Mo.—County Clk. Henry C. Helmering writes that the Missouri & Meramec Water Co., of which J. R. Waddell, 714 Wainwright Bldg., St. Louis, is Pres., proposes to construct a canal in St. Louis Co.

Lawrenceburg, Tenn.—The taxpayers will vote on the water works and electric light question.

Granger, Tex.—W. H. Kelso & Co. have sold the water works at this place. According to local press reports, Mr. Kelso, who will continue as manager, states that a stand-pipe will be constructed and the entire system improved.

Kansas City, Mo.—The contract for pumps for the Turkey Creek Pumping Station has not been let on bids received Sept. 1. The Council on Nov. 11 passed an ordinance authorizing the Bd. of Pub. Wks. to employ expert engineers, Geo. H. Benzenberg, John Donnelly and S. A. Mitchell, to prepare specifications, forms of proposals and advertisements for the new pumps needed at Turkey Creek and Quindaro. They are to make another examination of the conditions at these two plants and report on immediate needs and at the same time file a definite date when new machinery must be installed and in operation.

The Lower House of the Council has passed an ordinance appropriating $10,000 for the purchase of pipe to be used in extending water mains in the residence district.

Pascagoula, Miss.—It is proposed to establish municipal water works and an electric light plant.

Yazoo City, Miss.—The City Council has sold $175,000 bonds for the construction of water works, sewerage and an electric light plant.

Hannibal, Mo.—Capt. C. J. Lewis, Supt. of the Hannibal Water Co., has returned from St. Louis, where he received the authority of the management of the company to begin work on the improvements on the plant, which will mean an expenditure of $43,000.

Memphis, Tenn.—Local press reports state that the Artesian Water Co. will replace all its iron service pipes with lead pipes, on the streets to be paved with asphalt. Probable cost, $10,000.

Hidalgo, Tex.—The Hidalgo Canal Co., of Hidalgo, has been incorporated, with a capital stock of $500,000. Purpose, to construct a general system of irrigation, building a canal from the Rio Grande, also a water supply for the city waterworks. Incorporators: Wm. Briggs, H. W. Lanz, of Lake Charles, La.; F. B. Carroll, of Jennings, La., and others.

Beaumont, Tex.—A permit to do business in Tex. has been granted to the Glayds Electric Light, Water & Power Co. of South Dakota; capital stock, $100,000. The Texas office is to be located in Beaumont.

Gadsden, Ala.—F. A. Mitchell and associates have been granted a franchise to build and operate water works in Gadsden.

Meridian, Miss.—It is stated that plans and bids are wanted Dec. 4 for constructing water works. A. W. Washburn, Chmn. Council Water Com.

Cedar City, Utah.—Recorder R. W. Hegborne writes that at the election held Oct. 25 it was voted to issue $9,200 bonds for the construction of water works.

Meeteetse, Wyo.—City Clk. E. P. Bowman writes that on Nov. 11 it was voted to issue $10,000 bonds for constructing a system of water works.

Arcata, Cal.—The Reclamation Water Co., principal place of business, Arcata, has been incorporated with a capital of $12,080. Directors: E. B. Jackson, R. Q. Pull, M. P. Roberts and others.

Gunnison, Colo.—The proposition to grant a water works franchise is reported to have carried.

Washtucna, Wash.—The construction of a system of water works is said to be coatemplated.

Havre, Mont.—The Town Council is reported to have accepted the proposition of E. V. Hauser for water works and electric lights.

Sacramento, Cal.—It is stated that bids will be received Jan. 1 by the City Trus. for $150,000 bonds, to be used for extending the water mains.

Palisades, Colo.—Ch. of the Hydrographic Dept. of the Government, Mr. Newell, has recommended to the Secy. of the Interior the construction of a High Line canal to be taken out of the Grand River above Palisades.

Salt Lake City, Utah.—Articles of incorporation have been filed by the Big Cottonwood Lower Canal Co., its purpose being to operate a canal and irrigation system tributary to the Big Cottonwood Lower Canal. Capital, $24,000. E. H. Williams, Pres.; Jos. Sutherland, Secy. and Treas.

Phoenix, Ariz.—City Engr. Farrish estimates the cost of a complete system of water works for the city at $270,000.

Los Angeles, Cal.—The Los Berros Land & Water Co. has been incorporated, with a capital stock of $100,000. Directors: C. M. Stimson, S. H. Mott and W. E. Cummings, of Los Angeles, and others.

Oakland, Cal.—Milton French, H. H. Linnell, N. P. Williams and others have incorporated the Pure Water Co., with a capital of $30,000.

Aylmer, Ont.—Town Clk. J. Bradley writes that the city contemplates improving and extending its water works at a cost of $38,000. Bids will be received for two filters. H. E. Brownlee, Engr. in Charge.

Tampico, Mex.—Press reports state that Jas. P. McDonald, of Knoxville, Tenn., has received the contract for the construction of water works and a sewerage system for Tampico, aggregate cost to be about $2,000,000.

Cienfuegos, Cuba.—The Municipal Council of Cienfuegos has appointed H. J. Reilly, of New York, to draw up plans and specifications in view of the construction of a market, water works and sewer system at an estimated cost of $4,000,000.

SEWERAGE AND SEWAGE DISPOSAL.

Revere, Mass.—At a recent town meeting it was voted to petition Legislature for permission to borrow $100,000, outside the debt limit, to connect the sewers of the town with the metropolitan sewer at Chelsea.

New York, N. Y.—The following bids were opened Nov. 18 by Geo. Livingston, Comr. Pub. Wks., for the construction of a sewer in Stanton St., between Mangin and Ridge Sts.; A, F. Thileman, Jr.; B, N. Y. Sewer Constr. Co.; C, Wm. J. Moore; D, Wm. E. Welch; E, John A. Hadert; F, Norton & Dalton:

Items and Quantities.	A	B	C	D	E
4-ft. brick sewer—					
Class I, 1,100 ft......	$22	$19	$15	$13	$13.09
Class II, 500 ft.......	17	15	15	13	13.09
Class III, 238 ft......	17	14	14	13	13.09
12-in. vit. pipe, 100 ft...	5	3	3	3	4.00
Timber & plkg., 90,000 ft.	..	25	..	30	1.00
6-in. drains, 100 ft.....	1	3	3	1	1.00

Bids were opened at the same time for repairs to sewer in 12th and 13th Aves., 27th to 29th Sts., etc., as follows:

Items and Quantities.	A	B	C	D	E	F
4-ft. circular, 972 ft....	$18	$21	$15	$12	$14	$18.50
4′x2′ 8″ sewer, 240 ft...	14	17	10	12	10	17.25
3′ 6″x2′ 4″ sew., 1,012 ft.	14	*15	7	12	*6	15.75
12-in. vit. pipe, 84 ft...	3	2	3	3	4	3.00
Timber & plkg., 25,000 ft.	..	30	..	30	40	..

*Should read $15.85 and $6.50.

Syracuse, N. Y.—City Engr. Frank J. Schnauber estimates the cost of constructing a brick sewer, 46 x 69 in. and 40 x 60 in., in Midland Ave. at $28,000.

York, Pa.—The Common Council has passed on final reading an ordinance providing for an election to vote on the proposed increase of the city indebtedness to the extent of $400,000 for the construction of a sewerage system.

Oneida, N. Y.—The only bids received Nov. 11 for the construction of a trunk sewer were from De Nallo & Klingberg, of Kingston, N. Y., and Chas. H. Bartow & Co., being respectively as follows: 20-in. pipe, $6.50 and $10; 18-in. pipe, $5.30 and $6; 15-in. pipe, $3.45 and $5; manholes, $60 and $100; manhole junctions, $65 and $100; flush tanks, $50 and $100; 16-in. cast iron pipe at R. R. crossing, $13 and $20; brick masonry, $10 and $10; 12-in. pipe, $2.75 and $2; Portland cement concrete, $8 and $7.50; 8-in. pipe, $2.25 and $1; lumber, $22 and $40; 6-in. pipe, $1 and 75c.; totals, $39,484 (awarded) and $43,825.

Johnstown, N. Y.—The Sewer Com. has reported favorably upon the construction of a 30-in. vitrified pipe, about 800 ft. long with 8 intake basins. J. W. Miller, City Engr.

Colwyn, Pa.—John C. Wolfenden, Clk. of Council, writes that on Nov. 4 it was voted to issue $7,000 bonds for extending the sewerage system and improving the public highways.

Tonawanda, N. Y.—The Municipal Bd. is said to be considering the question of establishing a sewage disposal plant.

Westfield, Mass.—Town Engr. Oren E. Parks writes that the following bids were opened Nov. 5 for building Section 2 of the storm water sewer system.

Items and Quantities.	R. D. Maynard, Springfield.	Bruno, Salomone & Petittie, Boston.	D. W. Mellen, Springfield.	Frank. L. Allen, Worcester.	Rowe & Perini, So. Framingham.	D. J. Curtis, Springfield.	Geo. M. Atkins & Co., Palmer.	Michael Maloney, Springfield.
Earth exc., 54-in. sew., 2,075 ft.	$1.53	$1.98	$2.20	$2.50	$2.43	$2.67	$3.00	$2.87
Earth exc., 48-in. sew., 2,980 ft.	1.30	1.85	2.00	1.80	2.15	2.70	2.80	3.00
Earth excav., 42-in. sew., 560 ft.	1.00	1.75	1.75	1.50	1.79	2.60	1.90	2.58
Earth excav., 36-in. sew., 335 ft.	.85	1.75	1.60	1.25	1.50	1.87	1.80	2.15
Earth excav., 30-in. sew., 60 ft..	1.10	1.75	1.60	1.50	1.84	1.80	1.80	1.90
Brick masonry, 2155. cu. yds...	12.00	11.75	12.10	12.50	12.40	12.00	12.00	12.50
Concrete masonry, 400 cu. yds..	6.00	6.15	7.00	7.00	6.95	7.00	7.00	7.00
Piles in place, 375 ft..........	.25	.50	.35	.50	.50	2.00	1.00	.85
Spruce lumber, 10 M ft., B. M..	25.00	35.00	30.00	40.00	35.00	30.00	40.00	22.00
Totals	$36,563	$39,611	$41,443	$42,225	$43,104	$45,486	$45,779	$47,450

Note.—Mortar for brickwork, Portland Cement 1:2½. Concrete masonry, Portland Cement 1:3:6. Earth excavation, average cut—54-in., 13.1 ft.; 48-in., 12.1 ft.; 42-in., 10.7 ft.; 36-in., 8.9 ft.; 30-in., 12.0 ft.

Buffalo, N. Y.—Bids are wanted Nov. 27 for constructing a 10-in. tile sewer in Chelsea Place, a 10, 12, 15, 18 and 20-in. tile sewer in Freund St., also a 12-in. tile sewer in Manhattan Ave. and Weimar St. Bids are also wanted Nov. 28 for constructing a 10-in. tile sewer in Mathews St. and a 24-in. brick, 18 and 20-in. tile sewer in New South Ogden St. Francis G. Ward, Comr. Dept. of Pub. Wks.

Saratoga Springs, N. Y.—See "Water."

Roselle Park, N. J.—Boro. Clk. A. M. Woodruff writes that the following bids were opened Nov. 8 for the construction of a sewerage system, work to include 45,970 ft. of 8 to 15-in. pipe sewers, 140 manholes and 27 flush tanks; David Harper, Newark, N. J., $55,946; Union Building & Const. Co., Passaic, N. J., $51,542; Wm. J. McCloud & Co., Elizabeth, N. J., $58,362; J. Roosevelt Shanley, Jersey City, N. J., $51,640; Higginson & Shannon, Jersey City, N. J., $44,441.

Washington, D. C.—The following bids were opened Nov. 15 by the Commissioners, D. C., for constructing a portion of the low area trunk sewer in the Dist. of Columbia: The Warren F. Brenizer Co., 15th and G Sts., Washington, $73,665 (accepted); Andrew Gleeson, Washington, $104,820; E. G. Gummell, Eckington, D. C., $92,650; Patterson & Brierson, Baltimore, Md., $80,645.

Brooklyn, N. Y.—The following bids were opened Nov. 19 by Wm. C. Redfield, Comr. Pub. Wks., for alteration of sewers necessitated by Atlantic Ave. Improvement Subway, in Franklin Ave., from Atlantic Ave. to Brevoort Pl., etc., only the main items being given:

Items and Quantities.	John J. Cashlan.	John O'Grady.	James H. Holmes & Co.
54-in. brick sewer, 2,035 ft.......	$13	$17	$11
Manholes, 17.....................	35	75	39
Founda. planking, 18,000 ft......	20	20	25
Sheeting, etc., 285,000 ft.........	20	20	23
Siphon "A," complete............	3,400	2,100	1,300
Siphon "B," complete............	4,900	3,350	3,100

North Plainfield, N. J.—The estimated cost of installing a complete sewerage plant is placed at $48,000, and the cost of a disposal plant at $38,000.

Saratoga Springs, N. Y.—Bids will be received Nov. 26 by the Village Sewer, Water and Street Comn. for furnishing materials and constructing a 10-in. terra cotta sewer in portions of Greenfield Ave. H. F. Thomas, Clk.

St. Petersburg, Fla.—Bids will be received Dec. 10 by the City Council for constructing a sewerage system. The work includes the construction of approximately 13,000 ft. of 6 to 15-in. pipe, 25 manholes and 5 flush tanks. Address Grant J. Aiken, Clk.; J. P. Titcomb, City Engr.

Atlanta, Ga.—See "Water."

Cincinnati, O.—Bids are wanted Dec. 12 for improving portions of several streets by constructing sewers and drains with the necessary appurtenances thereto. Robt. Allison, Pres. Bd. of Pub. Service.

City Engr. Stanley has been directed to prepare plans and specifications for a sewer in 8th and several other streets, Price Hill. Probable cost, $20,000.

Milwaukee, Wis.—The City Council has allowed $16,000 for the construction of a brick tunnel to drain the west part of 19th Ward.

Monmouth, Ill.—The Bd. of Local Improvement has decided to recommend to the City Council the construction of the Central sewer, which is to be of brick, 36-in. in diameter, and will cost about $7,000.

Madison, Wis.—City Engr. John F. Icke writes that all bids received Nov. 14 for the construction of 2 miles of sanitary sewers, have been rejected as too high; new bids will be asked in the spring.

Washington, Ia.—City Clk. Hugh H. McCleery writes that the construction of a sewage disposal plant at a cost of $3,000 or more is contemplated; additional sewers will be put in.

Connersville, Ind.—City Clk. Jacob S. Clouds writes that Chas. C. Brown, of Indianapolis, is preparing plans, estimates, etc., for proposed pipe sewers.

Indianapolis, Ind.—Bids are wanted Nov. 27 for constructing sewers in Arsenal Ave. Harold C. Megrew, Clk. of Bd.

Walnut, Ill.—Bids will be received Dec. 5 by the Drainage Comrs. of Dist. No. 1 of Hamilton and Hahnaman Townships for enlarging the main ditch of the Dist. Estimated, 634,380 cu. yds. excavation. Jas. Foley, Chmn.; P. C. Knight, Engr., Pontiac, Ill.

Massillon, O.—Bids will be received Dec. 2 by the Sewer Comn. for constructing sanitary sewers in 2 streets. Orlando C. Volkmor, Clk.

Chicago, Ill.—Bids will be received Nov. 25 by the Bd. of Local Improv. for constructing vitrified tile pipe sewers, with manholes and catch-basins, in a number of streets; also brick and vitrified tile pipe sewers, with manholes and catch-basins, in several other streets. Andrew M. Lynch, Pres.

Waukegan, Ill.—Bids are wanted Nov. 28 for constructing about 1,680 lin. ft. of 24-in. vitrified tile sewers. F. Finer, Pres.

Joplin, Mo.—The citizens of South Joplin are considering the question of sewerage.

Johnson City, Tenn.—Consulting Engr. Samuel M. Gray, of Providence, R. I., writes that this city proposes to construct a sewerage system; estimates for same have not yet been made, and contracts for construction will probably not be let for several months. E. E. Ellisworth, Chmn. of Sewer Com.

Osceola, Ark.—Bids are wanted Nov. 28 at the County Clerk's Office for the construction of 27½ miles of drainage canal, as advertised in The Engineering Record.

Athens, Tenn.—The Chamber of Commerce has appointed a Com. to investigate the cost of building sewers in Athens.

Topeka, Kan.—Local press reports state that it is proposed to build a 36-in. sewer, either pipe or brick, on Euclid Ave. Address City Engr. McCabe.

Beaumont, Tex.—Bonds to the amount of $75,000 were voted at the recent election for sewers.

Yazoo City, Miss.—See "Water."

New Orleans, La.—The Sewerage & Water Bd. has adopted a resolution accepting the bid of the Camden Iron Wks. for furnishing pumping, steam and electrical equipment, as per contract D, for the sum of $246,500, being the lowest bid submitted Aug. 12.

Athens, Ala.—The Chamber of Commerce has taken steps to ascertain the cost of constructing a sewerage system.

Oklahoma, Okla. Ter.—The City Council has decided to extend the 1st St. storm sewer a distance of 3,100 ft. Cost about $15,000.

Fresno, Cal.—City Engr. I. Teilman writes that in Dec. a special election will be held to vote on the issue of $55,000 bonds for septic tank and intercepting sewer.

Long Beach, Cal.—At a recent citizens' meeting a vote was taken in favor of the issue of $30,000 bonds for the construction of a sewerage system.

San Diego, Cal.—The Sewer Com. has recommended that provision be made in the proposed bond issue for sewers to cost $137,457.

Seattle, Wash.—The Council has passed a resolution providing adequate sewerage for Madison St. Dist.

New Hope, Cal.—It is stated that plans have been prepared for the joint construction of a steel bridge over the Mokelumne River west of New Hope by San Joaquin (Stockton, C. H.) and Sacramento (Sacramento, C. H.) Counties; estimated cost, $20,000.

Manitou, Colo.—The Town Bd. has authorized preliminary surveys for extension in the sewer system estimated to cost about $20,000.

Tampico, Mex.—See "Water."

Toronto, Ont.—The Bd. of Control has decided to confer with the Medical Health Officer and City Engr. to see if they cannot be got to agree upon some system of sewage disposal.

Montreal, Que.—Local press reports state that the contract for extending St. James St. sewer has been awarded to Mony & Co., at $33.74 a yd.; $8,000 to be spent on the work this fall.

Cienfuegos, Cuba.—See "Water."

BRIDGES.

Boston, Mass.—City Engr. Wm. Jackson estimates the cost of constructing a bridge at Wordsworth St., East Boston, at $4,500.

Springfield, Mass.—Mayor Ellis has announced to the Board of Aldermen the appointment of Judge E. F. Lyford, Nathan D. Bill and Alderman Everett E. Stone as members of the Special Comn. to investigate the question of a proposed new bridge over the Connecticut River, the commission having been provided for in an order passed by City Council on Jan. 28.

Windsor Locks, Conn.—See "Railroads."

Woonsocket, R. I.—City Engr. Mills estimates the cost of building a new arch bridge over Blackstone River on S. Main St., at $36,300, and an ordinance appropriating this amount has been introduced in the Bd. of Aldermen.

Haverhill, Mass.—See "Electric Railways."

Allegheny, Pa.—It is stated that a new bridge has been planned across Ohio River between McKees Rocks and Woods Run, Allegheny. It will be built by the Western Bridge Co., a corporation formed by Pittsburg and Allegheny capitalists, and including in its membership officials of the Pittsburg Rys. Co.

It is stated that the Pennsylvania R. R. Co. has in contemplation the construction of a bridge from Herrs Island, the site of the new stock yards, over the back-channel of the Allegheny River to Allegheny, to connect the tracks on the island with the West Penn division. W. H. Brown, Ch. Engr., Philadelphia.

Scranton, Pa.—The Scranton Ry. Co. (E. D. Reed, Ch. Engr., Scranton) and the Delaware, Lackawanna & Western R. R. Co. (W. K. McFarlin, Ch. Engr., Hoboken, N. J.) are stated to have approved plans for the West Lackawanna Ave. viaduct, to cost about $80,000.

McKees Rocks, Pa.—The Engineering Dept. of the Pittsburg & Lake Erie R. R. is stated to have completed plans for a bridge across the McKees Rocks yards, to be known as the Island Ave. span; it will cost about $15,000. J. A. Atwood, Ch. Engr., Pittsburg.

Duryea, Pa.—The Grand Jury is stated to have recommended that $5,000 be appropriated to construct a bridge across Lackawanna River at Duryea. (Wilkesbarre, C. H.)

McKeesport, Pa.—The Dirs. of the Port Vue Bridge Co. at a meeting here Nov. 13 decided to make additional improvements to the bridge at a cost of about $5,000. Wm. P. Wampler, Pres.

Washington, Pa.—Bids are wanted Nov. 25 for constructing stone abutments for bridge in Deemston Boro.; also for bridge in East Finley Township over Rockey's branch of Wheeling Creek. W. G. Shillito, Chmn. of Co. Comrs., Cumberland, Md. Bids will be received Nov. 25 by the Com. on Streets and Alleys for constructing 3 steel beam and concrete bridges in this city. D. P. Le Fevre, City Engr.

Jamaica, L. I., N. Y.—The contract for building 3 steel bridges over the Long Island R. R. tracks at Washington, Prospect and Union Hall Sts. is stated to have been awarded to the Owego Bridge Co., Owego, N. Y., work to be competed May 1. The bridges will be 107 ft. long and 60 ft. wide, allowing for a 40 ft. roadway with two 10 ft. sidewalks. The entire work of the improvement, including excavation and laying of the 6 tracks from Jamaica station, through the village to Rockaway Junction, and the building of the bridges, will cost $100,000.

Berkley, Va.—The Superv. of Norfolk County and the Norfolk, Portsmouth & Newport News Consolidated Ry. Co. are reported to have under advisement plans to build a bridge across Piscara Creek at the terminus of the company's present line near the Union stock yards; probable cost, $5,000.

Tallahassee, Fla.—The Counties of Leon and Gadsden are stated to have agreed to build a bridge across the Ocklockonee River near Jacksons Bluff; a committee has been authorized to employ a civil engineer to prepare plans for the War Dept.

Des Moines, Ia.—Local press reports state that an effort is being made to secure an order for a viaduct over the Keokuk & Western R. R. tracks on what is known as the Bloomfield Road on the South Side. The viaduct and approaches would cost about $18,000.

Dayton, O.—City Engr. Frank M. Turner is reported to be preparing plans for 2 bridges over the Miami, one at 3d St. and the other at Stratford Ave. The one at 3d St. will be constructed first.

Rockford, Ill.—The Bd. of Superv. is said to be considering the construction of a 3-span bridge at South Beloit across Turtle Creek.

Peoria, Ill.—A resolution has been introduced in Council providing for the replacing of the low free bridge with a new structure.

Muscatine, Ia.—As no bids were received for the construction of the 4th St. foot-bridge across Mad Creek, the City Council is reported to have decided to do the work itself, and Alderman Duffield has been appointed to superintend its construction. The plans call for a 2 span 80 ft. bridge.

Washington, Ind.—The contract for erecting a bridge over the west fork of White River, joining Daviess and Knox Counties, is stated to have been awarded to the Indiana Bridge Co., Muncie, for $13,664.

Minneapolis, Minn.—Bids are wanted Dec. 1 for rebuilding bridge No. 120 over Bassett's creek in Golden Valley, bridge No. 126 on River Road in Brooklyn, and bridge No. 184 between Dayton and Hassan. Hugh R. Scott, Co. Aud.

Milwaukee, Wis.—The Council on Nov. 17 passed a resolution providing for the issue of $100,000 bonds for the Washington Ave. viaduct.

Unionville, Wis.—Bids will be received Dec. 2 by G. W. Dickson, Bridge Comr., for constructing a steel bridge across Shoal Creek, Lincoln Township.

Houston, Wis.—City Clk. R. S. Joslin writes that on Nov. 4 it was voted to construct a bridge across Lemouweir River, at a cost of $5,000.

Osceola, Mo.—Bids will be received Dec. 3 by W. A. Ingram, Co. Road and Bridge Comr., for constructing stone piers at the bridge to be erected over Big Monegan on the Taberville and Monegan road.

Chattanooga, Tenn.—Local press reports state that the Queen and Crescent Route will build a new and heavier bridge across Tennessee River, to replace the present bridge about 5 miles above this city. Geo. B. Nicholson, Ch Engr., Cincinnati, O.

Asher, Okla. Ter.—It is reported that preliminary soundings have been made for a steel toll bridge across the Canadian River at Asher, which a stock company proposes to construct.

Astoria, Ore.—A petition, asking that a special levy of 1½ mills be made for a period of 4 years for the purpose of constructing a drawbridge across Lewis and Clark River near its mouth, was presented to the County Comrs. The special levy will raise in the 4 years between $18,000 and $20,000.

Sheldon, Cal.—County Surveyor Boyd has submitted to the Bd. of Superv., Sacramento, plans and specifications for a bridge to cross Cosumnes River at Sheldon.

Sioux Falls, S. D.—The Co. Comrs. are stated to have ordered a 70-ft. steel bridge erected over the north end of Covell's Lake.

Victoria, B. C.—The following bids were opened Oct. 27 for constructing the steel superstructure of a bridge at Point Ellice; C. H. Topp, City Engr.: King Bridge Co., Cleveland, O., 6 55/100 cts. per pound weight; Canadian Bridge Co., Walkerville, Ont., 6 97/100 cts. per pound weight; Heenan & Froude, Manchester, Eng., 7 cts. per pound weight; Dominion Bridge Co., Montreal, P. Q., 6 54/100 cts. per pound weight; Victoria Machinery Depot Co., Ltd., Victoria (awarded), 6¼ cts. per pound weight; Puget Sound Bridge & Dredging Co., Seattle, Wash., for bridge and floor complete with concrete piers and abutments, $99,000.

PAVING AND ROADMAKING.

Woonsocket, R. I.—An ordinance has been introduced in the Common Council providing for an appropriation of $44,000 for highway purposes.

Haverhill, Mass.—See "Electric Railways."

Hartford, Conn.—Bids are wanted Nov. 26 for furnishing and laying the concrete base and sheet asphalt wearing surface of about 5,605 sq. yds. on Pearl St., as advertised in The Engineering Record.

Boston, Mass.—The following bids were opened Nov. 17 for constructing two sections of Columbia Road, one between I and Q Sts., S. Boston, the other between Buttonwood St. and the N. Y., N. H. & H. R. R. bridge, Dorchester, the roadway to be macadam on a telford base. For South Boston section—W. H. Ellis, $51,061; P. McGovern, $38,055; McGawley & Coughlan, $41,322.40; H. P. Nawn, $37,821; J. J. Sullivan, $74,021. Contract awarded to H. P. Nawn, of Boston, whose bid on items was: Removing trees, $50; earth excavation and sub-grading, 24 cts. per cu. yd.; gravel, $1 per cu. yd.; edgestones, 17 cts. per lin. ft.; telford base, 33 cts. per sq. yd.; 4-in. macadam, 17 cts. per sq. yd.; 9-in. macadam, 24 cts. per sq. yd.; flagging, $2.25 per sq. yd.; brick paving, 35 cts. per sq. yd.; gutter paving, 55 cts. per sq. yd.; 5-in. crushed stone sidewalk, 17 cts. per sq. yd.; 4-in. crushed stone sidewalk, 16 cts. per sq. yd.; loam, $1.15 per cu. yd.

For the Dorchester section—W. H. Ellis, $10,323; J. J. Sullivan, $18,267; Edw. J. Hayden, $25,962; McGawley & Coughlan, $12,288; H. P. Nawn, $10,496; W. J. Berry, $10,430; P. Doherty, $9,748 (contract awarded).

Bids will be received Nov. 26 by Jas. Donovan, Supt. of Streets, for constructing a macadam road on portions of Lindsey St.

Buffalo, N. Y.—Bids were opened Nov. 14 by the Bd. of Pub. Wks. for paving and repaving portions of several streets, the lowest bids being as follows: A, H. P. Burgard, Buffalo; B, Barber Asphalt Paving Co., Buffalo; S. Division St., 2,677 sq. yds., A, $8,000 for stone, and $5,948 for brick; B, $4,149 for asphalt. S. Division St. (another section), 2,704 sq. yds., A, $4,000 for asphalt, and $8,700 for stone; B, $6,706 for brick. 17th St., 1,283 sq. yds., A, $1,900 for asphalt, and $4,000 for stone; B, $3,284 for brick. Niagara St., 7,268 sq. yds., A, $11,000 for asphalt, and $23,500 for stone; B, $17,807 for brick. Willow Place, 873 sq. yds., A, $3,000 for stone, and $2,500 for brick; B, $2,244 for asphalt.

The Bd. of Aldermen has directed Col. Francis G. Ward, Comr. of Pub. Wks., to prepare plans, at a cost not to exceed $1,000, for the proposed elevated roadway along Hamburg turnpike to the city line.

York, Pa.—The Common Council has passed the ordinance providing for the paving with macadam of Biddle St.

Milton, Pa.—At an election to be held Feb. 17 a vote will be taken on the proposition to issue $12,000 bonds for the purchase of a stone crusher and steam roller.

Albany, N. Y.—It is estimated by the State Engr.'s Dept. that by the time the next Legislature is ready to make an appropriation for good roads, the County Boards of Supervisors shall have adopted plans for roads calling for an aggregate expenditure of $4,000,000. The State's share of this expense would be $2,000,000.

Newark, N. J.—The Bd. of Health in a communication to the Bd. of Pub. Wks. has recommended that Campbell St. be paved with either granite block or asphalt.

Binghamton, N. Y.—Broome Co. Bd. of Supervisors adopted final resolutions for several good roads appropriating $37,775 therefor.

Brooklyn, N. Y.—Ch. Engr. Tillson in a recent report to the Boro. Pres. on the proposition to widen Livingston St. from Flatbush Ave. to Court St. places the estimated cost at $1,800,000. Mr. Tillson recommends that 60 ft. be added to the present width of the street.

New York, N. Y.—The following bids were opened Nov. 18 by Geo. Livingston, Comr. Pub. Wks., Manhattan, for repaving with asphalt on present pavt. relaid as foundation 116th St., from Ave. A to Morningside Ave.: A, Asphalt Constr. Co.; B, Barber Asph., Pavg. Co.; C, Century Constr. Co.; D, Continental Asph. Pavg. Co.; E, Sicilian Asph. Pavg. Co.:

Bidders.	Asph., 31,400 sq. yds.	Old pavt. relaid, 8,550 sq. yds.	Concrete, 2,825 cu. yds.	New curb, 5,670 ft.	Old curb reset, 8,504 ft.	Manhole covers, 20.
A............	$1.25	$0.30	$5.50	$0.85	$0.25	$6
B............	1.17	.40	4.80	.80	.37	20
C............	1.39	.30	5.00	.82	.33	20
D............	1.25	.32	5.50	.70	.30	20
E............	1.10	.20	4.90	.80	.30	17

Silver Lake, N. Y.—A. J. Strange, Asst. Engr., Richmond County Park Comrs., New Brighton, N. Y., writes that the following bids were opened Nov. 17 by said Comrs. for furnishing labor and material for constructing road in Silver Lake Park, containing approximately 8,285 yds. of 12-in. telford and macadam and 3,115 sq. yds. of 6-in. macadam: Jos. Johnson, West New Brighton, S. I., N. Y., $16,372; E. K. Whitford, Port Richmond, N. Y., $16,798; A. R. Gold, Tompkinsville, S. I., N. Y., $14,500 (awarded).

Syracuse, N. Y.—The following bids were opened Nov. 17 for paving portions of Warren and Willow Sts.: F. J. Saker, Syracuse, (brick), $7,160; Empire Contracting Co., Syracuse (asphalt), $6,209.

Colwyn, Pa.—See "Sewerage and Sewage Disposal."

Pittsburg, Pa.—The Council on Nov. 17 passed a resolution appropriating $40,000 for repaving N. Negley Ave. and $9,500 for Stanton Ave.

New York, N. Y.—Bids will received Dec. 2 by Jacob A. Cantor, Boro. Pres., for regulating, grading and repaving the roadway of 7th Ave. from 110th St. to 120th St. Engineer's estimate calls for 23,650 sq. yds. of bituminous macadam pavement, 800 lin. ft. new curbstone, and 4,300 lin. ft. old curbatoue.

Baltimore, Md.—Bids are wanted Dec. 3 to grade, curb and recurb where necessary and pave with vitrified brick portions of Northwest St. B. T. Fendall, City Engr.; Thos. G. Hayes, Pres. Bd. of Awards.

Gloversville, N. Y.—City Engr. Morrell Vrooman writes that about 17,000 sq. yds. of macadam and about 8,000 sq. yds. of vitrified brick pavement will be done by contract during the coming year.

Savannah, Ga.—The City Council has adopted the ordinance providing for a vitrified brick pavement on 36th St.

Charlottesville, Va.—R. W. Duke, Clk. of the Corporation Court, writes that the proposition to issue $80,000 bonds for street improvements was defeated at the election held Nov. 4, but that another election will be held Dec. 17 to vote on this proposition.

Evanston, Ill.—A petition has been presented to the Bd. of Local Improvements for paving Dempster St., between Ridge and Dodge Aves., with granite-top macadam; work will probably be ready for letting by May 1, 1903. John H. Moore, City Engr.

Weston, O.—Town Clk. F. A. Henderson writes that on Nov. 4 it was voted to macadamize the roads of Weston Township.

Iowa City, Ia.—Engr. Magowan estimates the cost of paving Linn St. as follows: 11,690 sq. yds. of brick paving at $1.60 per sq. yd., 4,413 ft. of curbing at 50 cts. per ft., with storm-water inlets, etc.; total, $23,331.

Kalamazoo, Mich.—Comrs. of Pub. Improv. John J. Knight and O. K. Buckhout, with Engr. Geo. S. Pierson, have been inspecting various kinds of paving with a view to letting contracts for paving in this city in the near future.

Cincinnati, O.—City Engr. Stanley estimates the cost of paving with brick on Dorsey St. at $13,586.

A petition has been filed with the Bd. of Pub. Service asking that a portion of 5th St. be paved with asphalt.

Toledo, O.—According to local press reports the lowest bids received for paving Front St. were as follows: Bodette & McMahon, brick on sand, Athens block, at $23,176; also brick on concrete, Athens block, at $33,568. C. H. Burchinal, for asphalt block on concrete at $52,453, and for asphalt block on sand, $45,429; Harry Jennison, for Medina block on sand, at $52,429.

Grand Rapids, Mich.—The City Engr. estimates the cost of asphalt block paving on a concrete foundation, with 5-year guarantee for Wealthy Ave., at $65,243; cost with 10-year guarantee, $73,296; for sheet asphalt with 2-ft. concrete gutter and 10-year guarantee for said street, the estimated cost is $55,303, and for brick block paving on concrete the cost is estimated at $48,511.

Red Oak, Ia.—The City Council has approved 4 ordinances for paving.

St. Paul, Minn.—Property owners will ask the city to bear a portion of the expenses of paving W. 7th St. from Ft. Snelling to St. Paul. Total cost to be about $76,000.

Milwaukee, Wis.—The Common Council on Nov. 17 passed the ordinance appropriating $225,000 for permanent street improvements.

Marion, Ia.—Street improvement bonds to the amount of $10,000 are reported to have been authorized.

Green Bay, Wis.—Bids are wanted Dec. 11 for improving streets. W. L. Kerr, City Clk.

St. Joseph, Mo.—A plan is said to be under consideration for the paving with asphalt of all the unpaved streets of the city.

Nashville, Tenn.—According to local press reports this city has purchased from the Warren Bros. Co., for $8,000, the bituminous macadam plant erected in Nashville to fill contracts with the city.

Louisville, Ky.—The Bd. of Pub. Wks. is reported to have awarded to Lee Figg and Geo. W. Gosnell, the lowest bidders, contracts for vitrified brick paving in portions of Castlewood Ave., Greenwood and other streets, in all amounting to about $40,000; the average price per sq. yd. being $1.37.

Beaumont, Tex.—At the recent election it was voted to issue $95,000 paving bonds, in addition to the $125,000 now being expended by the City Council in street improvements.

Dallas, Tex.—Plans are said to have been prepared for the repaving of Main St. from Ervay St. to Exposition Ave. with asphalt.

Oakland, Cal.—The City Engr. has submitted plans for the improvement of San Pablo Ave. from 14th to 36th Sts., and the estimated cost is placed at $106,000; plans have also been submitted for the making and fitting up of the park between 8th and 12th Sts., and the improvement of 8th St. south of the park, at an estimated cost of $145,000.

POWER PLANTS, GAS AND ELECTRICITY.

Holyoke, Mass.—The Bd. of Aldermen on Nov. 18 passed an ordinance authorizing the issue of $720,000 bonds to cover the purchase of the municipal lighting plants.

Buffalo, N. Y.—The Council is reported to be in favor of constructing a municipal gas plant.

Binghamton, N. Y.—The Chmn. of the Bd. of Superv. is about to appoint a committee to consider the question of installing a heating and lighting plant for the County Buildings, at a cost of $20,000.

Phoenixville, Pa.—It is stated that the Schuylkill Valley Illuminating Co. will begin at once the erection of a power plant at Cromby, one mile north of Phoenixville. J. W. Gillette is the Engr. who will superintend the building of the plant. W. D. Jones, Supt., Phoenixville.

Easton, Pa.—The City Council is stated to have granted franchises to the People's Steam Heat & Power Co. and to the Phillipsburg & Easton Conduit Co.

Mifflinburg, Pa.—Town Clk. F. M. Getgen writes that on Nov. 4 it was voted to issue $6,000 bonds for the construction of an electric-light plant for the Boro.

Kenmore, N. Y.—This village is about to install a gas distribution system and has awarded the contract for furnishing pipe, valves and fittings to the Darling Pump & Mfg. Co., Ltd., of Williamsport, Pa. Kenmore is to get its supply of gas from the Niagara Light, Heat & Power Co., of Tonawanda, N. Y., with whom it has a contract for 5 years. John B. Winter, of Buffalo, was the lowest bidder for laying the pipe, but the Bd. of Trns. has not yet awarded this contract.

Oneida, N. Y.—The Bd. of Pub. Wks. is stated to have received on Nov. 11 only 1 bid for lighting the streets for the next 2 years, and this was from the Madison County Gas & Electric Co. On the first proposition, that of furnishing 100 1,200-c. p. lamps, 30 to burn all night every night, the company bid $6,500. On the second, with the same number of 2,000-c. p. enclosed arc lamps, $7,160, and on the third, providing for all all-night lamps, $7,350.

Penngrove, N. J.—See "Water."

Yardville, N. J.—Chas. A. Camp and C. A. Budd, of Yardville, and Augustus Wolf, of Chambersburg, Pa., are stated to have secured a charter from the Sec. of State for the Yardville Electric Heat, Light & Power Co., with a capital of $25,000.

Altoona, Pa.—W. H. Herr is stated to have secured the contract for constructing the power plant at 9th Ave. and 20th St., for the Citizen's Electric Light, Heat & Power Co., for $11,490.

Baltimore, Md.—The contract for naphtha lighting is stated to have been awarded to the American Lighting Co. for 3 years at $23.45 per lamp per year.

A press report states that the purchase of the $2,000,000 of common stock of the United Electric Light & Power Co. from the United Rys. & Electric Co. by a syndicate acting through the Continental Trust Co., was concluded Nov. 15. The purchase of the control of the light and power compnay practically assures the Susquehanna River electric power development by the syndicate. There are to be 3 developments that will cost between $10,000,000 and $12,000,000, and 2 years will be required to complete the work, the purpose being to supply motive power for the street railway system of Baltimore, to supply electricity for lighting the streets and for general power and heating purposes.

York, Pa.—The Boro. Council of North York is stated to have granted the Merchants' Electric Light Co. permission to extend its pole line to North York. C. H. Bear, Pres.

Philadelphia, Pa.—Bids are wanted Dec. 20 for furnishing engines, generators, boilers, etc., for a complete electrical power plant for the Frankford Arsenal. Maj. Frank Heath Commanding.

Brooklyn, N. Y.—Bids were opened Nov. 20 for the completion of the central power plant for the Brooklyn Inst. of Arts and Sciences, as follows: Thos. Dwyer, $94,700; Thos. Cockerill & Son, $89,500; P. J. Carlin & Co., 26 Court St., $78,693.

Macon, Ga.—The Macon Ry. & Light Co. is stated to have secured the contract for lighting the city at $75 per light per year for 150 arc lights, 450 volts, 2,000 c. p.; all over that number, $72.50 each. Incandescent lights 15 cts. per Kw. hour, and for power 13½ cts. per Kw. hour.

Miami, Fla.—John B. Reilly is reported interested in the construction of an electric-light plant.

Barlow, Fla.—The citizens are stated to have voted to issue $15,000 bonds for an electric-light plant.

Cheraw, S. C.—The Council is reported to be considering the question of electric lighting.

Detroit, Mich.—The Lighting Comn. is stated to have awarded to the Bradley Mfg. Co., of Pittsburg, Pa., the contract for the engine for the power plant, at $14,600. The Stanley Electrical Co., of Pittsfield, Mass., secured the contract for the generator and exciting dynamo at $900, and the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., the contract for the switchboard, instruments, and switches at $2,150.

Woodmere, Mich.—The Welsbach St. Lighting Co. is stated to have petitioned the Council for a franchise to light the streets of the village for a term of years.

Waterloo, Ia.—It is reported that the Council will secure estimates of cost of constructing an electric-light and gas system.

Canton, O.—The Metropolitan Paving Brick Co., W. E. Keplinger, Pres., writes: "We are in the market for an electric apparatus to operate about ¾ of a mile of tram-road, and also intend to light two of our plants by electricity."

St. Paul, Minn.—Bids will be received Dec. 2 by Matt Jensen, City Clerk, for lighting certain streets of the city with electricity, gas and gasoline.

St. Charles, Mich.—Village Clk. Jos. E. Brownell writes that bids will be opened Dec. 1 to construct an electric light plant estimated to cost $1,500. E. V. Parsons, Engr. in Charge.

Mankato, Minn.—City Engr. J. R. Thompson writes that on Nov. 7 the Council received the following bids for street lighting, for 1, 3 and 5 years respectively—*a*, every and all-night schedule; *b*, Philadelphia schedule: Mankato Gas & Electric Light Co., 65 or more 2,000 c. p. arcs, *a*, $105, $92 and $88, for 1, 3 and 5 years respectively; *b*, $84, $72 and $68; 100 or more 32 c. p. incandescents, *a*, $30, $28 and $29; *b*, $22, $20.50 and $20. American Development Co., 50 or more 1,000 c. p. lamps, *a*, $72, $71 and $70 for 1, 3 and 5 years respectively; *b*, $62, $61 and $60; 100 or more 60 c. p. lamps, *a*, $31, $30 and $29; *b*, $27, $26 and $25. The contract was awarded on Nov. 14 to the American Development Co., of St. Paul, for 1 year from Dec. 1, 1902. The Council will probably use about 25 of the 1,000 c. p. lamps at first and more of the 60 c. p.

Muscatine, Ia.—It is reported that Harry E. O'Neill, of Ottumwa, is about to submit a proposition to Council for the establishment of an electric light plant.

Waterloo, Ia.—The City Council is reported to have authorized the Committee on Light to investigate the cost of constructing a gas and electric plant to be owned and operated by the city.

Quincy, Ill.—Bids are wanted Nov. 26 for furnishing 336 electric arc lights, and lighting the streets of said city for a period of 3 years. Gottlieb Schanz, Chmn. Light Com.

Toledo, O.—The East Toledo Htg. & Light Co. is reported organized by L. E. Flory, F. E. McCory and others, to furnish heat and light in East Toledo.

Kewanee, Ill.—The Lighting & Htg. Co. of Kewanee has been incorporated with a capital of $50,000 to operate light, heat and power plants. Incorporators: X. Caverno, B. C. Parkinson and Jas. Nakes.

Pascagoula, Miss.—See "Water."

Linneus, Mo.—The citizens are stated to have voted on Nov. 10 to issue bonds for an electric-light plant and a public park.

Yazoo City, Miss.—See "Water."

Farmington, Mo.—The Laufketter-Bendit M. E. Co. of St. Louis, Mo., has been retained as consulting engrs. for the Farmington Electric Light & Ice Co., of Farmington, to remodel its electric-light and ice equipment. This Co. has been thoroughly reorganized, and will shortly be in the market for engines, generators, boilers, etc.

Nashville, Tenn.—See "Electric Railways."

Lawrenceburg, Tenn.—See "Water."

Tacoma, Wash.—R. G. Hudson and D. A. Worden are reported interested in the construction of a steam-heating and power plant, to cost about $50,000.

Havre, Mont.—See "Water."

Richmond, Cal.—The Richmond Light & Power Co. is reported incorporated, with a capital of $150,000, by W. A. Bissell, Walter P. Treat, and others, to furnish light and power in Richmond and other towns in Contra Costa County.

Ritzville, Wash.—See "Electric Railways."

Ord, Neb.—Jas. Barta is stated to have secured a franchise for an electric light plant.

ELECTRIC RAILWAYS.

Greenfield, Mass.—A charter is stated to have been granted to the Greenfield, Deerfield & Northampton St. Ry. Co., with a capital of $20,000. Directors: J. B. Bridges, W. W. Sanderson, and others.

Haverhill, Mass.—The Aldermen are stated to have granted the Haverhill & Southern New Hampshire St. Ry. Co. a location from Winter through Locust and Granite Sts. to the Boston & Maine depot. The company will build a stone arched bridge on Locust St. over Little River and block pave Granite St. at a cost of $7,000. F. Woodman, Mgr., Haverhill.

Waltham, Mass.—The Newton St. Ry. Co. is stated to have petitioned the Aldermen for a franchise to extend its tracks up Main St. to the western line. The company is also reported to have decided to extend its line through Weston Junction to Concord.

Winchester, Conn.—Henry W. Soule, of Tollard, Mass., is reported interested in the construction of an electric railway through Winchester and Colebrook, Conn., and Tolland, Sandisfield, Otis, Becket, and Lee, Mass.

Derby, Conn.—The Bd. of Aldermen is stated to have granted permission to the Fair Haven & Westville Co. (L. A. Farnham, Ch. Engr., New Haven) and the Connecticut R. R. & Lighting Co. (J. E. Sewell, Gen. Mgr., Bridgeport) to complete the extension from New Haven to Derby.

Newport, R. I.—The City Council is stated to have granted a franchise to the Newport & Bristol Ferry Ry. Co. to lay rails and operate cars in Newport.

Trenton, N. J.—It is stated that the Trenton St. Ry. Co. will soon install in its power house on Lincoln Ave. a $1,500 H.-P. engine and dynamo. H. C. Moore, Mgr., Trenton.

Duncannon, Pa.—The Perry County St. Ry. Co. is stated to have secured a right of way in Duncannon.

Pennington, N. J.—The Trenton, Pennington & Hopewell Traction Co., which is a branch of the Trenton St. Ry. Co., is stated to have secured a franchise from the Hopewell Township Com. to construct a trolley road through Pennington.

Bellwood, Pa.—Judge M. Bell is stated to have granted the Logan Valley Ry. Co. permission to construct an electric railway in Bellwood.

Odessa, Del.—The Town Council is stated to have granted a franchise to A. E. Tennis, of Philadelphia, Pa. The company he represents proposes constructing a line between Odessa and Middletown.

Syracuse, N. Y.—The Rapid Transit Ry. Co. has petitioned the Council for a franchise to extend the University line through S. Crouse Ave. and University Pl. to connect with the present tracks in Walnut Ave. C. F. Stierly, Ch. Engr., Syracuse.

McKeesport, Pa.—It is stated that the Pittsburg Rys. Co. will expend about $25,000 in improvements in McKeesport. F. Uhlenhaut, Ch. Engr., Pittsburg.

Pittsburg, Pa.—The Morningside St. Ry. Co. is stated to have petitioned the Council for a franchise. The company proposes to construct a line from Stanton Ave. and Negley to connect with the lines of the Pittsburg Rys. Co. on Butler St.

Murrysville, Pa.—A company is reported incorporated to construct a street railway from Trafford City to Murrysville, a distance of about 7 miles. W. S. McClure and Calvin Good, of Murrysville, are reported interested.

West Grove, Pa.—The West Chester St. Ry. Co. is stated to have secured a franchise from the Boro. Council. C. V. Mills, Supt., West Chester.

Wilmington, Del.—The St. and Sewer Dept. is stated to have granted the Union Ry. Co. permission to extend its 2d St. line.

New York, N. Y.—The contract for the construction of that part of the Brooklyn branch of the subway system from Bridge St., in Manhattan, under the East River, to a point near Clinton St., in Brooklyn, has been awarded by the Rapid Transit Subway Construction Co. to Andrew Onderdonk, 80 B'way.

Youngstown, O.—It is stated that the Youngstown & Southern Ry. Co., which is about to build an electric line from Youngstown to Columbiana proposes extending the line across Columbiana County to connect Columbiana, Leetonia, Salem, Lisbon, and East Liverpool. Gen. Asa W. Jones, John H. Ruhlman and J. E. Long, of Youngstown, are reported interested.

Boonville, Ind.—The Evansville, Boonville & Rockport El. Ry. Co. is stated to have secured a right of way in Warrick County.

Honeycreek, Ind.—The directors and stockholders of the Southern Indiana Ry. Co. are stated to have decided to build an extension known as the Terre Haute Belt line, from Honeycreek; also, to build branch roads in the counties of Clay and Vigo, none to exceed in length 50 miles.

Newcastle, Ind.—The Town Bd. is stated to have granted a franchise to the Indianapolis & Eastern Interurban Electric Ry. on Main St., from Bway, south. The line will be built from here to Dunreith, where it will connect with the main line.

Urbana, O.—The Champaign Co. Comrs. are stated to have granted a franchise to the Urbana, Bellefontaine & Northern Traction Co., and an extension of 7 months' time in which to complete the electric road between Urbana and West Liberty.

Winton Place, O.—The Council is stated to have granted the Cincinnati Traction Co. permission to make extensions through the eastern part of the village. J. R. Welzenecker, Ch. Engr., Cincinnati.

Chicago, Ill.—The Judiciary Com. of the Co. Bd. is stated to have recommended for passage an ordinance granting the Chicago, Milwaukee Ave. & Inland Lakes Traction Co. permission to construct and operate a trolley line on Milwaukee Ave. from the city limits to the Cook County line.

East Liverpool, O.—The Columbiana Central Electric Ry. Co. has been incorporated with a capital of $10,000 to construct and operate an electric railway from East Liverpool, through Lisbon to Salem, O. Incorporators: E. J. Miller, D. J. Ryan, and others. Headquarters of the company is at Columbus.

Cincinnati, O.—The Bd. of Pub. Service is stated to have granted the Cincinnati Traction Co. permission to extend the Gilbert Ave. and East End Routes. J. R. Welzenecker, Ch. Engr., Cincinnati.

Shawano, Wis.—The City Council is stated to have granted the Shawano & Green Bay Traction Co. a franchise through Shawano.

Sparta, Ill.—J. E. Wilson is stated to have petitioned the City Council for a franchise to construct and operate a street railway in Sparta.

Paoli, Ind.—The Town Council is stated to have granted a franchise to the New Albany, Paoli & French Lick Traction Co.

Wabash, Ind.—The Council has granted a franchise to Henry Law, to build an electric railway to Marion; also a franchise to the Rochester & Wabash El. Ry. to build to Rochester.

Mankato, Minn.—U. P. Hord, of Aurora, Ill., and F. G. Keator, of Chicago, Ill., are stated to have petitioned the Council for a franchise for a street railway through the city on the principal business streets.

Pascagoula, Miss.—S. S. Bush, of Louisville, Ky., is reported interested in the construction of an electric railway between Pascagoula and Moss Point.

Newton, Kan.—It is stated that the Union Electric Ry. & Construction Co., of Wichita, has petitioned the Harvey Co. Comrs. for a right of way for an electric railway it proposes constructing between McPherson and Arkansas City.

Louisville, Ky.—The directors of the Louisville Ry. Co. are stated to have decided to build an electric railroad from Louisville to Jeffersontown. F. M. Miller, Ch. Engr., Louisville.

Oklahoma City, Okla. Ter.—The Oklahoma Traction Co., of Oklahoma City, has been incorporated, with a capital of $2,000,000, to construct and operate a railway from Guthrie via Oklahoma City to Ft. Reno, a distance of 75 miles. Incorporators: John Shartel and M. L. Spitlock, of Oklahoma City; U. C. Guss, of Guthrie, and others.

Guthrie, Okla. Ter.—The Guthrie Light & Traction Co., of Guthrie, has been incorporated, with a capital of $500,000, to construct an electric railway in Guthrie. Incorporators: John Shartel, Oklahoma City; F. H. Greer and W. H. Mertens, of Guthrie.

Nashville, Tenn.—The new owners of the Nashville Ry. are stated to have drawn up plans calling for the expenditure of $2,379,000 on the street railway and electric-light plant, the latter being also owned by the same men.

Ritzville, Wash.—Col Lunceford and P. R. Clark, of Ritzville, are stated to have petitioned the Adams Co. Comrs. for a franchise for the construction of an electric railway and the transmission of electric power.

San Francisco, Cal.—The San Francisco, Oakland & San Jose Electric Ry. Co. has been incorporated, with a capital of $5,000,000, to construct an electric railway from San Francisco to Oakland, Haywards, San Jose, Santa Clara and Los Gatos, a total distance of 93 miles. Directors: F. M. Smith, F. C. Havens, E. C. Hearon, and others.

Santa Cruz, Cal.—The Superv. are stated to have granted Fred W. Swanton a franchise to construct an electric railway from Santa Cruz to Capitola.

Vallejo, Cal.—It is stated that bids will be received by the Clk. of Co. Superv. Jan. 2 for the purchase of an electric road franchise along certain roads in Suisun, Green Valley, Vacaville and Silveyville Townships. J. W. Hartzell has petitioned for the franchise.

RAILROADS.

Windsor Locks, Conn.—A press report states that the New York, New Haven & Hartford R. R. Co. has begun preliminary steps for extensive improvements and changes in its roadbed, whereby the road between this place and Springfield will be shortened about ½ mile and a dangerous curve eliminated. The plans include the erection of a steel bridge across Connecticut River, between Windsor Locks and Enfield. The improvements will probably cost, it is said, about $1,000,000. C. M. Ingersoll, Jr., Ch. Engr., New Haven.

Philadelphia, Pa.—Local press reports state that $200,000,000 will be spent by the Pennsylvania R. R. and the companies which are parts of the Pennsylvania system, during the next 2 years, in improving and requipping the trunk lines and branches, building new tunnels, etc. W. H. Brown, Ch. Engr., Philadelphia.

Waynesburg, Pa.—A corps of engineers of the B. & O. R. R. Co. are about to commence surveying for a line to be constructed from Waynesburg to Uniontown, through the Connellsville coke region. J. M. Graham, Ch. Engr., Baltimore.

West Brownsville, Pa.—A charter has been granted to the Pennsylvania, Monongahela & Southern R. R. Co. to build a link from West Brownsville, on the Pittsburg, Virginia & Charleston, to a point near the mouth of Little Whiteley Creek, Greene County; total distance about 22 miles. Jas. Neale and others interested in Brown & Co., Iron Mfgrs., of Pittsburg, are reported interested.

Ronceverte, W. Va.—It is stated that surveys have been made for a railroad to run from Ronceverte to Lewisburg, W. Va., 6 miles distant. Dabney C. T. Davis, Jr., Pres., Lewisburg.

Richmond, Va.—The Chesapeake & Western R. R. Co. is stated to have received permission to increase its capital from $1,000,000 to $2,700,000. The promoters intend soon to build eastwardly to deep water on Chesapeake Bay. E. H. Jackson, Gen. Supt. Harrisonburg, Va.

Ashland, Ky.—The Kentucky & West Virginia R. R. Co. is stated to have completed a survey from Ashland up the Rockcastle valley to Inez, and embracing the Elkhorn coal regions.

Geneva, Ala.—A charter has been granted to the Geneva R. R. Co., with a capital of $100,000, to build and operate a line from Geneva to Chancellor to connect with the Central of Georgia's Chattahoochee and gulf branch; the distance is 11 miles. Incorporators: W. W. Barnett, J. J. Morris and others.

Guthrie, Okla. Ter.—The City Council is stated to have granted the Denver, Enid & Gulf R. R. Co. a right of way through West Guthrie.

The Central Oklahoma Union Depot & Terminal R. R. Co. has been incorporated, with a capital of $5,000,000, to erect union depots at Guthrie and Oklahoma City, and construct belt lines in these cities and to build 150 miles of railroad in Central Oklahoma.

Ashdown, Ark.—It is reported that the Arkansas & Choctaw R. R. Co. will extend its line from Ashdown to Lawton, Okla. Ter. F. W. Valliant, Ch. Engr., Rocky Comfort, Ark.

Little Rock, Ark.—The Arkansas, Red River & Paris R. R. Co. has been incorporated, with a capital of $266,000, to construct a railroad about 38 miles in length. Directors: W. A. Carroll, Nena; A. D. Moon and W. S. Pryor, of Kansas City, Mo., and others.

Articles of incorporation have been filed with the Sec. of State by the Arkansas, Red River & Paris R. R. Co., with a capital of $266,000, to construct a railroad from Morris Ferry, in Little River County, westward into Ind. Ter., to Harris Ferry, on Red River, a distance of 38 miles. Directors: W. A. Carroll, Mena, Ark.; A. D. Moon and W. S. Pryor, Kansas City, Mo., and others.

Piggott, Ark.—The Piggott & Northwestern R. R. Co. has been incorporated, with a capital of $50,000 to construct a railroad from Piggott to the Cache river bottom, a distance of about 12 miles. Directors: F. G. Taylor, Jonesboro; J. M. Myers, R. J. Goeppinger and others, of Piggott.

England, Ark.—The England Clear Lake R. R. Co. has been incorporated, with a capital of $30,000, to construct a railroad from a point in Lonoko Co. to Lasters Landing, a distance of about 9 miles. Directors: J. E. Hicks, N. B. Beakley and others.

Durham, Cal.—The Butte Co. Superv., at Oroville, are stated to have granted the Diamond Match Co. a franchise to construct a railroad from its timber holdings on Magalia ridge to Durham.

PUBLIC BUILDINGS.

Boston, Mass.—Bids will be received Nov. 28 by the Trus. of the Mass. Hospital for Epileptics, at the office of Kendall, Taylor & Stevens, Archts., 93 Federal St., for heating and plumbing of Nurses' Home, now being erected at Monson, for the above institution, and for steam piping and connections for an electric building at the same place. Wm. M. Bullard, Chmn.

Boston, Mass.—Bids will be received Nov. 26 by the Boston Transit Comn. for building the foundations for the columns, erecting the columns and constructing part of roof of Old State House station of East Boston Tunnel. Geo. G. Crocker, Chmn.

New York, N. Y.—John J. Deery, Betz Bldg., Philadelphia, Pa., is stated to have been selected to prepare plans for a church and rectory to be erected on 67th St. and Amsterdam Ave. for St. Matthews R. C. Church, to cost about $120,000.

A permit has been issued for a 3-story brick hospital to be erected on Blackwells Island opposite 54th St., to cost $30,000. Architects, York & Sawyer, 156 5th Ave.

Bids will be received Dec. 3 by the Bd. of Health for furnishing and erecting all the materials necessary or required to complete the alterations, additions and repairs to the stable building, and for erecting 2 porte cocheres, a solarium and an inclosed fire escape to pavilion No. 1 at the Riverside Hospital, North Brother Island, Boro. Bronx.

Brooklyn, N. Y.—Bids will be received Dec. 3 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and erecting 3 underground public comfort stations, at the junctions of Division Ave. and B'way, Fulton and Joralemon Sts., and Fulton St. and Flatbush Ave.

The following bids were opened Nov. 19 by Wm. C. Redfield, Comr. Pub. Wks. for general repairs and alterations to interior of Borough Hall: Chas. Wille, $28,000; W. & T. Lamb, $29,100; Thos. Dwyer, $31,730; Danl. J. Ryan, 723 3d Ave., Brooklyn, $27,600.

Bernardsville, N. J.—The Public Library Trus. are stated to have purchased a site for the erection of a $20,000 library.

Allegheny, Pa.—It is stated that the Congregation of the Central Presbyterian Church will erect a $30,000 edifice.

Buffalo, N. Y.—Carl Schmill, 97 E. Utica St., is reported to have prepared plans for a $100,000 church to be erected on Kent and Clark Sts. for the Parish of Corpus Christi.

Washington, D. C.—The congregation of the Foundry M. E. Church are stated to have approved the plans of Appleton P. Clark, Jr., 605 F St. n, w., for the new edifice to be erected on 16th and Madison Sts., to cost $120,000.

Scranton, Pa.—Bids are wanted Dec. 19 for the erection and completion of a group of buildings for the almshouse to be erected at Hillside Home, near Clark's Summit, Pa., as advertised in The Engineering Record.

Binghamton, N. Y.—Bids are wanted Dec. 2 for erecting a detention hospital, including heating and plumbing. A. W. Reynolds, Archt. I. C. Hull, City Clk.

Atlanta, Ga.—Geo. Foster Peabody has offered to present to the State Univ. a new fireproof library, to cost not less than $50,000, providing the Legislature will appropriate to the University for maintenance the sum of $10,000 a year for two years; also enough money to construct an annex to the old library.

Cleveland, O.—The contract for furnishing and installing a steam-heating system in the engine house of the Kirtland St. pumping station has been awarded to Chafer & Becker, of Cleveland, at $1,372.

Vinton, Ia.—M. M. Hall, of Cedar Rapids, is stated to have secured the contract for erecting the Carnegie Library, for $12,000.

Centerville, Ia.—The citizens of Appanoose County are stated to have voted to erect a $75,000 court house.

Denison, Ia.—The citizens of Crawford County are stated to have voted to erect a $75,000 court house.

Manitowoc, Wis.—A resolution is stated to have been introduced in County Council providing for the erection of a court house for Manitowoc County, to cost $100,000.

Chicago, Ill.—Local press reports state that a new hospital to be called "The Shore Inn" will be erected on Michigan Ave. and Eldredge Court, to cost about $400,000. Dr. Franklin H. Martin and Dr. Bertram W. Sipply are among the physicians interested.

Tipton, Ia.—M. M. Hall, of Cedar Rapids, is stated to have secured the contract for erecting the Carnegie Library, for $11,924.

Lincoln, Ill.—Co. Clk. N. F. Beidler writes that on Nov. 4 it voted to levy taxes amounting to $150,000 for the construction of a court house.

Kansas City, Mo.—The University Hospital is about to erect a $30,000 brick hospital at 1005 Campbell St.

Oxford, Miss.—Bids are wanted Nov. 27 for erecting a dormitory and addition to the Lyceum Bldg. of the Univ. of Mississippi, on the Univ. grounds, near Oxford. T. C. Link, Archt., Jackson. R. B. Fulton, Chancellor.

Brookhaven, Miss.—The Superv. of Lincoln County are stated to have passed an order authorizing the issue of $20,000 bonds to build a new jail.

Lexington, Ky.—The Upper St. Baptist Church is reported to be preparing to erect a $25,000 edifice. Rev. W. D. Nolin, Pastor.

Beaumont, Tex.—The citizens on Nov. 11 are stated to have voted to issue bonds to the amount of $75,000 for school and $40,000 for a city hall, city prison and fire station.

Yankton, S. D.—The citizens of Yankton County are stated to have voted to issue $40,000 bonds for a court house.

Santa Cruz, Cal.—A site is stated to have been selected for the erection of a $20,000 Carnegie Library.

Los Angeles, Cal.—It is stated that plans are about completed, and contracts will soon be let, for the erection of the Santa Fe Hospital on Boyle Heights, to cost about $100,000.

Martinez, Cal.—The citizens are stated to have voted to issue $70,000 bonds to complete the court house and $20,000 for erecting a new jail.

BUSINESS BUILDINGS.

Boston, Mass.—The Beacon Hill Trust, composed of Chas. R. Evans and Leslie C. Wead, is stated to have purchased a site at 13 to 15 Beacon St., and will erect on same a 10-story office building.

Brattleboro, Vt.—Holden & Martin, of Brattleboro, are the builders for a $30,000 factory to be erected for B. Souto & Co., of New York, N. Y. Architects, Barker & Nourse, of Worcester, Mass.

Boston, Mass.—Plans have been filed for a brick building, 44 x 85, to be used as a Turkish bath, and erected on Carver St. at a cost of $30,000. Owner, John Ritchie; Builder, J. A. Vickery & Son; Architect, Dwight & Chandler, 31 Beacon St.

New Kensington, Pa.—The Lalor Engineering Co., 1305 Arch St., Philadelphia, is stated to have completed plans and specifications and will take sub-bids until Dec. 10 for a new plant to be constructed at New Kensington, Pa., for the Westmoreland Boiler Co. The plant will include a foundry, 275x50 ft.; machine shop, 50x80 ft.; cleaning house, 50x30 ft.; boiler and engine house, 38x76 ft.; core house, 175x50 ft., and a storehouse, 40x75 ft. The buildings will be 1 story high except the storehouse; this will be 3 stories high. All of the structures will be of brick and steel; estimated cost of the work, $90,000.

Pittsburg, Pa.—John Dimling is reported interested in the erection of a 10-story hotel on Forbes and Halket Sts., to cost about $1,500,000.

McKees Rocks, Pa.—A. M. Eilkie & Co. are stated to have secured the contract for erecting a 4-story office building, 50 x 100 ft., for the Pressed Steel Car Co., to cost $100,000.

New York, N. Y.—Babb, Cook & Willard, W. 29th St., have filed plans and specifications for the erection at 73 Cannon St. of a 4-story and basement brick clubhouse, to cost $55,000. It will be known as the Edward Clark Club, and be the gift of Mrs. Potter.

Jersey City, N. J.—The Jarvis Terminal Cold Storage Co. will erect an 8-story fireproof building, 150x140 ft., on Provost and 12th Sts., to cost about $150,000.

Athens, O.—Holmboe & Lafferty, of Clarksburg, W. Va., are stated to have been selected to prepare plans for a business block to be erected for C. H. Grosvenor and E. J. Jones, to cost $800,000.

Columbus, O.—The N. M. & C. Interurban Ry. Co. is stated to have purchased property on Dublin Ave. and Spring St. and will erect on same car barns, storage tracks and a freight station.

Sullivan, Ill.—It is stated that a $25,000 home for Masons' widows and orphans will be erected near Sullivan. P. W. Barclay, of Cairo, Ill., is a Trus. of the Home.

Madison, Wis.—The Metropolitan Hotel Co. is reported formed here, to erect a hotel to cost about $300,000. W. W. Huppeler, Prop. of the Capital House, is reported interested.

Duluth, Minn.—J. J. Waugenstein, Providence Bldg., is reported to be preparing plans for a 3-story building at 7th Ave. E. and Superior St., for T. Nusbaum; cost, $35,000.

Cleveland, O.—It is stated that the Lake Shore R. R. (F. J. Stout, Gen. Supt., Toledo), the Pennsylvania R. R. (W. H. Brown, Ch. Engr., Philadelphia, Pa.), and the Big Four R. R. (G. W. Kittredge, Ch. Engr., Cincinnati), will erect a union depot in Cleveland at a cost of about $2,000,000.

Waukesha, Wis.—It is stated that the Waukesha Malleable Iron Co. is planning to erect an office building on White Rock Ave.

Kansas City, Mo.—The Broadway Bldg. Co. is about to erect at 616 to 624 B'way a brick warehouse to cost $60,000.

The Methodist Book Concern is about to build a brick store at 1121 and 1123 McGee St. Cost, $15,000. Architects, Shepard & Farrar, Bank of Commerce Bldg.

The Baker-Lockwood Awning Co. is reported to be preparing to erect an $80,000 building on 3d and Oak Sts.

Geo. L. Brown & Son, 221 Am. Bank Bldg., are stated to have secured the contract for a 6-story building to be erected on 7th St. and B'way, to cost $80,000.

Ft. Worth, Tex.—The Ft. Worth National Bank is stated to have purchased a site at Main and 5th Sts. for the erection of a 6-story business building.

Beaumont, Tex.—It is reported that the Y. M. C. A. is to erect a building, at a cost of about $50,000.

Kansas City, Mo.—The Chicago, Milwaukee & St. Paul R. R. Co. is stated to have decided to erect a freight house on Liberty, 14th and 16th Sts. D. J. Whittemore, Ch. Engr., Chicago, Ill.

St. Louis, Mo.—Local press reports state that plans have been prepared under the direction of Henry Weaver, Mgr. of Planters Hotel, for 3 hotels of 1,040 rooms each, which it is proposed to erect adjoining the World's Fair grounds on the north. The cost of the 3 structures will be over $1,000,000. A company is being organized to build the hotels. They will be built of tiling and staff and will be only temporary.

The Frisco Bldg. Co. has been incorporated with a capital of $600,000, to erect a structure for the general offices of the Frisco R. R. Architects, Eames & Young, Chestnut and 7th Sts.

Alexandria, La.—The Alexandria Opera House Co., Ltd., has been organized here, with a capital of $30,000, to erect an opera house. J. W. Alexander, Pres.; W. Oshee, Secy.

Hobart, Okla. Ter.—The Oakland Mfg. Co. is to erect an experimental and pattern building, 20x40 ft., and a warehouse, 50x100 ft. A. M. Lumm, Secy.

San Francisco, Cal.—Salfield & Kohlberg, 339 Kearny St., are stated to have prepared plans for a 7-story hotel to be erected on Van Ness Ave. and Bush St. for Mrs. Sarah Rodgers, to cost about $150,000.

Cheyenne, Wyo.—The Rocky Mountain Bell Telephone Co. proposes to build an exchange to cost about $18,000; bids not yet asked.

Oakland, Cal.—It is reported that the Italian-American Bank will erect a 7-story building.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Jones & 4th Sts, 7-story br loft & store bldg; c, $40,000; o, Geo H Pigueron; a, W G Pigueron.

53 Wooster St, 7-story br storage bldg; c, $30,000; o, Thos Monahan; a & b, John A Dooner.

Ave D & 3rd St, 6-story br tenemt and stores; c, $40,000; a, Horenburger & Straub.

126 W 34th St, 6-story br and stone office and store bldg; c, $20,000; o, Chas L Tappin; a, Dodge & Morrison.

4143 & 4145 3rd Ave, 2 5-story br tenemts and stores; c total, $55,000; o, Stephen M Anderson; a, Rudolph Moeller.

Clinton and Broome Sts, 5-story br club-house; c, $110,000; o, Social Halls Assoc; a, Howells & Stokes.

Fulton and Pearl Sts, 3-story br and stone office and store bldg; c, $40,000; o, Chas Lane; a, Harry T Howell.

368 and 370 Madison St, 6-story br tenemt and stores; c, $40,000; o, Lippman & Gold; a, Horenburger & Straut.

66 and 68 E 3d St, 6-story br tenemt and stores; c, $35,000; o, Falk & Fine; a, Bernstein & Bernstein.

Bway and Duane St, 18-story br and stone office bldg; c, $1,000,000; o, The Barclay Realty Co, Inc; a, Stockton B Colt; b, Marc Eidlitz.

4 E 177th St, 5-story br tenemt and store; c, $30,000; o, Jacob Fleigman; a, Nathan Langer.

450 5th Ave, 4-story and basemt extension to 4-story and basemt br and stone club-house; c, $25,000; o, estate Mary C. Clark; a, John B. Smook.

BROOKLYN.

West & Java Sts, 5-story br shop and lofts; c, $30,000; o, G Mulligan; a, W L Irving.

DWELLINGS.

Pittsburg, Pa.—E. M. Butz & Co., Park Bldg., are reported to have prepared plans for a 3-story apartment house to be erected in St. Clair St., East End, for John C. Conley, at a cost of $30,000.

Buffalo, N. Y.—Plans have been approved for a 4-story brick apartment-house to be erected at 274 Summer St. and Ashland Ave. for Flora I. Thrale, to cost about $50,000.

Washington, D. C.—Jas. G. Hill, Corcoran Bldg., is stated to have prepared plans for a 6-story fireproof apartment house to be erected on Ontario, Poplar and Summit Sts., for the Ontario Apartment House Co.

Chicago, Ill.—A permit has been granted to Jas. B. Waller for the erection of a 3-story brick apartment building, at 1293 Sheridan Road, to cost $47,000.

Kansas City, Mo.—A $30,000 brick apartment house is about to be erected for Webster Davis at 1120 to 1124 Paseo St.

Louisville, Ky.—A. E. Ferguson has taken out a permit for a $75,000 residence. Dodd & Cobb, Equitable Bldg., are the architects.

NEW YORK CITY.

Permits for the following buildings have been issued: o, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

52nd St & Madison Ave, 5-story br and stone dwell; c, $30,000; o, Thos S Young, Jr; a, Robertson & Potter; b, Harvey Murdock.

117th St & 5th Ave, 6-story br flat; c, $35,000; o, Chas Adams; a, Lorenz F J Weiher.

685 5th Ave, 1 and 2 story and basement extension to 4-story and basement br dwell; c, $30,000; o, Chas W Harkness; a, Chas Volz; b, Wells Bros. Co.

118th St and Manhattan Ave, 2 6-story br and stone flats; c total, $140,000; o, Silverman & Liebeskind; a, Geo F Pelham.

Ft Washington Ave and 195th St, 1½-story frame dwell; c, $32,000; o, C K G Billings; a, Guy Lowell.

135th St and St Anns Ave, 2 5-story br tenemts; c total, $75,000; o, Wahlig & Sousin; a, Moore & Landsiedel.

131st St and 5th Ave; 6-story br tenemt; c, $75,000; o, C M & M M Silverman; a, Neville & Bagge.

SCHOOLS.

Boston, Mass.—The School House Comrs. have under consideration the following bids for the erection and completion of a grammar school on Norman St., at the West End; J. W. Bruty, $275,400; S. Brennan & Co., $295,486; C. H. Belledeau & Co., $289,975; Conners Bros., $293,000; H. P. Cummings & Co., $291,000; C. H. Dodge, $290,897; A. Fales & Sons, $266,800; John J. Flynn, $298,380; Morrill & Whiton Const. Co., $289,670.95; Henry McGahey, $286,000; Mack & Moore, $267,900; Mead, Weston & Co., $314,250; Norcross Bros., $305,875; Whidden & Co., $297,810; Wheaton Bldg. & Lumber Co., $269,000; Goodwin & Wester, $263,949. Bidders all of Boston.

Bids will be received Dec. 1 by the Schoolhouse Comrs. for erecting a primary school, in Martin Dist., Huntington Ave. and Kenwood Road, exclusive of heating, plumbing and electrical work, requiring a bond of $25,000. Wheelwright & Haven, Archts.; R. Clipson Sturgis, Chmn.

Greenfield, Mass.—Gardner & Grahm, of Springfield, are the architects for proposed alterations to High School, to cost $25,000.

Ravenswood, L. I. City, N. Y.—Bids will be received Dec. 1 by C. B. J. Snyder, Supt. of School Bldgs., New York, N. Y., for erecting school No. 83 on Vernon Ave., Boro. Queens.

Philadelphia, Pa.—Bids will be received Nov. 25 by the Com. on Property for erecting 2 schools, 1 at Morris and Moyamensing Ave. and the other at 63d St. and Elmwood Ave. A. F. Hammond, Secy. Bd. of Educ.

Brooklyn, N. Y.—The following bids were opened Nov. 17 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., New York City, for the general construction of addition to and alterations in School 123, Boro. of Brooklyn: *a*, to complete Sept. 1, 1903; *b*, to complete Jan. 1, 1904: Myron C. Rush, *a*, $156,945; *b*, $149,945. John Auer & Sons, *a*, $149,000 (awarded); *b*, $142,575. Geo. Hildebrand, *b*, $151,889. John H. Goetschius, *a*, $150,000; *b*, $150,000. Peter Cleary, *b*, $150,000. Tolmie & Kerr, *b*, $146,756. Wm. P. McGarry, *b*, $146,371. Chas. H. Peckworth, *b*, $144,445. Wm. & Thos Lamb, *b*, $148,000.

Richmond, L. I., N. Y.—Bids will be received Dec. 1 by C. B. J. Snyder, Supt. of School Bldgs., New York, N. Y., for alterations and additions to the ventilating and heating apparatus for school No. 16, Madison Ave., New Brighton, Boro. Richmond.

Pittsburg, Pa.—The Congregation of the Holy Family R. C. Church (Rev. A. Smelox, Pastor) is reported to be making arrangements to erect a school, at a cost of $35,000.

Yonkers, N. Y.—A. B. Barr & Co., 67 Dock St., are stated to have secured the contract for the heating and lighting apparatus for the High School addition, for $4,967.

Marion, Ind.—The High School is reported to have been destroyed by fire Nov. 16.

Racine, Wis.—The Finance Com. of Council is stated to have decided to issue $80,000 bonds for enlarging and improving the schools.

Milwaukee, Wis.—The Bd. of Aldermen is reported to have decided to erect a $75,000 school in the 1st Ward, and has recommended the issue of $150,000 bonds for a high school on the north side.

Forest, O.—City Clk. Harry E. Moore writes that at the recent election it was voted to issue $20,000 bonds for the construction of a school.

Two Rivers, Wis.—The citizens are stated to have voted to issue $35,000 bonds for the erection of a new school.

Rutland, Ill.—It is stated that plans have been prepared for a $20,000 school.

Lexington, Ky.—The citizens are reported to have voted to issue $75,000 bonds for the erection of 3 schools.

Paola, Kan.—It is stated that the Ursuline Sisters will erect a $35,000 academy here.

Stockton, Cal.—The Bd. of Educ. has rejected all bids for the High School as being too high, and contemplate changing plans to bring cost inside of $100,000; lowest bid was $120,000.

Guelph, Ont.—Schultz Bros. Co., Brantford, are stated to have secured contract for erecting the Macdonald Institute at the Agricultural College, Guelph. This is one of the two buildings which are being erected from a gift of $125,000 by Sir Wm. Macdonald, of Montreal, Que.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—The only bid received Nov. 21 for the removal of snow and ice in Manhattan Boro. was that of Wm. Bradley, 534 W. 48th St., at 30 cts. per cu. yd.

Reading, Pa.—Geo. W. Beard & Co. have received the contract for the erection of a plant for the Reading Sanitary Reduction Co., to be located on the farm of Chas. Fischer, in Cumru, near the County Home. Mr. Fischer was given the garbage contract recently by the city for 5 years, and it will be handled by this Co.

St. Paul, Minn.—The Com. on Streets has approved a resolution to expend $40,000 for street sprinkling.

Sandusky, O.—According to local press reports Wm. F. Seitz, Jr., is at the head of a local Co. which proposes to erect a garbage disposal plant in this city, at a cost of $30,000 to $40,000. The Co. will be a branch of the Waste Utilization Co. of New Jersey.

Kansas City, Mo.—Local press reports state that bids will be opened Dec. 19 by the Special Garbage Com. of Both Houses of the Council for collecting and disposing of the city's garbage. Dr. Langsdale, City Physician.

Seattle, Wash.—The Bd. of Health recommends the construction of a crematory for the disposal of city garbage, and the proposition to issue bonds for same may be voted upon at the next special election.

GOVERNMENT WORK.

Baltimore, Md.—Bids are wanted at the U. S. Engineer Office until Dec. 17 for dredging in Curtis Bay, Md., as advertised in The Engineering Record.

Buffalo, N. Y.—The following bids were opened Nov. 17 at the Treasury Dept., Washington, D. C., for the construction of a shed over driveway at mailing entrance of the U. S. Post Office, Buffalo: Master & Summers, Buffalo, $15,500; J. R. Churchyard, Buffalo, $11,284; A. B. Stannard, New York, N. Y., $11,467.

New York, N. Y.—Lt. Col. C. W. Raymond, Corps of Engrs., U. S. A., writes that the lowest bids received Nov. 13 for dredging were as follows: The International Contracting Co., New York, N. Y., 23½c. cu. yd. for Keyport Harbor and Matawan Creek, and 35c. cu. yd. for South River; E. R. Seward, New York, N. Y., 30c. cu. yd. for Raritan River; Kirk, Driscoll & Co., Syracuse, N. Y., 35c. cu. yd. for South River; 35c. cu. yd. for Elizabeth River, and 30c. cu. yd. for Shoal Harbor and Compton Creek; John & Joseph McSpirit, Jersey City, N. J., 25c. cu. yd. for South River.

Bids were also received Nov. 10 by Lt.-Col. C. W. Raymond for dredging, the bid recommended for award in each case being as follows: Lemon Creek, N. Y., Duncan J. Currie, Perth Amboy, N. J., at 19c. per cu. yd. prism measurement; Woodbridge Creek, N. J., Newburgh Dredging Co., Newburgh, N. Y., at 20c. per cu. yd. scow measurement; Raritan Bay, N. J., R. G. Packard Co., New York, N. Y., at 16c. per cu. yd. scow measurement.

The following bids were opened Nov. 15 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for removing from 90,000 to 140,000 cu. yds. of material from waters of Navy Yard, New York; prices are per yd. scow measurement: R. G. Packard Co., New York, 33½c.; International Const. Co., New York, 54c.; Morris & Cumings, New York, 57c.

Wilmington, Del.—Bids are wanted Dec. 15 for construction of jetty at mouth of Mispillion River. Col. Jared A. Smith, Corps Engrs., U. S. A.

Savannah, Ga.—Bids are wanted Dec. 22 at the U. S. Engr. Office for building training dikes in Savannah River, near Augusta, Ga., as advertised in The Engineering Record.

Milwaukee, Wis.—Bids are wanted at the U. S. Engineer Office until Dec. 18 for constructing concrete superstructure on breakwater and on North Harbor Pier, at Milwaukee Harbor, Wis., as advertised in The Engineering Record.

Chicago, Ill.—The Secy. of the Treasury has awarded to John Peirce, of New York, the contract for the interior finish of Chicago Post Office, at his bid of $997,500, reserving the right to improve the finish if additional money is appropriated by Congress for that purpose.

St. Louis, Mo.—The contract for erecting and completing the U. S. Government Bldg., at the Louisiana Purchase Exposition, is stated to have been awarded to W. O. & C. G. Burton, of Richmond, Va., for $268,980.

Chilocco, Okla. Ter.—Bids are wanted Dec. 11 for furnishing material and erecting a stone dormitory and an addition to a dormitory, including steam heat, electric light and plumbing, at the Chilocco school. Address A. C. Tonner, Acting Comr. of Indian Affairs, Washington, D. C.

Laredo, Tex.—A correspondent writes that the Treasury Dept. has purchased a site at $11,000 for the U. S. Custom House. Appropriation, $150,000.

Memphis, Tenn.—Local press reports state that contracts will be let in April, by the Treasury Dept., Washington, D. C., for building the $250,000 addition to the Federal Bldg. in Memphis.

Dover, Tenn.—Bids are wanted Dec. 13 for constructing roadway to National Cemetery. C. D. V. Hunt, Q. M.

Mobile, Ala.—Bids are wanted Dec. 17 for furnishing material for repairing and extending depot wharf at Egmont Key Light Station, Fla. Lieut.-Col. A. N. Damrell, U. S. A., Light-House Engr., Mobile.

Ft. Meade, S. D.—The contracts for constructing brick barracks at Ft. Meade, is reported to have been awarded to Burns & Schummer, of Sturgis, S. D., for $48,611; and the contract for electric wiring to S. O. Oliver, of Sturgis, for $950. New bids will be asked for the plumbing and heating apparatus.

San Francisco, Cal.—The following bids were opened Oct. 16 by Lieut. R. P. Johnston, Corps of Engrs., U. S. A., for building portions of dam, known as Barrier No. 1, on Yuba River, about 14 miles above Marysville, Cal.:

Bidders and Addresses.	50,000 lin. ft. Wakefield sheet piles.	Placing 3,130 Wakefield sheet piles.	13 M ft. B. M., capping.	2,333 sq. yds. brush mattress.	1,500 sq. yds. brush protection.	Random stone. 875 tons (pieces at least 500 lbs.).	Random stone. 2,525 tons (pieces less than 500 lbs.).	6,000 cu. yds. earth fill.	1,000 cu. yds. gravel backing.	1,190 cu. yds. loose brush.	57 cu. yds. loose poles.
	Cts.										
Dundon Bdg. & Const. Co., San Fran.	17½	$3.10	$40.00	$0.47	$0.45	$1.90	$1.50	$0.40	$0.20	$1.15	$1.00
E. B. & A. L. Stone Co., Oakland.....	25	2.50	32.00	1.25	1.00	2.00	1.50	.75	.35	3.00	3.00
City St. Improv. Co., San Francisco..	21¾	3.69	30.00	.93	.60	2.37	1.97	.22	.25	.60	1.00
Clark & Henery, Stockton..........	28	1.90	40.00	.65	.65	2.00	2.00	.35	.35	1.25	1.25
Hyde Const. Co., San Francisco......	33	2.00	40.00	.75	.40	2.00	1.80	.40	.50	.90	1.50
Cotton Bros. & Co., Oakland.........	32	2.00	34.00	.80	.50	1.80	1.60	.30	.50	1.00	1.50
Sam Montgomery, Woodland.........	28	1.80	36.00	.70	.58	2.60	2.60	.60	1.10	1.50	1.50
Atlan., Gulf & Pac. Co., San Francisco.	23	.85	35.00	.50	.30	3.00	2.50	.30	.20	.60	1.00

Totals: Dundon Bridge & Const. Co., San Francisco, $30,220; E. B. & A. L. Stone Co., Oakland, $39,286; City Street Improv. Co., San Francisco, $35,273; Clark & Henry, Stockton, $33,767; Hyde Const. Co., San Francisco, $35,981; Cotton Bros. & Co., Oakland, $34,509; Sam Montgomery, Woodland, $38,016; Atlantic, Gulf & Pacific Co., San Francisco, $27,940 (contract awarded).

MISCELLANEOUS.

Syracuse, N. Y.—Bids are wanted Nov. 25 for $50,000 Onondaga Creek improvement bonds. E. J. Mack, Compt.

New York, N. Y.—Bids will be received Nov. 26 by Thos. W. Hynes, Comr. of Correction, for furnishing and delivering iron, steamfittings, electrical supplies, etc.

Atlantic City, N. J.—The Council has appropriated $80,000 for boardwalk purposes.

Albany, N. Y.—The Flood Com. of the Chamber of Commerce has made the following recommendations to the State Water Storage Comn., for preventing floods: the establishment of a system of storage reservoirs on tributaries of the Hudson, and the improvement of the Hudson River channel so as to prevent the possible formation of ice gorges.

Buffalo, N. Y.—Local papers quote Comr. of Pub. Wks., Col. Ward, as having stated that the cost of improving Buffalo River, including the deepening of river, acquirement of lands necessary for improvement and the placing of flood-gates on sewers, will cost about $1,500,000, and contract will probably soon be let.

Glens Falls, N. Y.—Repairs to the Glens Falls feeder and Champlain canal at Glens Falls, Ft. Edward and Moses Kill, to cost about $30,000, have been authorized by the Supt. of Pub. Wks., Albany.

Baltimore, Md.—The contract for the new pier to be erected at Curtis Bay by the B. & O. R. R. has been awarded to A. R. Morrison, of Wilmington, Del., for $450,000, to be completed in 10 months; length to be over 800 ft.

The B. & O. R. R. has applied for a permit to erect a corrugated iron shed, 794 ft. long and 138 ft. wide, on its proposed import and immigrant pier at Locust Point, to cost $180,000.

Augusta, Ga.—The City Council has voted to borrow not exceeding $100,000 to construct a levee on the river bank from 15th to 9th Sts., capable of keeping out the water of Savannah River of a 36-ft. rise.

Columbus, O.—Bids will be received Dec. 9 by the State Bd. of Pub. Wks. for constructing concrete walls, on stone masonry, along water lines of canal between Liberty St. and Queen City Ave., and between 14th and 15th St. Chas. E. Perkins, Ch. Engr., Pub. Wks.

Chicago, Ill.—Bids will be received Jan. 14 by A. R. Porter, Clk. of Sanitary Dist., for dredging the main and the south branch of Chicago River, and docking that portion of river front contiguous to the portions dredged, together with other work relating thereto. Thos. A. Smyth, Pres.

San Diego, Cal.—Samuel Parsons, Jr., of New York City, is stated to have been engaged by the city to prepare plans for beautifying 1,400 acres of city park.

NEW INDUSTRIAL PLANTS.

Henry L. Norton, Springfield, Mass., engineer and contractor for steel bridges, buildings, girders, etc., is building a 40x100-ft. shop, together with blacksmith shop and sheds. The capacity will be about 100 tons per month.

Findlater & Copeland, San Angelo, Tex., are excavating the cellar for a 2-story, 50x100-ft. concrete building, the ground floor to be used for blacksmithing and woodworking machinery and the upper story for buggy and carriage salesroom, etc. A machine shop and foundry may be installed later.

The Hockensmith Wheel & Mine Car Co., Irwin, Pa., has contracted for the steelwork for a 228x60-ft. foundry and machine shop; 178x50-ft. blacksmith and wagon shops; 2-story, 125x30-ft. pattern shop and an 80x25-ft. power house. The power plant will have a capacity of about 150 H.-P.

The Susquehanna Silk Mills, which have a large weaving mill in Sunbury, Pa., will erect next spring in the same place a piece dyeing and finishing establishment. It will be a one-story structure about 300 ft. square, and is to be equipped with the best and most modern machinery. The New York office is at 62 Greene St.

The Richmond, Ind., Handle Co. is building a 40x80-ft. factory. A 70-H.-P. boiler and 60-H.-P. engine will be installed. J. A. Greenstreet, New Castle, Ind., Secy.

Thos. J. Lillard, Elkin, N. C., desires prices on hosiery mill machinery.

The Eagle Shoe Co., Newport News, Va., capital $100,000, proposes to build a factory. V. M. Fleming, Pres.

The Gladiator Consolidated Gold Mines & Milling Co., Iowa Loan & Trust Bldg., Des Moines, Ia., will erect a mill and reduction works having a daily capacity of 200 tons on the Gladiator group and a 100-ton plant on the Red Cloud Group.

The Deshler, Neb., Broom Co. will erect a 2-story, 50x300-ft. factory and install a power plant of 40 to 50 H.-P.

BUSINESS NOTES.

The Richardson Scale Co., 21 Park Row, New York, announces that it is prepared to manufacture and sell Richardson automatic scales in the United States. These scales have been manufactured in Great Britain for a number of years, and are adapted for weighing coal, cement, sugar and similar materials.

The Salisbury Steel & Iron Co., Utica, N. Y., has been incorporated with a capital of $1,000,000. The directors are: Geo. M. Bard, Wilmington, Del.; Harvey L. Atkins, Wm. W. Hearne, Philadelphia; Wm. Kerby, New York; Henry N. Clark, Boston; Victor Adams, Little Falls, and Wm. H. Switzer, Utica.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Penna. R. R. Co., 450 H.-P. engine for the Altoona shops and 250-H.-P. at the Meadows, N. J., shop; 250-H.-P. engine for the American Sugar Refining Co., Jersey City, N. J.; an engine for the Bishop & Babcock Co., Cleveland; engines for the Western Packing Co., Denver, Col., direct connected to two 100-Kw. Crocker-Wheeler generators.

The Kennedy Valve Mfg. Co., New York, has completed an order for the Boston Navy Yard for a large lot of valves and over 100 of its underwriters' approved weather-proof adjustable indicator posts for automatic sprinkler systems.

The National Drill & Mfg. Co., 159 La Salle St., Chicago, has been incorporated with a capital of $500,000, and is installing machinery in its plant at Barberton, O. Road machinery will be included in its manufactures. E. R. Stettinius, of the Stirling Boiler Co., is president; Arthur Cameron, former sales manager for the Austin Mfg. Co., is vice-president and general manager, and O. C. Barber, of the Diamond Match Co., is among its financial backers.

The New York Continental Jewell Filtration Co., New York, reports receiving an order for a large gravity filter plant for the Northern Hospital for the Insane at Winnebago, Wis., and from the Chicago & Eastern Illinois Ry. for plant for purifying water for boiler use at its Kinmundy, Ill., station.

The Park Mfg. Co., Chicago, has been incorporated, with a capital of $250,000, for manufacturing in iron and steel. The incorporators are: George N. and Frank H. Lyman and George D. Bardon.

The Indiana Asphalt Co., Chicago, has been incorporated, with a capital of $300,000, to manufacture asphalt. The incorporators are: Alexander G. Warren, R. W. Barnes and Arthur Griffin.

The Allis-Chalmers Co., Chicago, reports the following among its sales of Reynolds-Corliss engines during October, 1902: Indiana Rolling Mill Co., Newcastle, Ind., a 26x48 and a 28x48-in.; Scott & Van Arsdale Lumber Co., McCloud, Cal., a 26x48-in.; Downie-Wright Mfg. Co., York, Neb., a 12x36-in.; Kirby Lumber Co., Houston, Tex., a 22x48-in.; Coleman Implement Co., Peoria, Ill., an 18x42-in.; Wyckoff, Seamans & Benedict, Ilion, N. Y., a 14 and 28x30-in.; Chicago Edison Co., 32 and 64x60-in.; Lansing, Mich., Wagon Wks., 16x36-in.; A. C. White, Saginaw, Mich., 22x42-in.; H. R. Johnstone, 16x36-in.; J. L. Lindsay, Richmond, Va., 14x36-in.; International Paper Co., New York, two 22x42-in.; National Tube Co., Pittsburg, six 22 and 42x42-in. and a 44 and 84x60-in. vertical blowing engine; Scott & Van Arsdale Lumber Co., St. Cloud, Minn., 18x42 and 22x42-in.; Minot, N. D., Milling Co., 12x36-in.; Brogon Cotton Mills, Anderson, S. C., 30 and 64x60-in.; Des Moines, Ia., Brick & Tile Co., 18x42-in.; Milwaukee, Wis., Worsted Mills, 20x42-in.; F. E. Kreatz, St. Cloud, Minn., 18x36-in.; Metropolitan Paving Brick Co., Canton, O., 22x52-in.; Booten & Lyne, Orange, Va., 12x30-in.; Euston & Co., Chicago, 18x42-in. engine and a 6x16-ft. boiler; Columbus, O., Milling Co., 14x36-in.; National Biscuit Co., Chicago, 20x36-in.; Carnegie Steel Co., Pittsburg, 48 and 78x60-in. combined horizontal and vertical; D. E. Converse Mfg. Co., Glendale, S. C., a 14x36-in.; New Jersey & Hudson River Ry. & Ferry Co., 28 and 56x48-in. Also an 8,000,000 gal. pumping engine to the city of Milwaukee; Penna. R. R. Co., two 384-H.-P. Sederholm boilers; Theresa Gold Mining Co., 16x30-in. single drum hoist; Compania Minera de Penoles, Mex., a Riedler air compressor, with 14x18-in. steam cylinder and 10½ and 18x18-in. air cylinder.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Nov. 25. Findlay, O. .... Nov. 15
Nov. 26. Newport, R. I. .... Oct. 25
Dec. 1. South St. Paul, Minn. .... Nov. 15
Dec. 1. Ottumwa, Ia. .... Nov. 15
Dec. 1. West Milton, O. .... Nov. 8
Dec. 1. East Dundee, Ill. .... Nov. 8
Adv., Eng. Record, Nov. 8.
Dec. 1. Pumps, Seguin, Tex. .... July 26
Dec. 4. Meridian, Miss. .... Nov. 22
Dec. 4. Boston, Mass. .... Nov. 15
Adv., Eng. Record, Nov. 15.
Dec. 20. Pumping engines, Louisville, Ky. .... Oct. 25
Adv., Eng. Record, Oct. 25 to Nov. 22.
Dec. 29. Gillett, Wis. .... Nov. 15
Jan. 1. Sacramento, Cal. .... Nov. 22

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 25. Chicago, Ill. .... Nov. 22
Nov. 25. Paulding, O. .... Nov. 8
Nov. 26. Saratoga Springs, N. Y. .... Nov. 22
Nov. 26. Brooklyn, N. Y. .... Nov. 15
Nov. 26. Cincinnati, O. .... Nov. 1
Nov. 27. Buffalo, N. Y. .... Nov. 22
Nov. 27. Indianapolis, Ind. .... Nov. 22
Nov. 28. Drainage Canal, Osceola, Ark. .... Nov. 22
Adv., Eng. Record, Nov. 22.
Nov. 28. Buffalo, N. Y. .... Nov. 22
Nov. 28. Waukegan, Ill. .... Nov. 22
Dec. 2. Massillon, O. .... Nov. 22
Dec. 2. Des Moines, Ia. .... Nov. 15
Dec. 2. South Orange, N. J. .... Nov. 15
Adv., Eng. Record, Nov. 15, 22.
Dec. 5. Walnut, Ill. .... Nov. 22
Dec. 7. Dixon, Ill. .... Nov. 8
Dec. 10. St. Petersburg, Fla. .... Nov. 22
Dec. 12. Cincinnati, O. .... Nov. 22
Dec. 15. Montevideo, Uruguay .... Sept. 13
Dec. 20. Pumping Station, Washington, D. C. .... Nov. 15
Adv., Eng. Record, Nov. 15.

BRIDGES.

Nov. 25. Washington, Pa. .... Nov. 22
Nov. 25. Cumberland, Md. .... Nov. 22
Nov. 26. Saginaw, Mich. .... Nov. 8
Nov. 28. Wapakoneta, O. .... Nov. 8
Dec. 1. Minneapolis, Minn. .... Nov. 22
Dec. 1. Bigtimber, Mont. .... Sept. 27
Dec. 1. Chehalis, Wash. .... Nov. 15
Dec. 1. Boston, Mass. .... Nov. 15
Dec. 2. Unionville, Wis. .... Nov. 22
Dec. 3. Piera, Osceola, Mo. .... Nov. 22
Dec. 9. Franklin, Pa. .... Nov. 15
Dec. 17. Chicago, Ill. .... Nov. 1
———Jonesboro, Tenn. .... Nov. 15

PAVING AND ROADMAKING.

Nov. 26. Boston, Mass. .... Nov. 22
Nov. 26. Hartford, Conn. .... Nov. 22
Adv., Eng. Record, Nov. 22.
Nov. 26. Hoboken, N. J. .... Nov. 8
Nov. 27. Keokuk, Ia. .... Nov. 8
Dec. 1. Toledo, O. .... Nov. 8
Dec. 1. Delphi, Ind. .... Oct. 25
Dec. 2. New York, N. Y. .... Nov. 22
Dec. 2. Des Moines, Ia. .... Nov. 15
Dec. 3. Baltimore, Md. .... Nov. 22
Dec. 8. Toledo, O. .... Nov. 15
Dec. 11. Green Bay, Wis. .... Nov. 22
Dec. 11. Guthrie, Okla. Ter. .... Nov. 1
Dec. 22. Portsmouth, Va. .... Oct. 18
Adv., Eng. Record, Oct. 18, 25.
———Pratt City, Ala. .... Nov. 8

POWER, GAS AND ELECTRICITY.

Nov. 26. Quincy, Ill. .... Nov. 22
Dec. 1. St. Charles, Mich. .... Nov. 22
Dec. 2. St. Paul, Minn. .... Nov. 22
Dec. 2. North Amherst, O. .... Nov. 15
Dec. 4. Ft. Monroe, Va. .... Nov. 8
Adv., Eng. Record, Nov. 8.
Dec. 6. Hot Springs, Ark. .... Nov. 15
Dec 20. Philadelphia, Pa. .... Nov. 22
Jan. 15. Rome, Ga. .... Oct. 11
Mar. 4. Franchise, Manila, P. I. .... Nov. 15

GOVERNMENT WORK.

Nov. 25. Ft. Riley, Kan. .... Nov. 1
Adv., Eng. Record, Nov. 1 to 22.
Nov. 25. El. wiring Pub. Bldg., Boise, Idaho .... Oct. 25
Adv., Eng. Record, Oct. 25, Nov. 1.
Nov. 26. (San Diego Harbor) Los Angeles, Cal. .... Nov. 8
Nov. 26. Storehouse (Ft. Greble), Newport, R. I. .... Nov. 1
Adv., Eng. Record, Nov. 1 to 22.
Nov. 26. Dredging, Washington, D. C. .... Nov. 1
Adv., Eng. Record, Nov. 1 to 22.
Nov. 26. Newport, R. I. .... Oct. 25
Nov. 28. Dover, N. J. .... Nov. 8
Nov. 29. Ft. Huachuca, Ariz. .... Nov. 8
Nov. 29. Storehouse, Norfolk, Va. .... Nov. 8
Nov. 29. Dredging, Philadelphia, Pa. .... Nov. 8
Nov. 29. Machine shop, Boston, Mass. .... Nov. 8
Nov. 29. Htg. & Veht. Pub. Bldg., Boise, Ida. .... Oct. 25
Adv., Eng. Record, Oct. 25, Nov. 1.
Nov. 30. Plattsburg Barracks, N. Y. .... Nov. 8
Dec. 1. Bldg., Ft. Myer, Va. .... Nov. 15
Dec. 1. Ft. Lincoln, N. D. .... Nov. 8
Dec. 1. Ft. D. A. Russell, Wyo. .... Nov. 8
Dec. 2. San Francisco, Cal. .... Nov. 15
Dec. 2. Dredging, Boston, Mass. .... Nov. 1
Adv., Eng. Record, Nov. 1, 8.
Dec. 3. Kiowa Agency, Okla. Ter. .... Nov. 15
Dec. 3. (Rappahannock River, Va.) Wash., D.C. .... Nov. 8
Adv., Eng. Record, Nov. 8 to 22.
Dec. 3. Emporia, Kan. .... Nov. 1
Adv., Eng. Record, Nov. 1, 8.
Dec. 4. Ft. Monroe, Va. .... Nov. 8
Adv., Eng. Record, Nov. 8, 22.
Dec. 6. Dredging, Philadelphia, Pa. .... Nov. 15
Dec. 6. Ft. Rosecrans, Cal. .... Nov. 15
Dec. 6. (Breton Bay, Md.) Washington, D. C. .... Nov. 8
Adv., Eng. Record, Nov. 8 to 22.
Dec. 6. Smithery, Boston, Mass. .... Nov. 8
Dec. 6. Dredging, Galveston, Tex. .... Oct. 11
Adv., Eng. Record, Oct. 11 to Nov. 22.
Dec. 8. Newport, R. I. .... Nov. 8
Adv., Eng. Record, Nov. 8 to 22.
Dec. 8. New York, N. Y. .... Nov. 8
Adv., Eng. Record, Nov. 8 to 22.
Dec. 10. Jetty work, Galveston, Tex. .... Oct. 11
Adv., Eng. Record, Oct. 11 to Nov. 15.
Dec. 11. Chilocco, Okla. Ter. .... Nov. 22
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Another Proposed Isthmian Canal Route.

The Isthmian Canal Commission, in its report made in 1901, recommended the adoption of the Panama route for a ship canal across the Isthmus. Congress at its last session authorized the President of the United States to cause to be constructed on the Panama route a ship canal of the dimensions and according to the plans recommended by the Isthmian Canal Commission, provided that the New Panama Canal Company could convey a satisfactory title to all its rights and privileges on the Isthmus, and provided the requisite concessions could be secured on satisfactory terms by treaty between the governments of the United States and of the Republic of Colombia. Should the President fail to fulfil either of the stipulated conditions, he was then authorized to enter into negotiations with the Nicaraguan government for the purpose of securing the necessary rights and concessions to construct the ship canal on the Nicaragua route. Inasmuch as treaty negotiations have not yet been satisfactorily concluded with the Colombian government, it is perhaps too soon to reject all consideration of matters pertaining to the Nicaraguan route. At the same time, any data offered in connection with such a consideration should be most carefully scrutinized.

In 1888-1889 Mr. J. Francis LeBaron, M. Am. Soc. C. E., was engaged in engineering examinations on the Maritime Canal Company's project, and the experience and information gained at that time have prompted him to present a paper before the American Society of Civil Engineers on "An Alternative Line for the Nicaragua Canal; and a Proposed New Method of Dam Construction," which appeared in the "Proceedings" of that society for October, 1902. Mr. LeBaron adopts for his purpose practically the Ochoa dam and San Carlos embankment line, but with some different features of construction of the dam of the Menocal project. He proposes, however, a radically different canal line from the dam to the sea, lying on the southerly or easterly side of the San Juan River, with its terminus at the mouth of the Colorado River, 30 miles easterly from Greytown. He recognizes the great volume of sand movement at Greytown with the resulting difficulties and costs of harbor maintenance. At the mouth of the Colorado (which is the main outlet of the San Juan River), the coast line appears to be practically stable, and the real purpose of the proposed alternative line is to reach that point and adopt it for harbor purposes, claiming much reduction in cost of canal between the San Carlos dam and the sea, as well as a far more desirable harbor location.

A careful reading of the paper does not disclose information secured by an actual survey of the proposed alternative line, nor by borings made along it. Some reconnaissances and surface observations had been made over portions of the location, but those are all. In view of the great extent of the survey and boring work done by the numerous parties of the Nicaragua and Isthmian Canal Commissions on both their trial and final lines, it would seem that correspondingly thorough data would be required to determine the merits of any alternative location. The author of the paper states at one point that information which one would naturally suppose to be an important part of the necessary knowledge was obtained "from the high pilot house of a steamer on the San Juan River." When it is remembered that the information gained in that way bears upon the depth of cutting required for the canal and the character of the material to be excavated, it can readily be realized that conclusions based upon such data should be drawn cautiously or rather, not at all.

The conditions at Greytown are certainly most unencouraging for a harbor and the search for some other harbor site is a necessity in the complete consideration of the Nicaragua route; but the alternative line proposed appears to involve very serious difficulties of its own. The Isthmian Canal Commission pointed out a grave obstacle to any location on the right bank, or southerly side, of the San Juan River, viz.: the crossings of the San Carlos and Serapiqui rivers. The author avoids the former by utilizing the old Ochoa dam site and dangerously underestimates the difficulties of the latter. He names eleven crossings of streams made by the Isthmian Canal Commission's lines on the left, or northerly, bank of the San Juan River and compares with them seven crossings, including the San Carlos and Serapiqui rivers, on the right, or southerly side, thus showing four less on the latter. He fails, however, to observe that the total volume of discharge of the eleven streams is so much smaller than that of the Serapiqui alone as to be practically insignificant in comparison with it. According to the report of the Isthmian Canal Commission, the flood discharge of the Serapiqui is considerably larger than 26,000 cubic feet per second. Coupling the difficulty of such a crossing by a ship canal with the fact that essentially all exact data on which estimates and comparisons of features must be based are lacking, it is apparent that the proposed alternative has not yet reached a stage of very clear definition as to its value. Nothing short of a complete survey of an entire line with borings to establish positively the character of the materials to be dealt with will determine whether a portion of the proposed canal route is worthy of serious consideration. Anything less than that is too uncertain and too speculative to be considered in comparison with the more reliable data obtained on other locations.

Another grave objection, indeed fatal objection, to the proposed alternative line is the stone-fill dam at Ochoa. Such a structure has been sufficiently discussed in other engineering publications to make it inadvisable to prolong that discussion here. Whether that type of dam properly designed may not legitimately be adopted for some locations is doubtless an open question, but it certainly is not a suitable type of structure for the San Juan River at Ochoa, nor is Ochoa the proper location for a dam having for its purpose the extension of the lake level along the river. It would be exceedingly injudicious to attempt at all to hold the flood waters of the San Carlos with all the sediment carried by them; they should have free passage down the San Juan. The virtue of the chain netting proposed is questionable, even if it would not quickly rust away in the waters of a tropical river. It still appears not unlikely that the investigations of the Isthmian Canal Commission have settled all the main features of the Nicaragua route so completely as to leave little need for consideration of other than secondary or detail studies.

New York Rapid Transit Railroad.

Residents in New York and the strangers in their midst as well have had no need to be told during the last year that the Rapid Transit Railroad would soon be an accomplished fact. A long period of legal controversy has been succeeded by a short period of construction on a scale which has been attempted within the limits of no other city. In a hazy way the history of the work and the plans for the road have been known to the public, yet it is a noteworthy fact that the Board of Rapid Transit Railroad Commissioners never made a comprehensive report until this year, although the commission has existed continuously in one form or another for eleven years. The Board is not required to make periodical reports and the long delay in the publication of any such documents is ascribed officially to the lack of tangible and physical results in which the public would be interested. This absence of any legal requirement making it necessary to print records of its work, and the advantage of this fact which the Board took, may explain the former feeling of many taxpayers that the Commissioners were altogether too independent and secretive. The citizens acquainted with large affairs recognized, however, the shrewdness and public spirit of the members of the Board, and appreciated the necessity of silence in negotiations affecting closely some of the strongest corporations in the city. These years of investigation, legislation and conference with existing railway corporations were really the crucial period of the undertaking, and the completeness with which the Commissioners' acts have at last been published shows their desire to take the public into their confidence fully as soon as the conditions warrant. The record is one of patience, tact and shrewdness which merits a conspicuous place in the city's annals.

While the Board had full power to adopt whatever type of road it judged would afford the greatest advantage, nevertheless the public had to be convinced of the desirability of underground traction because it would sooner or later have to vote to accept or reject the entire project. How well that missionary work was done is shown by the fact that the plans were approved by a vote of 132,647 to 42,916. It was also necessary to secure from the Legislature privileges of an entirely novel sort. "The great object aimed at," Mr. Abram S. Hewitt has said, "was to secure the early completion of the work, its continued ownership by the city, and its reversion at the end of fifty years to the city, free and clear of all incumbrances of every kind and nature whatever." To this end the city's credit had to be extended in a novel manner, already described in The Engineering Record, and the permission to make this use of municipal funds, granted by the Legislature in 1894, is the keynote to the great work now taking place on Manhattan Island. Without it all the skill of the engineer and the diligence of the contractor would be of no avail.

The engineering problems involved in the construction of the road have been described in numerous articles in this journal. The general design was adopted after a careful investigation of all systems of urban railways in the United States and abroad. The question of routes was settled in no small degree by the courts in the course of protracted litigation over other matters. Plans had to be made for extensive modifications of the water and sewerage systems of the city, the change of electric conduits and gas pipes, and the maintenance of conduit electric railways with heavy traffic. Under the most favorable conditions the engineering work would be extremely complicated, but in New York records of underground construction are scanty and confusing. It is impossible to foretell with certainty what obstacles may be encountered in excavating a large trench in any of the leading streets of the city. Consequently the celerity with which construction has progressed and the absence of friction between the engineering department and the contractor make it interesting to notice their respective organizations. This is particularly true when the unsatisfactory experience on the Chicago Drainage Canal is considered.

The staff of Mr. William Barclay Parsons, chief engineer of the Board, is headed by a deputy chief engineer, Mr. George S. Rice. For convenience in superintending the construction, the work was separated into five divisions, each under a division engineer. There is also a general inspector of designs in charge of the preparation of all detail designs and a general inspector of materials. Each division and also the Bureau of Inspection has had an office separate from that at headquarters, with an appropriate force of assistant engineers and inspectors. Of the 118 engineers on the force 100 were graduates of technical schools, Columbia having 27 representatives, much the largest number contributed by any one institution. Even among the 75 rodmen and axemen, 44 out of 75 were graduates.

The contractor's methods are of special interest because this undertaking is the largest municipal contract awarded to a single person, and its progress has been notably rapid when the difficulties of the work are considered. The executive staff embraces a chief engineer, general manager, electrical director, mechanical engineer and car designer, all eminent specialists. The railway was divided into fifteen sections, their points of beginning and ending being fixed by local conditions requiring variations in the construction; and the reconstruction of the most important sewers which had to be changed as a result of the railway was also sublet independently of the sections to which they were related. Some idea of the magnitude of the undertaking may be gathered from the following table of some of the estimated quantities. In connection with these quantities it is interesting to note that although the contractor was given the option of making the working drawings himself, subject to the approval of the Board, or permitting them to be worked out under Mr. Parson's direction, the latter course was adopted, even to the design of the station details. Drawings when thus completed have been forwarded to the contractor, who, in turn, has sent them to the sub-contractor for steel. The latter then prepared the requisite shop drawings, sending them to the contractor, who forwarded them to Mr. Parsons for examination and approval. In this way every drawing has had a double check.

Some of the Quantities on the New York Rapid Transit Railway.

Length, feet	109,570
Underground track, feet	245,514
Elevated track, feet	59,766
Earth excavation, cubic yards	1,700,228
Rock excavation, cubic yards	921,182
Rock tunneling, cubic yards	368,606
Steel work, net tons	65,044
Concrete, cubic yards	489,122
Waterproofing, square yards	775,795

The inspection of materials for this undertaking has demonstrated forcibly how uniform the grade of steel and cement can be maintained when the manufacturer so desires. Out of 1,269 different heats of steel tested in 1900, only 17 were rejected, and out of 3,033 heats tested in 1901 but 12 failed to pass. In the shops, moreover, the manufacture of the steel approached closely to the theoretical limits. The Board's specifications prohibited the weight of finished material from falling below the estimated weights, as computed from the drawings, by more than 2½ per cent., and the contractor, in his arrangement with the American Bridge Company, the sub-contractor for shop work, imposed a similar restriction as to the excess of weight. Up to the present year, the variation of the shipping weights from the estimated weights is only 0.03 of one per cent., this amount being a deficiency.

The record in the matter of cement has been equally interesting. The entire contract for both natural and Portland cement was placed with a single manufacturer, the American Cement Company. As soon as the cement was made it was placed in bins holding about 1,400 barrels each, whence the samples were taken. The material was kept stored in this way until after the completion of 28-day tests, unless rejected sooner. After acceptance it was placed in bags closed with lead seals, and thus shipped. During 1900 42,000 barrels of Portland and 5,000 barrels of natural cement were shipped, and during 1901 the amounts were 148,420 and 10,920 barrels respectively. The results of the briquette tests are given in the accompanying table:

Briquette Tests of Cement.

	1900.	1901.
Portland cement, neat—		
Broken	1,827	15,606
Passed	1,733	15,560
Failed	94	46
Portland cement, sand—		
Broken	726	10,671
Passed	698	10,654
Failed	28	17
Natural cement, neat—		
Broken	411	750
Passed	363	750
Failed	48	...
Natural cement, sand—		
Broken	138	882
Passed	134	882
Failed	4	...

The Board had a laboratory at the cement works, equipped with two testing machines, boiling and steaming apparatus and all other appliances necessary to determine the character of the cement offered for use. In addition to the regular tests to determine properties mentioned in the specifications, various investigations were conducted to ascertain the effect of modifications in the process of manufacture on the quality of the product. In these investigations the manufacturer co-operated heartily and the improvement in the product in 1901 over that in 1900 is doubtless due in a considerable measure to these researches. "The special quality of cement obtained was largely the result," Mr. Parsons states, "of a ruling requiring a specific ratio of increase in tensile strength from 7 to 28 days, and, furthermore, that cement showing as high as 750 pounds at the earlier stage should be generally refused as unlikely to give good practical results in long-time tests."

The Annual Report season is approaching, and so we wish to remind the readers of The Engineering Record that municipal, State and other reports containing items of interest to engineers will be gladly received. Please send your reports promptly.

The Hibernia Building, New Orleans.—II. Superstructure.

The interesting foundations for the Hibernia building, for which Messrs. D. H. Burnham & Company, of Chicago, are architects, and Mr. J. G. Glaver, structural engineer, were described in a recent issue of The Engineering Record. In this article a description of the steel cage superstructure will be given. The building is adjacent to the St. Charles hotel, at Carondelet and Gravier streets, is 82x128 feet and has a basement, twelve stories and an attic.

The angles at the corners of the lot vary from about 79½ to 97 degrees, and on the St. Charles side there is a 29x40-foot open court with its angles varying slightly from right angles. These features prevent the arrangement of all the columns in the same straight lines, and eleven of them are located in two diverging longitudinal rows from about 31 to 46 feet apart between end columns. The intersections of these rows with the building lines are not on the centers of wall columns, and for this reason many of the panels of floorbeams and girders are not rectangular. In the ends of the building the wall columns are closer together than the interior columns, and near the elevator shaft additional columns are interpolated to reduce the long spans between columns at the intersections of the regular rows. These conditions make the framing simple but special, and necessitate the use of unusually heavy girders and floorbeams and some bent plate connections for the long spans and oblique panels.

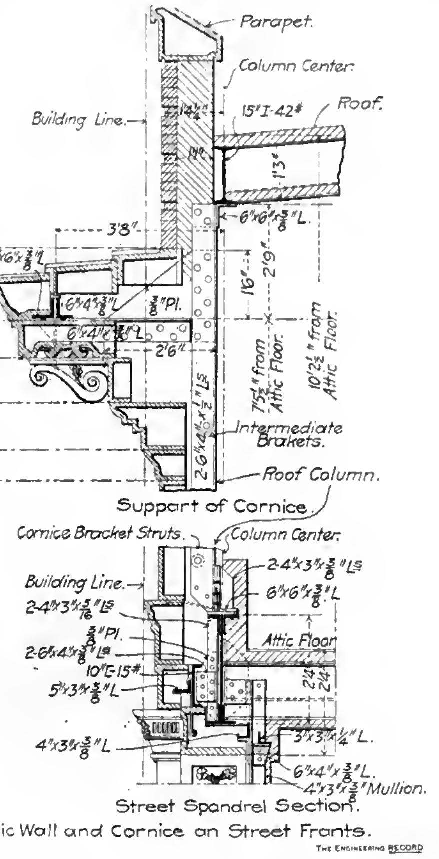
In the typical floors, from the 4th to the 10th stories inclusive, there are in the center of the building two transverse girders, 34 and 37 feet long, which are respectively made with pairs of 24-inch, 100-pound and 24-inch 80-pound I-beams. Adjacent to one of them is a 31-foot plate girder with a 15x7/16-inch web, four 6x6x¾-inch flange angles and two 13x⅝-inch flange cover plates. At the opposite end of the row, in front of the elevator shaft, there is a 40-foot plate girder 28 inches deep; beyond it where the span is still greater intermediate columns are introduced between the longitudinal rows and the girders are reduced to single and double 15-inch I-beams which are used in all other cases in the remaining floor panels. The floorbeams which they support are 12 and 15-inch I-beams, spaced from 5 to 7½ feet apart.

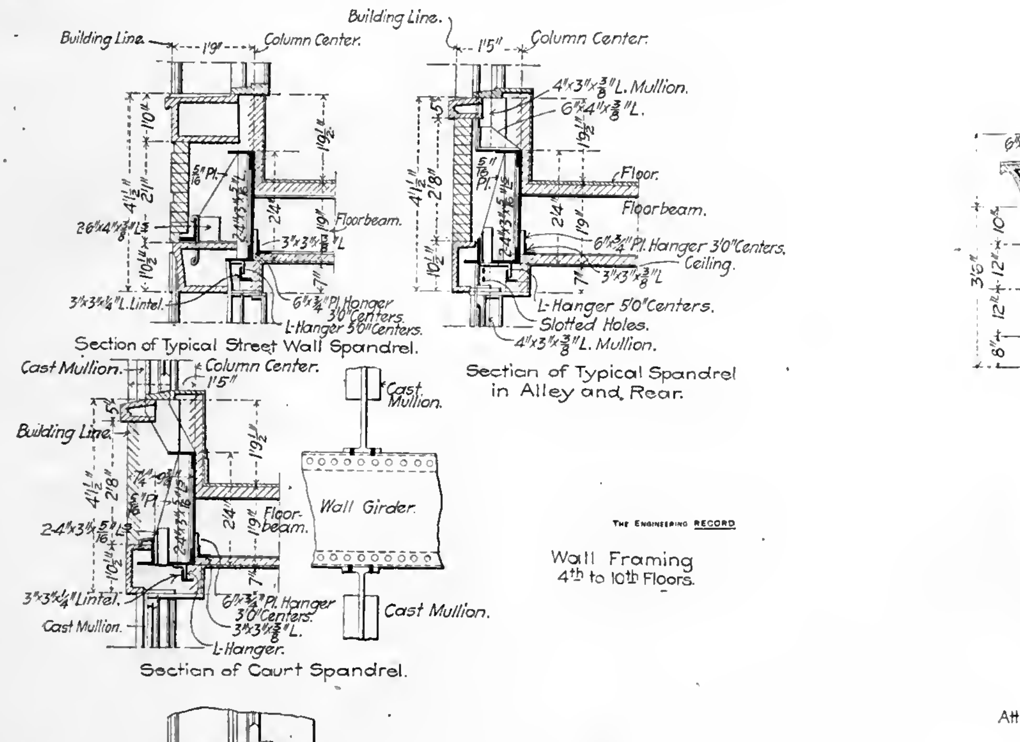
The wall girders carry both the wall masonry and the ends of the floorbeams and have uniformly 28-inch webs in the planes of the centers of the columns, and two 6x4-inch flange angles each, except in one court wall girder which has two 5x3½-inch flange angles. In the party wall between the Hibernia building and the St. Charles hotel the wall girders have four 6x4-inch flange angles, are in the center line of the wall and carry the ends of the beams in the hotel floors. Elsewhere the wall girders are wholly inside the masonry lines, are enclosed by plastering furred out around them, and have, on their exterior faces, solid plate brackets opposite the ends of the floorbeams, which carry a 6x4x7/16th-inch short angle continuous around the exterior of the building to support the terra cotta courses between the windows in successive stories. Where necessary, 3x3-inch horizontal angles are suspended from the wall girders for window lintels and to receive the edges of the floor arches.

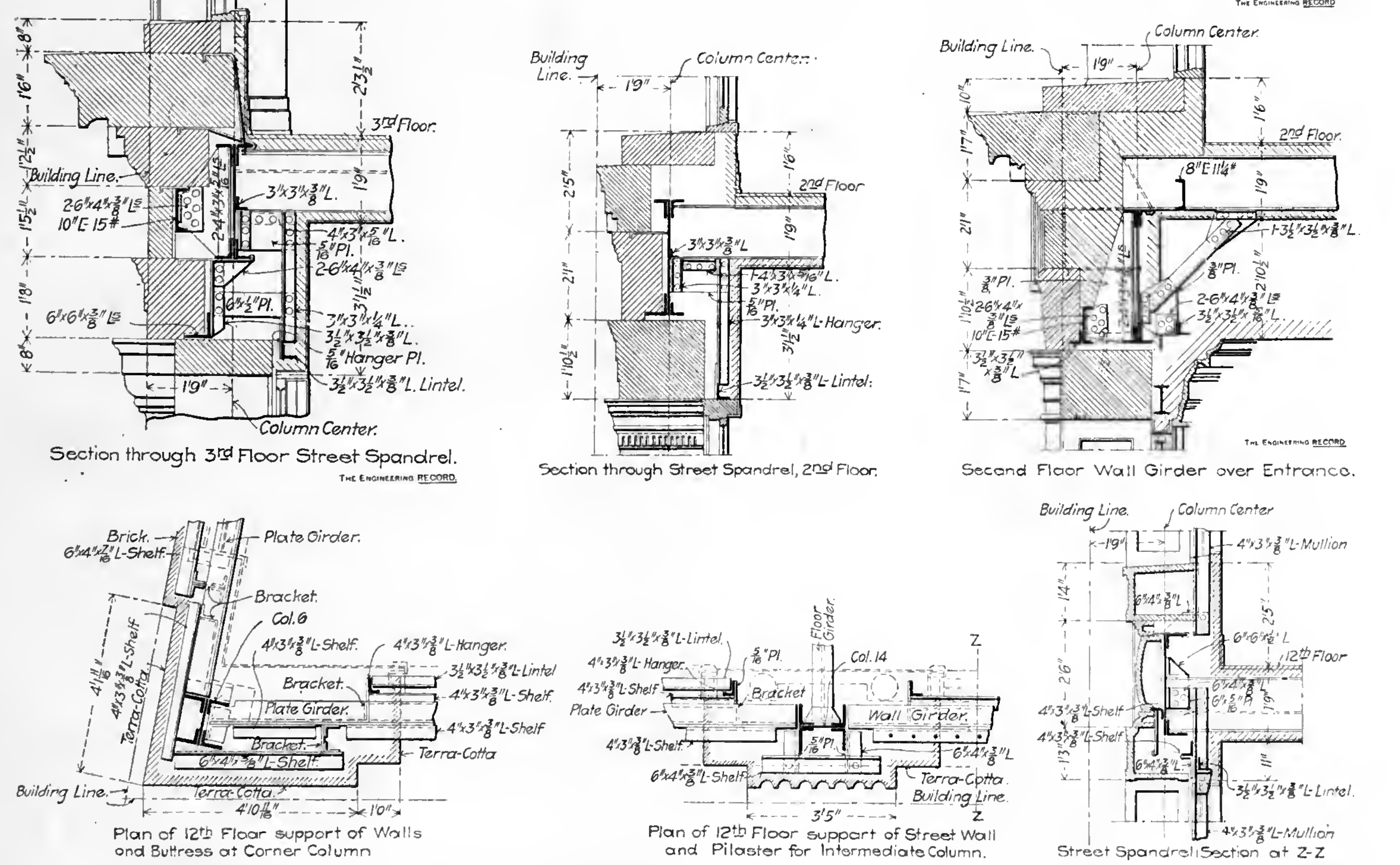
In the alley and rear walls the mullions are single 4x3-inch vertical angles offset nearly a foot from the girder webs. Their feet are riveted to angle brackets projecting across the top flanges of the wall girders, and their upper ends have slotted holes for bolts in similar brackets riveted across the bottom flanges, as shown in the detail cross section of girder and wall. In the light court the mullions are vertical cast iron T-bars with their tops and bottoms bent at an oblique angle so that they can be flange bolted directly to the wall girders. There is a triangular space 40 feet long and nearly 4 feet in maximum width between the elevator girder and the elevator shafts. The ceiling here is dropped about 12 inches below the general height, to enclose the bottom of the girder, and is plastered on the under sides of flat tile arches carried on the lower flange of the 28-inch plate girder and on parallel 6-inch I-beams suspended from other 6-inch I-beams 12 inches in the clear above them, framed into the regular floorbeams.

The arrangement and most of the details in the other floors correspond closely to those in the typical floors, the principal variations being made in the spandrel supports to provide for the architectural treatment of the wall masonry. In the second floor the wall girders in the street fronts are 32 inches deep and their 6x4-inch shelf angles are omitted. Their top flanges are made with two 5x3½-inch angles and the bottom flanges with one 6x6 and one 3½x3½-inch angle, the latter serving for a direct support of one course of solid face masonry. Over the entrance on Carondelet Street, the wall girder is 38 inches deep with four 5x3½-inch flange angles, and partly supports the heavy masonry on a channel and angle bracketed out from its face. The upper courses are anchored back to its top flange and web, which is stiffened to receive them, by knee braces to the floorbeams, as shown in the cross section.

Next to the St. Charles party wall there is a floorbeam about 4½ feet from the wall girder and the space between it in the wall is utilized for a pipe chamber between the floor and ceiling. The pipes are carried by transverse 3x3-inch T-bars resting on the lower flange of the floorbeam and on a 5x3½-inch angle bracketed out from the wall girder web, so as to be clear of the party wall. At the third floor there is a projecting course of stones nearly 4 feet wide which is entirely supported from and an-



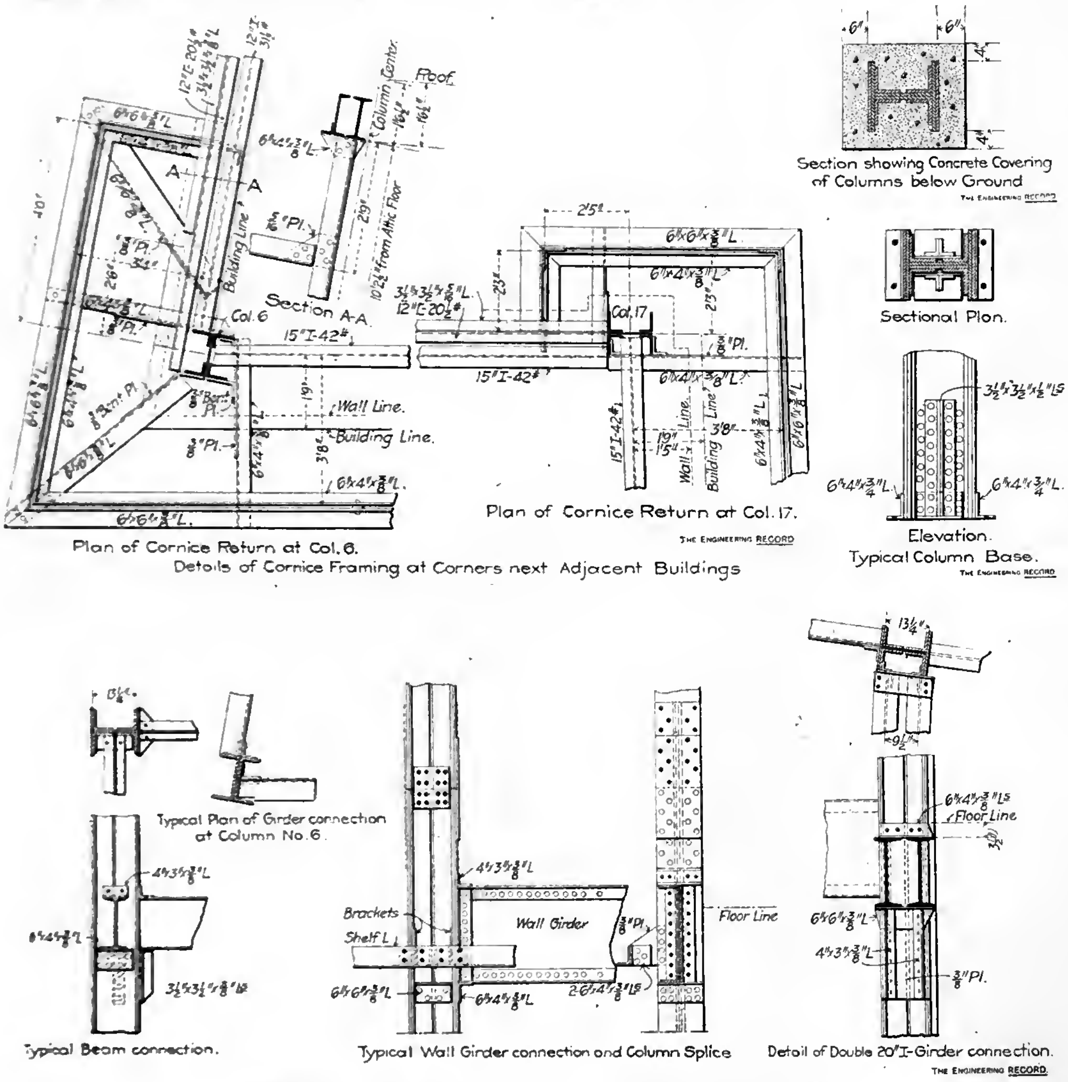




DETAILS OF THE SUPERSTRUCTURE OF THE HIBERNIA BUILDING, NEW ORLEANS.

chored to the wall girders as shown in the section of the street front spandrels. The heaviest courses are carried on a 10-inch channel bracketed out about 14 inches from the girder web, and the bottom courses and the window lintels are carried from a shelf angle which with the lintel angles is riveted to vertical frames suspended at intervals from the wall girders and the floorbeams.

At the 12th floor the wall columns are enclosed in masonry which projects from the face of the wall to form buttresses or pilasters. These are carried on shelf angles bracketed out from the wall girders and columns as shown in the horizontal sections through columns 6 and 14. At this floor the mullions and shelf angles on the Carondelet Street front are inside the wall girders and are suspended from their webs, and the terra cotta belt courses are carried on the lower flange angle which is reversed and about 4 inches above the lower edge that for the other floors in that there are no wall girders and that, as the excavation extends over only a part of the area of the lot, the floor rests on the earth beyond the basement walls and no part of it is carried by the wall columns. The outer ends of the floorbeams rest on cast iron bearing plates on top of the retaining walls and have pin anchors. Pipe trenches 4 feet wide, with concrete side walls, are carried from the retaining wall to the feet of the wall columns and are covered with 3x3-inch T-bars 18 inches apart resting on the side walls and supporting book tiles and concrete. The pavement is laid on the surface of the ground and its outer concrete edge is confined by a 6x4-inch curb angle with the horizontal lower flange turned inwards. The curb is anchored by transverse horizontal angles 2 feet long, riveted to it 5 feet apart, which are buried in the earth and have short transverse angles riveted across their inner ends.



DETAILS OF SUPERSTRUCTURE OF THE HIBERNIA BUILDING.

of the girder web. At the attic floor the terra cotta courses are carried partly on a 10-inch channel and 5x3½-inch angle bracketed out from the face of the wall girder, and partly from a 4x3-inch shelf angle suspended from brackets on the inside of the girder webs.

In the street fronts the wall girders carry on their top flanges vertical posts, about 6 feet apart, and 7 feet high, which are riveted at their upper ends to the horizontal 15-inch I-beams connecting the tops of the wall columns. These posts have T-shaped cross sections made with two 6x4-inch angles and have riveted between them at the top the solid web plates of brackets for projecting horizontal beams made of pairs of 6x4-inch angles 4 feet long carrying at their extremities two horizontal angles to support the overhanging cornice.

The first floor framing is very different from

At the street corners the cornice shelf angles project nearly 7 feet from the centers of the columns, on the diagonal line, and are mitered together and supported by special brackets riveted directly to the column flanges with oblique bent plates as shown in the plan at column 6.

The column details are very simple. All have I-shaped cross sections made with a web plate and four angles, and some of them have cover plates on the flange angles. At the foot of the lowest section of each column the web is reinforced by vertical angles and there are horizontal flange angles on every side to connect with the base plate seated on the planed top of a cast iron pedestal with extended base and longitudinal, transverse and diagonal webs. The column splices are made with web and flange cover plates, field-riveted to both sections. All plate girder connections have top and bottom shelf angles and vertical web connection angles. I-beam connections are made with top and bottom shelf angles, the latter reinforced by vertical angles when necessary.

The steel shell of the smokestack is 216½ feet high and is ⅜-inch thick in the bottom third of its height, 5 1/6 inch in the middle third and ¼ inch at the top. It is stiffened by inside horizontal rings of 2x1⅝-inch angles 3 feet apart vertically, and is made in 6-foot courses, shop-riveted together in sets of three with 4x5/16-inch outside splice plates. The 18-foot sections are field-riveted together with 2x3-inch flange angles. The smokestack passes through openings framed with longitudinal and transverse I-beams in every floor of the building, and at every third story each side of the shell is anchored by a projecting bracket with a vertical slot which engages a bolt in a lug riveted to the beam web and allows vertical adjustment for expansion and contraction.

The Sulphurous Anhydride Waste-Heat Engine.

Abstract of a paper read by Prof. Edward F. Miller, of the Massachusetts Institute of Technology, at the meeting of the New England Water-Works Association, November 12. The complete paper will be published in the forthcoming number of the "Journal" of the New England Water-Works Association.

For a few months back experiments have been made in Germany upon a new type of steam engine in which an unusually high efficiency is secured by increasing the range of temperature through which it works by reducing the temperature of exhaust far below what is current practice. The engine was described in the paper which, through Professor Miller's courtesy, we are enabled to abstract.

In an ordinary steam engine about sixty per cent. of the heat of the coal goes to waste, and the subject of the paper is how some of the heat that is lost can be recovered. The efficiency of any heat engine is evidently the ratio of the heat transformed into work to the heat received, or the heat supplied minus the heat exhausted divided by the heat supplied is the efficiency in per cent. It has been shown by theoretical discussion that for what is called the perfect engine, the efficiency is proportional to the ratio of the temperature worked through to the absolute temperature of the source of supply. As an illustration, take the case of the steam engine using steam at 165 pounds absolute pressure and exhausting at 26 inches vacuum, and see what would be the efficiency of the theoretically perfect engine. Such an engine is supposed to be one which has no losses, no cylinder condensation, no radiation, and the walls of the cylinder are supposed to absorb no heat. Such an engine is called the theoretically perfect or Carnot engine. Its efficiency would be the temperature of supply minus the temperature of exhaust divided by the absolute temperature of supply. Reducing the temperatures of the steam at the two pressures given to absolute zero, we get as the efficiency of the perfect steam engine 29 per cent. The actual engine, on account of its cylinder condensation and radiation, realizes only 80 per cent. of this and has a thermal efficiency of 23 per cent.

Attempts have been made recently to increase the efficiency by raising the temperature of the incoming steam. In modern plants in Germany it is now the custom to superheat the steam 300 degrees F. and that raises the efficiency. An engine working with the same pressures as those mentioned but with steam superheated 300 degrees F., gives us 48 per cent. as the efficiency for the perfect engine. Taking 80 per cent. of that we have about 38 per cent. as the efficiency of the actual engine, but, of course, if you superheat the steam it means that you must have an extra furnace or some superheating device, and that means that the cost of a pound of superheated steam is more than the cost of a pound of saturated steam.

It is only recently that attempts have been made to increase the efficiency by lowering the temperature of the exhaust. Evidently you can raise the efficiency by raising either the temperature of the source of supply or lowering the temperature of the exhaust. If you will consider the expression for efficiency for a moment you will see that for an engine to attain an efficiency of 100 per cent. the engine must transform all the heat it receives into work. It must exhaust no heat. It must exhaust at the absolute zero of temperature, or 460.7 degrees below zero Fahrenheit. One can see that the actual steam engine must necessarily have a limit to its efficiency. The best vacuum ordinarily maintained is about 26 inches. That means the temperature of the steam leaving is 126.3 degrees F. Cooling water for the condenser entering, say, at 70 degrees F. will leave the condenser somewhere in the vicinity of 130 degrees F. If you maintain a vacuum of 26 inches of course your cooling water will leave at a temperature much lower than 126.

Instead of using cooling water in the condenser the new engine uses sulphurous anhydride. Sulphurous anhydride at the ordinary temperature is a gas, colorless like air, has a peculiar odor of sulphur and can be easily liquefied at the ordinary temperature by applying a pressure of about twenty-five pounds. It is called SO_2 in chemistry, consisting one atom of sulphur and two of oxygen in a molecule. In the sulphurous anhydride engine the SO_2 is used in the place of the cooling water in a surface condenser. The sulphurous anhydride is vaporized and the SO_2 is used in a separate cylinder. This cylinder gives power which is utilized, and then the SO_2 from this separate cylinder passes to another condenser where it is condensed by cooling water, then the liquid SO_2 is again pumped back into the vaporizer or condenser, thus the SO_2 is used over and over again.

Figure 1 shows the arrangement of a triple expansion engine. The condenser in this case has to be made specially for the liquid sulphurous anhydride which passes in as indicated by the arrow. The steam is condensed and a vacuum is maintained on the low pressure cylinder by means of an ordinary air pump. The heat given up by the steam in condensing serves to vaporize the sulphurous anhydride, and the pressure of something like 175 pounds of the sulphurous anhydride vapor is maintained in this surface condenser. That vapor passes to the cylinder at the right where it is used, and from the cylinder at the right it exhausts to the condenser at the left, which is nothing but a surface condenser. After being condensed here under a pressure of forty pounds the liquid is pumped by a small pump back into the vaporizer, thus making a complete cycle. In Figure 2, the pressure curves of the SO_2 and steam are given. At 180 degrees F. the pressure of the steam is only 7.5 pounds, whereas the pressure of sulphurous anhydride is something like 270 pounds. At 100 degrees F. the pressure of sulphurous anhydride is something like 80 pounds, and its total heat is very much lower than that of steam. On the same cut, the total heat of a pound of steam ranges in the neighborhood of 1,100 and of sulphurous anhydride 190. This, of course, will make it evident that it is possible to vaporize sulphurous anhydride and get excessive pressures with it, the fact being that the total heat of sulphurous anhydride is low and its pressure rises rapidly with rising temperature.

Reproductions of indicator cards taken from the engine are given in Figure 3. The sulphurous anhydride card is shown at the bottom. The initial pressure in the cylinder was 160 pounds, the back pressure approximately 135 pounds. The size of the sulphurous anhydride

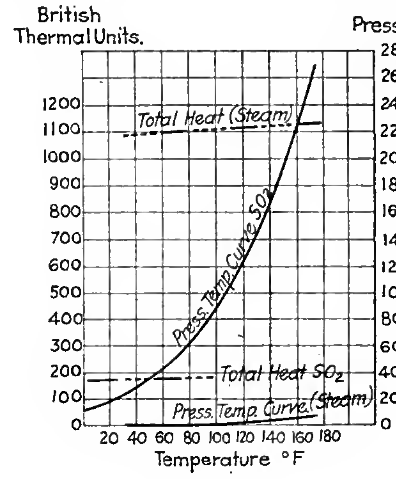


FIGURE 2.

Test of a Triple Expansion Condensing Engine Having a Sulphurous Anhydride Heat-Saving Cylinder Attached.

Arrangement of Apparatus during the Test		1	2	3	4	5	6	7	8	9	10	11	12	13
		Steam engine working triple expansion									Steam engine working compound			
		Water from the condensation traps led into the vaporizer							into the disch'ge pipes	Water from the condensation traps led into the vaporizer				
		Superheated Steam.								dry saturated	Superheated Steam			
Speed—r.p.m.		139 6	136 3	143.5	137.4	145.	145.	148.	148.	149.	137.	148.	137.	146.
Volts at Dynamo		210.	189.5	210.	191	209.	212.	231.	230.	230.	218.5	235.8	210.	230.
Amperes from Dynamo		502.	529.	584.	414.5	579.	576 4	610.	610.	600.5	508.7	531.	470.	272.
Steam Engine: Temperatures °F.	Boiler steam—admission	534.	588.	590.	583.	579.	579.	590.	574.	373.	630.	619.	630.	626.
	Degrees—superheat	175.	219.	221.	214.	210.	210.	221.	204.		257.	247.	261.	257.
Steam pressures	Inlet pressure—High-press.-cyl.—lbs per sq. in. above atmos	136.5	156.5	158.	156.5	156.5	156.5	156.5	158.	156.5	166.5	163.7	156.5	156.5
	Per cent. vacuum in condenser	80.	80.5	70.	85.	79.5	69.	68.5	68.5	68.2	73.	69.1	70.2	75.2
Indicated output Horse power	High-pressure cylinder	59.2	55 2	68.6	40.9	59.6	63.6	76.5	76.2	59.2	77.5	86.7	73.9	50.8
	Intermediate cylinder	43.3	35.7	43.2	31.3	42.4	41.1	42.5	45.0	47.3	—	—	—	—
	Low-pressure cylinder	29.6	34.3	42.4	29.4	43.3	39.8	42.9	42.0	49.8	44.3	53.8	43.7	31.6
	Complete engine	132.1	125.2	154.2	101.6	145 3	144.5	161.0	163.2	158.3	121.8	140.5	117.6	82.4
Steam consumption in lbs. per hour	Condensation from the vaporizer	1652.	1405.	1881.	1465	1980.	1994.	2133.	1775.	2562.	1649.	1885.	1612.	1197.
	Condensation from the steam jackets and receiver	—	—	—	—	—	—	—	367.	—	—	—	—	—
	Total condensation	1652.	1405.	1881.	1465.	1980.	1994.	2133.	2142.	2562.	1649.	1885.	1612.	1197.
	per H.-P. ind.	**12 5**	**11.2**	**12.2**	**14.4**	**13.6**	**13.8**	**13 2**	**13.1**	**16.4**	**13.5**	**13.4**	**13 7**	**14 5**
Waste-Heat-Engine: Temperatures °F.	SO_2 vapor. Admission to cylinder	132.0	133.7	151.7	122.7	137.3	157.1	155.1	158.9	153.5	1.2.8	155.4	154 2	147.9
	SO_2 liquid. Outlet from condenser	66.2	65.8	67.6	64.4	68.5	67.6	68.0	65.6	70.0	64.6	66.9	75.2	65.1
	Circulating water—inlet	49.6	49.9	49.9	50.2	50.2	50.2	50.2	50.2	50 2	50.2	50.2	50.0	50.0
	Circulating water—discharge	59.9	60.2	62.4	60.2	63.8	63.3	63.4	62.1	65.1	61.2	63.3	76 6	63.0
SO_2 pressures (above atmospheric in lbs. per sq. in.)	in vaporizer	132.	128.	172.	110.9	142.2	187.7	186.3	192.	180.6	177.7	1 3.4	180.6	164.9
	in condenser	31.2	33.5	34.8	31.2	35.5	35.5	36.2	34.2	38.	33.2	34.8	46.2	33.1
Output—H.-P.	Indicated	45.3	42.8	56.8	31.0	50.1	57.6	61.3	54.7	66.0	48.0	55.6	40.8	30.6
	in per cent. of steam engine	**34.4**	**34.2**	**37.0**	**30.5**	**34 5**	**40.0**	**37.9**	**33 3**	**42.1**	**39 4**	**39.5**	**34.8**	**37.2**
Consumption of waste steam per I.H.P. per hour lbs.	Condensation from the steam jacket and receiver: Taken into the Vaporizer	**36.5**	**32.8**	**33.2**	**47.3**	**39 5**	**34.6**	**34.8**	—	**38.9**	**34.4**	**33.9**	**39.5**	**39.1**
	Condensation from the steam jacket and receiver: Led to the discharge pipes	—	—	—	—	—	—	—	**32 5**	—	—	—	—	—
Combined Engine: Output—H.-P.	Indicated	177.4	168.	211.	1.2.6	195.4	202.1	2.3.2	217.9	222.3	169.8	196.1	158.4	113.
	Effective	151.8	143.8	177.2	114.2	174.3	176.2	202.9	201.9	201.	150.8	180.2	141.3	89.7
	Electrical	140.9	131.	164.5	106.3	162.5	163.5	189.1	188.2	187.2	141.9	167.5	132.	83.7
Total steam consumption per hour—lbs.		1652.	1405.	1881.	1465.	1980.	1994.	2133.	2142.	2562.	1649.	1885.	1612.	1197.
Steam consumption per I.H.P. per hour—lbs.		**9.7**	**8.36**	**8.8**	**11.05**	**10.12**	**9.86**	**9.55**	**9.65**	**11.5**	**9.7**	**9.6**	**10.22**	**10.6**
Quantity of circulating water in gal.	Total per hour	—	11,660	13 090	—	12,486	11,3 0	12,468	12,584	13,310	12,144	12,056	5,236	8,140
	Per I.H.P. per hour for the comb. engine	—	69.5	61.6	—	63.8	56.1	55.8	57.7	59.9	71.6	61.5	33.0	71.9
Mechanical efficiency	Electrical output ÷ I.H.P.	79.5	80.1	78.	80.4	82.8	81.	84.5	86.	84.2	83.5	85.5	83.5	74.
	B.H.P.*) ÷ I.H.P.	85.5	86.2	83.8	87.5	89.1	87.	90.8	92.5	90.5	89.8	92.	89.8	79.5
Number of test		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**

*Dynamo efficiency assumed, 93%.

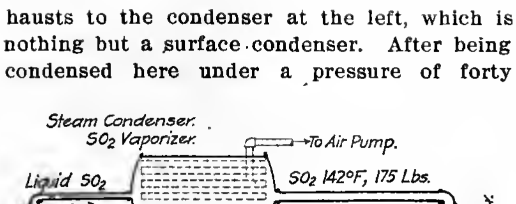


FIGURE 1.

cylinder was about the same as that of the high pressure cylinder.

On the combined diagram, Figure 4, the indicator cards from the sulphurous anhydride engine are plotted to the same scale as that of the steam cards. The shaded area is the low pressure card. Its length represents the volume of the cylinder and the height the actual

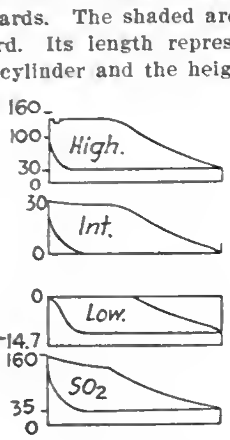


FIGURE 3.

pressure in it. The card above is the intermediate and the one above that the high pressure, each showing the range of temperature and pressure in a cylinder. Drawn to the same scale at the right is the sulphurous anhydride card shown on the diagram in Figure 3 and reduced to the same scale of volumes and scale of pressures. To make the comparison still more marked the card of the sulphurous anhydride cylinder is reduced to the same scale as the low pressure card.

The cards shown are taken from test number 8 given in the table. The table gives the date and results of a series of tests made by Professor E. Josse, of the Kgl. Tech. Hochschule of Berlin, Germany. The engine which he designed was about 175 horse power and the steam supplied to the engine was superheated some 200 degrees F. to 300 degrees F. in tests. The output in horse power obtained by the use of the SO_2 cylinder is between 30 and 40 of the total output of the steam engine. Theoretically this can be so, as will be seen by referring to the chart of efficiency. With the ordinary steam engine the range of temperature is from 365.9 degrees F. down to 126.3 degrees F. In the waste heat engine the temperature of the exhaust of the combined engine is reduced to 71 degrees F., which is the temperature of the SO_2 leaving the last cylinder. Suppose we substitute in the formula for efficiency. Instead of having 587 degrees F. as abso-

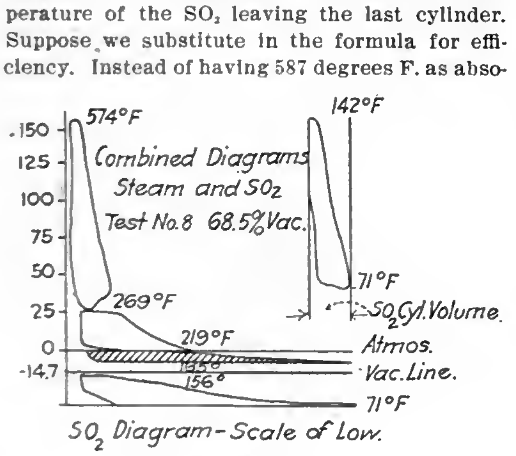


FIGURE 4.

lute temperature of the exhaust we have now 530.7 degrees F., giving us for the steam engine using saturated steam an efficiency of 36 per cent. as against 29 per cent. With the SO_2 cylinder attached to the steam engine cited in the second case where the steam was superheated 300 degrees, we obtain 53 per cent. efficiency against 48 per cent. The actual engine would probably realize 80 per cent. of these values.

The device for utilizing the waste heat can be attached to any engine which exists. The only thing needed is a safe, strong surface condenser to stand the pressure which you realize in the vaporizer acting as the condenser where the exhaust steam is condensed.

One might say that when combined with water SO_2 makes sulphurous acid, but there is no danger from any acid formed. As to the leakage and formation of H_2SO_3, the pressure of the SO_2 is always greater than the pressure against it, hence the tendency will be for the SO_2 to leak outwards, and should it leak outwards in the vaporizer it would immediately pass into the condensed steam which is constantly changing, so when the SO_2 combined with water it would pass off to the pump and be changing all the time. If it leaks into the other condenser where the pressure is 40 pounds, it would go into the cooling water, which is changing all the time.

Besides its application to the steam engine it can be applied in many other ways, as, for example, in the recovering of some of the waste heat of the exhaust of gas engines and in saving the heat of the flue gases leaving a battery of boilers. There is no reason why the draft cannot be maintained artificially and the heat going out from the exhaust be absorbed by an SO_2 vaporizer. The probable field for this engine and its most direct way into the market will be through its application to the gas engine. The ordinary gas engine gives a higher thermal efficiency than the steam engine, and the efficiency of the gas engine does not depend to any great extent on the load, as in the case of the steam engine. You often see the exhaust pipe of a gas engine of a dull cherry red color, which means a large loss of heat.

An SO_2 engine with vaporizer is now being applied to a gas engine in Germany. They intend to recover as much as possible of the waste heat of the gas engine by passing it through the SO_2 vaporizer. The steam engine of the class described has hardly passed the experimental stage. There have been three built which have been in use more than a year. There has been one running constantly day and night for about a year in an electric light station in Berlin furnishing power. The other engines have been built mostly for experimental work, and the earlier one was simply an old steam engine altered over to make it apply to this case.

The only difficulty so far has been in the method of packing the piston rod of the sulphurous anhydride cylinder. The difficulty was not a great one, but it was uncomfortable to work in the engine room if there was a leak of SO_2, and the stuffing boxes had to be absolutely tight in order to make it pleasant to visit that particular engine room. The difficulty was with the stuffing boxes, and the trouble has been overcome by making the stuffing box in two parts.

[A description of Prof. Josse's experimental engine and a brief account of the work done since 1892, the date when the subject was brought into prominence by the inventors Behrend & Zimmerman, was given in The Engineering Record of May 5, 1900.]

The American Institute of Architects will hold its thirty-sixth annual convention in Washington, D. C., December 11, 12 and 13. Papers on the "Improvement of Washington" will be presented by Messrs. Daniel H. Burnham, Frederic Law Olmsted, Jr., and Charles Moore, and Captain John Stephens Sewell, Engineer Corps, will read a paper on "The Relations of the Architect and the Engineer." The development of municipal improvement will be discussed by Messrs. W. B. de las Casas, Albert Kelsey, Owen Fleming and E. L. Masqueray.

The New York Tower Foundation for the Manhattan Bridge.

Bridge No. 3 across the East River will reach from the Bowery and Canal Street, Manhattan Borough, to Gold and Willoughby Streets, Borough of Brooklyn. It will be 9,330 feet long and 120 feet wide, and will have a main suspended span 1,400 feet long in the clear. Each tower for this span will have eight steel columns seated on a single masonry pier 23 feet above mean high water. The footings for these piers will be very large, wooden pneumatic caissons carried down beyond danger of settlement or scour. The Brooklyn pier and caisson, which is now nearly completed, were described and illustrated in The Engineering Record of March 2, 1901. Specifications have just been issued for the corresponding pier on the New York side, and notice of an invitation for bids for its construction appears in another column of this issue.

The 78x144-foot caisson will be 44½ feet in height and will correspond almost exactly to the Brooklyn caisson. According to the drawings and specifications, the masonry above the caisson is about four feet lower than that of the Brooklyn pier and differs from it chiefly in having only one well instead of three. It is built of 12x12-inch timber and 3x12-inch planks, with the walls of double, solid courses of timber and two courses of outside sheathing planks. The working chamber has a roof with two solid, crossed courses of timber and three of planks, and is divided into rectangular spaces by two longitudinal bulkheads and eight transverse struts. Above the roof there are transverse and longitudinal struts about 6 feet apart in alternate courses up to a height of 27½ feet above the cutting edge, and in every fourth course up to the top. These struts are braced together by diagonal timbers in longitudinal and transverse vertical planes, and all the interstices are filled solid with concrete to the top of the caisson, about 34 feet below mean high water.

Above that point there is a removable cofferdam, 44 feet high, constructed similarly to the caisson walls in three detachable vertical sections and having longitudinal and transverse struts 12 feet apart in horizontal planes about 6 feet apart. These struts are X-braced in vertical planes by planks which are removed when the masonry is built. The cutting edge and vertical corners are shod with steel angle plates, and the seams are calked with two threads of cotton, followed with four threads of oakum and served with hot pitch. The concrete is made with Portland cement and is machine mixed. The nine preliminary diamond drill borings indicate water of a maximum depth of from 25 to 46 feet, then silt, sand and gravel to a bed of rock or boulders at a depth varying from 100 to 129 feet below mean high tide. It is expected that the caisson will be sunk to a depth of about 79 feet and seated on fine sand and gravel. It is required that the work shall be completed in 300 consecutive working days, and that the bids shall be for a total price for completed work down to —79.15 feet, and for additional prices per cubic yard for work between horizontal planes at —79.15, —83, —87, —91, —95, —99 and —103 feet below mean high water.

The caisson is to be completed, before launching, to a height of 27½ feet, and will then contain 95,450 cubic feet of timber and 148 tons of iron, will weigh about 2,534 tons and will draw, without false bottom, about 13 feet. While floating it will be completed to a height of 44 feet 9½ inches and will then contain 128,100 cubic feet of timber, 163 tons of iron, will weigh 3,888 tons and will draw 15 feet. The bottom will be dredged from about 33 to 40 feet and to land the caisson on it about 5,300 cubic yards of concrete will be deposited in the caisson. To sink the caisson to —79.15 it will require to be filled with concrete up to the footing course and to be loaded with about 761 cubic feet of ashlar stone masonry besides. The approximate estimated total quantities are as follows: Dredging, 3,530 yards; excavation in caisson, 16,300 yards; timber in caisson, 132,000 cubic feet; iron in caisson, exclusive of pipes and shafts, 163 tons; concrete above roof, 12,500 yards; concrete below roof, 2,511 yards; masonry in pier, limestone 13,740 yards, granite 2,690 yards; timber in cofferdam, 45,522 cubic feet; iron in cofferdam, 41.2 tons.

The specifications contain some special provisions, among which it is required that the contractor must keep a fire extinguishing apparatus in proximity to the caisson at all stages of the work. The air shafts for men shall not be less than 4½ feet inside diameter, and must be equipped with elevators, and every safeguard must be taken to protect the men from the injurious effects of working under pressure. Electric lights and a telephone must be provided in the working chamber. Special care must be taken in concreting in the working chamber under the cutting edge, under the bulkheads and under cross timbers where there shall be in all cases a thickness of 6 inches of concrete for the full width. Pneumatic rammers must be used for the concrete in sealing the working chamber and in difficult places, and where ramming is impracticable the spaces must be grouted under pressure.

The work is being executed under direction of Mr. Gustav Lindenthal, Commissioner of the Department of Bridges, and Mr. H. A. LaChicotte, engineer in charge.

A Break in a Cast-Iron Pipe in the Thirlmere aqueduct supplying water to Manchester, England, emphasizes once again the importance of attention to a detail of pipe laying with which all water-works men should be familiar, especially inspectors and foremen, to whom it usually falls to see that the conditions of the pipe as placed in the trench are right. The following account of the accident is taken from "Engineering:"

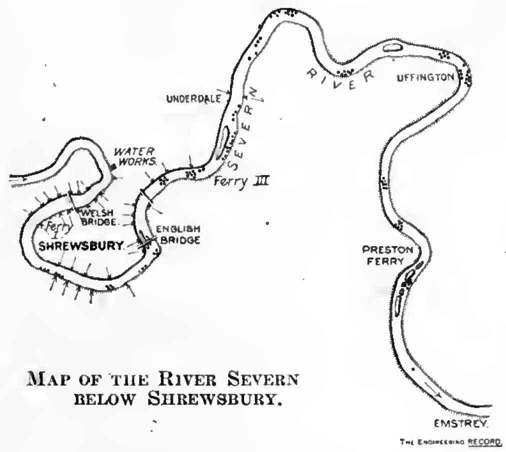
The week before last, the whole side of a pipe in the Thirlmere aqueduct burst out in one piece under the pressure of the water. The cause of the accident is remarkable. A second line of pipe is being laid. The pipe which gave way on the old line was just one length ahead of the last length laid in the new line, and the excavation had been made to receive the new pipe opposite to it. This excavation was about 10 feet deep, and was properly timbered. The men had ceased work a quarter of an hour before the burst occurred. When the outrush of water had been checked by the automatic valves on the line of pipe, it was found that the whole weight of the water and of the pipe, which was laid on the slope of a hill, was unsupported, except by a pinnacle of rock which jutted up under its center. The rest of the bed must have been soft ground. A photograph, which shows this rock and the fractured pipe, was taken just after the excavation above the pipe had been made for its removal, but before the ground below had been disturbed after the rush of water. There was a small transverse crack visible just above the point of contact between the pipe and rock. The diameter of the pipe was 40 inches; length, 12 feet; and the thickness of the metal, which was good cast-iron, was 1⅜ inches. The head of water in the pipe was 270 feet. The joints were bell and spigot.

Pollution and Self Purification of the River Severn at Shrewsbury.

A Review by George C. Whipple.

The second report of the Royal Commission on Sewage Disposal, recently issued, contained an interesting study of the pollution and self purification of the River Severn at Shrewsbury, by Prof. Boyce and Drs. MacConkey, Grünbaum and Hill. Shrewsbury is a town of about 29,000 inhabitants, located on a bend in the River Severn at a point where the minimum flow is about 85,000,000 gallons per day and the maximum flow something above 1,000,000,000 gallons. From this stream the town takes its water supply without filtration (the water is not used for drinking, however), and into this stream all its sewage is discharged without treatment. The dry sewage flow is said to be about 844,000 gallons per day, equal to about 1 per cent. of the volume of the stream. The upper reaches of the River Severn are comparatively unpolluted. One of its most important tributaries is the River Vyrnwy, which is one of the main sources of the water supply of Liverpool. This part of the watershed is scrupulously protected from contamination.

The water supply of Shrewsbury is drawn from a point in the stream just above the town, and above the intake the only important source of pollution is the sewage from the County Asylum, which enters the river two miles above. As the river winds through the town it receives from both banks the discharges of 36 small sewers, which enter at the points indicated on the accompanying map. In addition to this it receives deposits of garbage, refuse of all kinds, ashes, and the wastes from several manufacturing establishments. Below Underdale the amount of pollution is small, and except for occasional "land drains" there is but little pollution down to Ironbridge, the next town on the river below Shrewsbury, a distance of 23.5 miles. The water in the "soil drains" was, with one exception, perfectly clear, and out of 17 drains which were tested for the presence of B. Coli, 70 per cent. of them gave negative results, while the numbers of bacteria varied between 100 and 3,000 per cubic centimeter. Of 17 tributary brooks which were examined all were found to contain B. Coli in small numbers. The object of the investigations was to ascertain the character of the water at various points between the County Asylum and Ironbridge, and the effect of the sewage upon the bottom and shores of the stream. Two lines of work were carried on: first, that of the analysis of water at various places, and second, that of a study of the stream deposits. In both of these prominence was given to bacteriological rather than to chemical data.



MAP OF THE RIVER SEVERN BELOW SHREWSBURY.

Water Analyses: The water in the River Severn above the County Asylum was said to show but slight traces of pollution, but at the point from which the water supply of the town was drawn the evidences of pollution were quite marked, as may be seen from the following range of analyses:

Analysis of Water of the River Severn at the Intake of the Shrewsbury Water Works. Range from November 18, 1899, to March 27, 1901.

	—Parts per Million.—		
Total solids	112.8	to	162.4
Chlorine	9.7	"	20.0
Oxygen consumed in 4 hours	1.2	"	3.4
Nitrogen as albuminoid ammonia	.071	"	.125
Nitrogen as free ammonia	.028	"	.102
Nitrogen as nitrates	.30	"	.40
Number of bacteria per cubic centimeter	430	to	64,500
Number of B. Coli per cubic centimeter	1	"	111
Per cent. of samples which contained B. Enteritidis sporogenes	27		

Color, dark brown.

The number of bacteria varied, according to the stage of the river, from 430 to 64,000 per cubic centimeter, while every sample was found to contain B. Coli in numbers which ranged from 1 to 111 per cubic centimeter. The turbidity of the river water varied according to the rainfall but the method used for measuring the turbidity was an arbitrary one, based on the use of the centrifugal machine, and there appears to be no way by which their results can be transferred into terms with which American analysts are familiar. The water when clear is said to have a dark brown color, due to peaty matter in solution.

Samples collected from the stream as it flows through the town show the effect of pollution in the increased turbidity, the amount of organic matter, the total number of bacteria and the number of B. Coli per cubic centimeter. Below the town the water improves in character until at Cressage, 18 miles down stream, the total number of bacteria is lower than at the County Asylum. The numbers of B. Coli, however, do not decrease so rapidly, as will be seen from the figures in the following table. This may be due to the effect of the small feeders which, as above stated, were not entirely free of B. Coli.

Average Analyses of the Water in the River Severn at Various Points between Asylum and Ironbridge. November 18, 1899, to March 27, 1901.

Miles.	Locality.	Parts per Million. Albuminoid ammonia.	Free ammonia.	Nitrates.	Number of bacteria per c.c.	Number of B. Coli per c.c.	Per cent. of samples which contained B. enteritidis sporogenes.	*Turbidity.
0.0	Asylum	.090	.009	.42	7,000	13	0.0	5.5
2.0	Water works	.113	.056	.43	13,000	46	27.0	..
2.6	Ferry I.	...	...	..	20,000	177	51.2	..
3.6	English Bridge	...	...	..	23,000	321	85.7	..
4.5	Ferry III.	.197	.073	.42	19,000	600	41.7	8
6.75	Uffington	.153	.062	.57	17,000	142	33.3	7
11.0	Atcham	.135	.048	.51	13,000	48	38.9	6.9
18.0	Cressage	.147	.044	.43	5,000	36	31.6	6.8

*Parts of suspended matter in 600 cubic centimeters water.

The authors place great stress on the test for B. Coli as an indication of the sanitary condition of the water, but from the description of the methods which they employed, it is questionable whether they have not included under the term B. Coli certain related forms which are not of intestinal origin. In fact they admit this, and give a list of bacteria which they consider as belonging to the general group of B. Coli. Their contention that all these organisms are in a measure indicative of contamination seems to be sound, judging from their experiments and from the work of other investigators in the same line. Their tests for the presence of B. enteritidis sporogenes, for example, follow along in parallel series with the tests of B. Coli, as shown by the table.

The authors attribute the improvement in the quality of the water below the town to dilution, sedimentation, the straining action of aquatic plants, and the influence of some of the lower forms of microscopic life. In order to compare the purification which takes place in the River Severn with that of other rivers, they give a table of the results of certain German investigators, and show that there is a general correspondence between them. Thus, experiments made in 1890 by the Imperial Board of Health of Berlin gave the following number of bacteria in the water above and below the city:

Locality.	Number of Bacteria per c.c.
Above Berlin	8,900
Just below Berlin	24,400
2.8 miles below Berlin	34,300
6.7 miles below Berlin	170,000
8.7 miles below Berlin	131,000
10.3 miles below Berlin	17,500
43.5 miles below Berlin	9,200

This river, which has a normal flow of about 25,000,000 gallons per day, is said to receive 1/30 of its volume of sewage.

Stream Deposits.—The River Severn at Shrewsbury has an average width of about 200 feet, and is comparatively shallow above and below the town. Its bottom is gravelly and rocky, but between the water-works and Ferry III. it is filled with irregular deposits of mud. The banks of the stream are for the most part muddy and lined with willow trees. During the summer season there is an extensive growth of weeds, such as the water Ranunculus, Potamogeton and Myriophynlum, which in places extend from shore to shore across the stream. These water weeds exert a marked influence on the deposition of suspended matter in the stream.

In order to determine at what points in the stream the more solid portions of the polluting material tend to settle, the experiment was made of putting into the stream at Ferry I. a large number of colored corks. After 15 hours the river was examined and the position of the corks noted. They were found in the positions shown on the map. It was observed that for the most part they had lodged over heavy deposits of mud, and it was noted that the color of the mud in these places was blacker than elsewhere in the stream, and was more offensive in character. Samples of mud were collected for analysis at various points between the County Asylum and Ironbridge, and were found to contain the following numbers of B. Coli:

Locality.	Number of B. Coli per gram.		
Above County Asylum	8	to	70
Between County Asylum and the Water Works	30	"	1,600
Between Water Works and English Bridge	49,000	"	52,000
Opposite Brewery sewer above English Bridge	300,000	"	1,200,000
Between English Bridge and Ferry III	2,240	"	43,200
Between Ferry III. and Uffington	1,580	"	17,500
Between Uffington and Cressage	33	"	2,490
Between Cressage and Ironbridge	33	"	165

On the map, the sewer outlets are shown by the arrows; and the positions, on May 17, 1900, of the corks thrown in at Ferry I. on the preceding day are indicated by dots in the river.

These results show that the mud of the stream was seriously contaminated all the way from Shrewsbury to Ironbridge, and indicate how at times of flood these deposits may become secondary sources of pollution. In some cases it was found that decomposition was taking place under anaerobic conditions, and the authors pointed out how the gaseous products might create nuisances along the stream. The authors claim that they have found no evidences of the multiplication of B. Coli in the water of the river.

The article is illustrated with 4 maps, 5 diagrams and several excellent photographs of micro-organisms, besides 20 tables which give in detail the results of analyses.

Experimental Laboratory of the North German Lloyd.

In a recent issue of the "Austrian Weekly of Public Works" Herr A. Schromm gives a description of the experimental station of the North German Lloyd, at Bremerhaven, which is of considerable interest. A condensed translation of this paper is given below:

The object of such an experimental laboratory for shipbuilding is to furnish data based on the resistance encountered by the model of a ship, if moved through a water tank with a certain velocity. These data are to be used to determine the resistance of ships of forms similar to those experimented upon. The experiments made in this direction by the well known English naval engineer, Mr. Froude, have been fundamental in this direction. Mr. Froude was the first to base on such experiments with models a theory of ship resistance, and his theory remains the best in the field, giving results nearest to the actual facts.

According to the character of the ship to be built its displacement is computed and its water-lines are laid out. From this plan the model of the ship is made, in this laboratory, by means of an ingenious machine which cuts the model out of paraffine. These paraffine models are generally 13 to 16 feet long and are perfectly similar to the geometric shape of the intended ship. The model is drawn through a tank filled with water and its resistance to motion is measured by a dynamometer, which records automatically the time and the space traversed. The extreme difficulty of designing an absolutely correct ship is seen at once from the consideration that, for a given displacement, an indefinite number of dimensions are possible in length, width and draft. Of course conditions set by harbors or rivers, canals or docks, limit the variations to a considerable extent, nevertheless, numerous forms of ships are still left which all satisfy a given displacement. A model tank therefore furnishes sure means for determining which forms will best satisfy the required conditions. Before the introduction of this experimental method, the design of the form of boats consisted merely in copying previous successful boats. For centuries this was the only procedure, and the ship-builder kept the secret of a successful ship hidden from the rest of the world.

The tank of the Lloyd's laboratory is some 540 feet long and 20 feet wide, and has a depth of 10.5 feet. Along the sides a substantial track is laid on which the traction platform, 20.5 by 31 feet, is moved by electric motors. The motive power is so controlled that it can furnish 430 different but uniform velocities varying from 1.5 to 15.5 feet per second. The corresponding velocity of the model is computed according to the principle of the "mechanical similarity," announced by Newton. Froude was the first to apply this Newtonian principle to the computation of the velocities of his models. The principle of the "mechanical similarity" is: If two ships exactly similar geometrically move in water with corresponding velocities, the wave and vortex resistances of these bodies are to each other as the third power of their linear dimensions or as their displacements.

The required corresponding velocity having been determined the model is tested for a range of velocities both sides of the computed value. The different velocities of traction and their corresponding resistances are then plotted as abscisses and ordinates respectively and the curve of resistance is thus obtained. The total resistance, W, encountered by a body moving in water may be divided into two parts, a resistance due to friction, W_1, and a resistance due to wave and vortex motion, W_2. The first is caused by the friction of the wetted surface of the floating body on the water, the second by the formation of waves in front of the body and the wave and vortex formation in its back. According to Froude's formula the friction resistance is determined empirically. It is a direct function of the area and character of the wetted surface, of the density of the water and of the velocity at which the model is moved through the water. If the co-efficients of friction for the different kinds of surface of the model and of the ship are known, the frictional resistances can be computed without further difficulty. If the total resistance of the model has been determined by experiment, the wave and vortex resistance, which cannot be computed, is found by the subtraction of the frictional from the total resistance.

The wave and vortex resistance of the model once having been determined by experiments it needs only to be multiplied by a^3, that is by the third power of the ratio of the scale of the ship to the model in order to find the corresponding resistance of the ship. Adding to the latter resistance the frictional resistance, the total resistance of the ship is given by:

$$W = W_2 a^3 + W_1$$

The paraffine used for making the models has a specific gravity of 0.87 and a melting point of 58° to 63° C. The moulding box is some 20 feet long, 3.3 feet wide and 3 feet deep. The model consists of a hollow casting about 1½ to 1¾ inches thick. It is cut to the required shape and dimensions by a rotary model cutting machine which is ingeniously arranged to follow the lines on the drawing.

Gas Power Development.

Some interesting installations of gas generators in connection with gas engine central stations for producing electricity for light and power are under course of construction by Westinghouse, Church, Kerr & Company, engineers, New York City. At the Winchester Repeating Arms Company, in New Haven, a power house has been designed to accommodate a new gas engine equipment and the entire power for manufacturing and lighting purposes will be supplied from it. Three Westinghouse gas engines aggregating 500 horse-power drive direct-current generators, two additional units to be employed as auxiliaries and Loomis Pettibone gas generators comprise this plant.

The gas making plant of the Consolidated Industries Company, at Batavia, N. Y., will be arranged to produce metallurgical coke and fuel gas, the latter to operate gas engines driving alternating-current generators. At Rockland, N. Y., there will be an installation consisting of an independent gas manufacturing plant employing the Loomis Pettibone process, and a power plant containing Westinghouse direct-connected gas engine generator units. The producer plant will supply water gas to the Ramapo Iron Works and the Ramapo Foundry Company for heating and metallurgical purposes, and electric power to other industrial plants in the vicinity, including the Standard Brake Shoe Company, located about 4 miles distant from Hillburn. The plant will also supply current for lighting throughout the Ramapo Valley district, some 14 miles in extent. The gas engines installed are also of the new Westinghouse horizontal double-acting type of 350 horse-power, each equipment aggregating 1,200 brake horse-power or 1,400 brake horse-power maximum. The engines are direct connected to Westinghouse polyphase generators and constructed to operate in parallel. A 128 horse-power vertical gas engine unit will also be employed for carrying light loads, and assisting at peak loads.

The Artesian Water Supply of Memphis, Tenn.

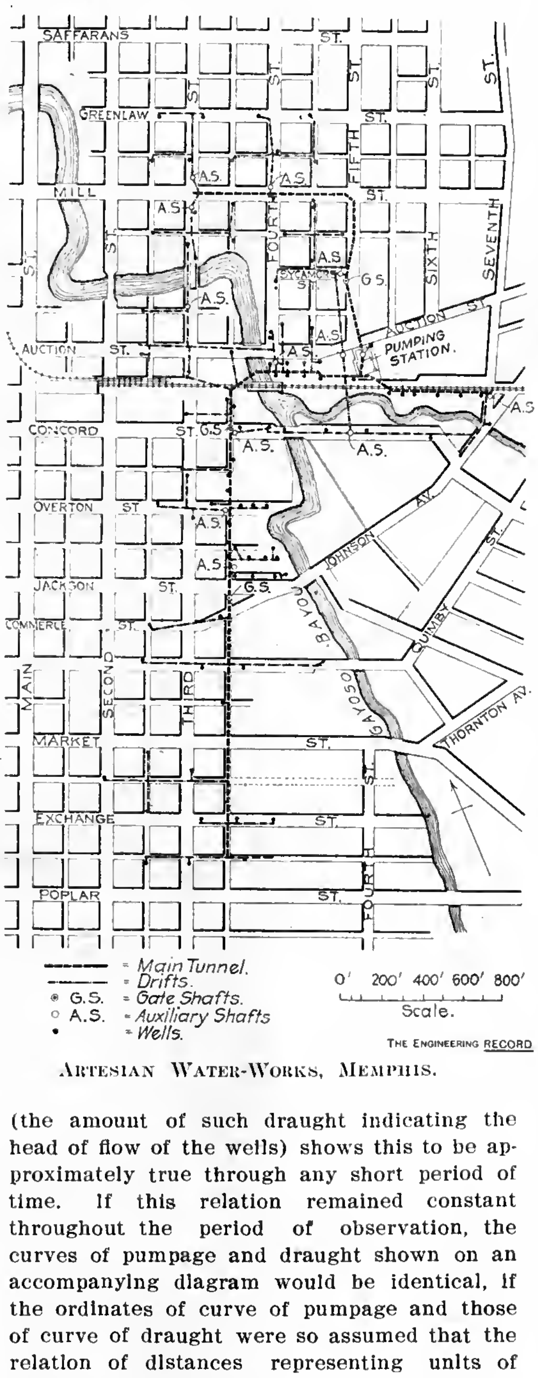
The present supply for the Memphis waterworks system is derived from a stratum of water-bearing sand underlying the Mississippi valley in that neighborhood, about 350 feet below the surface. The water is obtained by means of wells 6, 8, and 10 inches in diameter sunk through the upper stratum of impervious clay and extending well into the sand. Brass strainers about 50 feet long are attached to the bottoms of the well casings, to collect the water and prevent the influx of sand. The older wells generally had single casings of 6 or 8-inch wrought iron pipe, while the later casings are of heavier, 10-inch steel pipe, with specially protected threads, and an outer, or protective, casing of 13-inch steel pipe.

The water is found to be under pressure not quite sufficient to cause it to flow from the tops of the wells at the surface of the ground, although it has been stated that originally it rose 6 or 7 feet above the surface. On this account a tunnel with drifts connecting with the individual wells was constructed at a depth of 70 or 75 feet below the surface. Through these drifts and the tunnel the water is led to a suction chamber, from which it is lifted by the pumps and then forced through the distributing mains to the various parts of the city. In the different shafts, shown on the plan of the supply system, are gates operated from the surface, by means of which a section of the supply system can be shut off from the remainder, its wells balled off (i.e., shut off from the tunnel) from the surface, the water pumped out from the pump chamber in the shaft, and the section made accessible for inspection or repairs. An extended description of these works soon after their construction was given in The Engineering Record of September 12, December 5 and 19, 1891, January 2 and February 13 and 20, 1892.

The city of Memphis is growing rapidly, and it is estimated that in a short time there will be a demand for 20,000,000 to 30,000,000 gallons per day made on its water supply. It has also been estimated that the economical limit of supply from the present system of wells, taken at 25,000,000 gallons per day, will be reached in five years, at the outside. It is therefore evident that a very considerable increase in the supply will be necessary within a few years, and the question arose as to whether the system of artesian wells could be profitably extended so as to practically double the supply, or whether it would be better to take the additional supply from the Mississippi River. Three consulting engineers, Messrs. Arthur Hider, J. A. Omberg, Jr., and A. T. Bell, were engaged by the city to investigate this matter, and report, among other things, on the condition and value of the present plant, which is owned by the Artesian Water Company, of Memphis. Some valuable information in regard to the action of artesian wells was obtained by this commission in the course of their investigations, which is presented in a special report. This report, together with one on the financial condition of the Artesian Water Company by Messrs. Haskins & Sells, public accountants, of New York, was presented to the city council of Memphis recently and, somewhat condensed and rearranged, form the major part of this article.

There is a definite limit to the rate at which water can be obtained from any well or system of wells. The quantity which will flow from any one well will depend on three factors, the pressure at which it discharges, the size of the pipe, and the freedom with which the water enters the well at the strainer. In the case of a number of wells, the aggregate discharge is governed by the same conditions. Observations of the total discharge from the Memphis wells under very different conditions extending over the period of four years considered by the commission, show plainly the effect of varying any of the three factors just named.

Experimentation on individual wells has shown that the quantity of water discharged from a given well varies directly with the head of flow; that is, if a well flowing under a given head yield a given quantity of water per second, at twice the given head the quantity of flow will be approximately doubled. If this be true for each individual well, the total yield from a system of a fixed number of wells should bear a fixed relation to the draught or head of discharge. A comparison of the rate of pumping and the corresponding draught or lowering of the level in the suction chamber



ARTESIAN WATER-WORKS, MEMPHIS.

(the amount of such draught indicating the head of flow of the wells) shows this to be approximately true through any short period of time. If this relation remained constant throughout the period of observation, the curves of pumpage and draught shown on an accompanying diagram would be identical, if the ordinates of curve of pumpage and those of curve of draught were so assumed that the relation of distances representing units of pumpage and units of draught were the same as the constant relation between pumpage and draught. For example, if it were found that for every 4 feet of draught there were about 1,000,000 gallons of water per day discharged, then the spaces on pumpage curve representing 1,000,000 gallons should be equal to those on draught curve representing 4 feet of draught.

This relation of 4 feet of draught per million gallons per day was found to be close to the true relation between pumpage and draught, and the curves on the diagram were plotted on that basis. A glance at the diagram, however, shows that the curve of draught, while showing variations corresponding to change in pumpage, is far from being identical with it. This variation in the relation between the flow and head is evidently due to the other two conditions determining flow, viz., size of wells and the freedom with which the water enters the strainer. By size of wells is meant the aggregate sectional area, or the number of wells. The number of wells in use since 1897 has been nearly constant, so that the amount of discrepancies between the two curves represents approximately the comparative freedom with which water entered the strainers. In the other part of the same diagram the amount of variation in the relation between flow and head is shown and the curve represents the relative condition of the supply at various times. With a given condition of supply represented by a point on the curve, it is easy to determine approximately the maximum probable yield from the system of wells in use at that time, at suction limit or maximum draught.

In October, 1898, the condition of the supply system was at its worst, showing that at that time, with that system of wells, the maximum rate of yield possible was only about 10,200,000 gallons per day, a rate which would be totally inadequate to supply the present demand. This condition was due to the abandonment of an old battery of wells shortly before. The very marked improvement in the next six months showing the ultimate rate of yield at suction limit to have increased to about 19,000,000 gallons per day, was due to turning on thirteen new wells. The same marked improvement is shown where nineteen new wells were turned on in January, 1901, though the improvement due to the nineteen new wells is not proportionately greater than that due to the thirteen wells, because of the greater average quantity pumped reducing the general head of flow from the system.

In this connection it will be noted from the diagram that the increase in the rate of yield due to increasing the number of wells is not entirely permanent, but gradually falls away, and in the course of a year or two, almost disappears. This is due to the deterioration in the condition of the individual wells. Tests of the flow from the individual wells show that the discharge is always much greater shortly after first being turned on than after it has been in use for a time. This rapid reduction of the average flow is to be expected, is unavoidable, and does not in any way represent a depreciation of the well. It is due to the voids in the average coarse sand around the strainer becoming more or less filled by finer sand from the surrounding area, which is carried by the water flowing toward the well.

An average condition of a supply of about 50 wells for the past four years shows a rate of yield of about 14,900,000 gallons per day at suction limit. By cleaning strainers and sinking more wells this maximum may be brought up greatly. The curve of condition shows that on July 1, 1902, this limit of supply was about 17,500,000 gallons, and had been raised to that amount since April, when it was about 16,500,000 by flushing strainers. On July 18, six new wells were connected and increased the total flow to about 19,000,000 gallons per day, from which it may recede during the next four months to about 17,500,000 gallons per day. The ultimate rate of yield referred to does not mean the ultimate rate obtainable from the artesian sands at that point, but the maximum rate of yield from the systems of wells, under existing conditions, already in use at the time of observation. By the condition of the wells generally, is meant the condition of the material immediately around the strainer. If there is a small stratum of clay in proximity to the strainer, the slots quickly become clogged and the well flow is diminished accordingly. If there are indications of clay in proximity to the strainer, shown by whitish or milky water, it would probably be better to abandon the well and draw the casing for utilization elsewhere.

When a well made in good sand shows considerable decrease in flow, flushing is resorted to, to improve its condition. In doing this a stream of water under considerable pressure is forced from the inside of the strainer through the slots and into the sand. An ingenious tool has been devised for this purpose, which confines the water to a small section of the strainer, insuring a much more thorough cleansing than is possible by merely forcing a stream of water down the well and allowing it to dissipate through the parts of the strainer offering the least resistance. A diagram in the report of the commission (not reproduced) gives some of the results of flushing with this tool. An average of four wells shows a falling off in flow of about 32 per cent. during nine months, after which flushing was begun and increased the flow about 70 per cent., or about 13 per cent. above the original condition at the beginning of the record. The average of two other wells which were not flushed showed a very regular decrease in flow from 230,000 to 120,000 gallons in seven months.

The flushing tool mentioned has been in use only since April, 1902, hence no extended period of observation is available, but the results thus far seem to show that the present supply system can be increased about 20 per cent. by its use. The effect of this flushing seems to disappear in about three to five months. The expense of each flushing is at present about $70, making a maintenance charge of about $23 per month per well, on a basis of flushing four times a year in order to maintain 19,000,000 or 20,000,000-gallon supply. In order to obtain and maintain a supply greater than this, or to obtain an absolutely reliable supply of this size, it will be necessary to materially increase the number of wells.

If each additional well sunk increased the supply in proportion to the number of wells, there would be no limit to the supply obtainable by adding to the number of the wells; but such is not the case. Each new well sunk diminishes the flow from the existing wells, and provides an additional quantity of water equal only to the difference between its own flow and the diminution of the aggregate flow of the other wells, caused by reducing the head. As the number of wells in a given area increases, the difference between these two quantities becomes smaller and smaller until a point is reached where the revenue from the increased amount of water would not justify the interest and maintenance charges on the well and additional underground construction.

In this connection it is interesting to note what occurred when engineering operations were first begun on the system with a temporary plant in May, 1888. At that time, wells 21 to 31 inclusive were connected at the surface of the ground by a cast iron suction pipe. On May 10, a test was made as follows: First, by means of gates all the wells were disconnected from the pipe but one. Before starting the pump, the water rose in the well pipe some 6 or 7 feet above the surface of the ground. The pump, which was depressed several feet below the surface of the ground, was then started and the water in the well was lowered about 30 feet, or as low as the pump could draw it and surely fill the pump chambers. The quantity pumped was at the rate of a little over 1,000,000 gallons per day. One after another of the wells were added, until eight wells were in operation, the water in them being lowered as before about 30 feet below the flow line. The result was a total yield at the rate of 2,500,000 gallons per day from the eight wells.

The present area over which wells are distributed is about one quarter of a square mile. The absolute maximum amount possible from that area would be obtained when the whole area was converted into one vast well of one

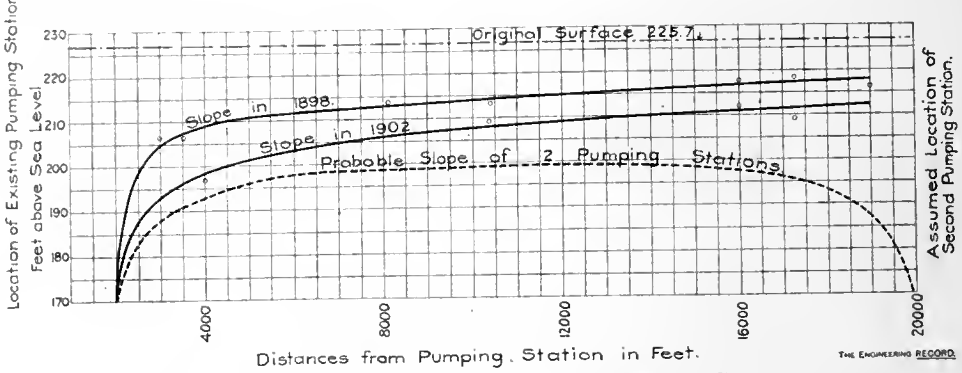
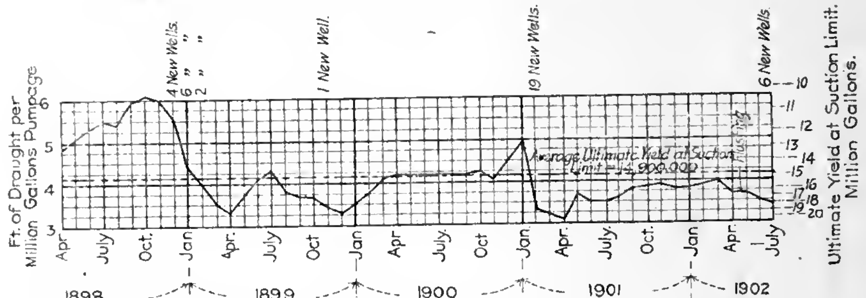
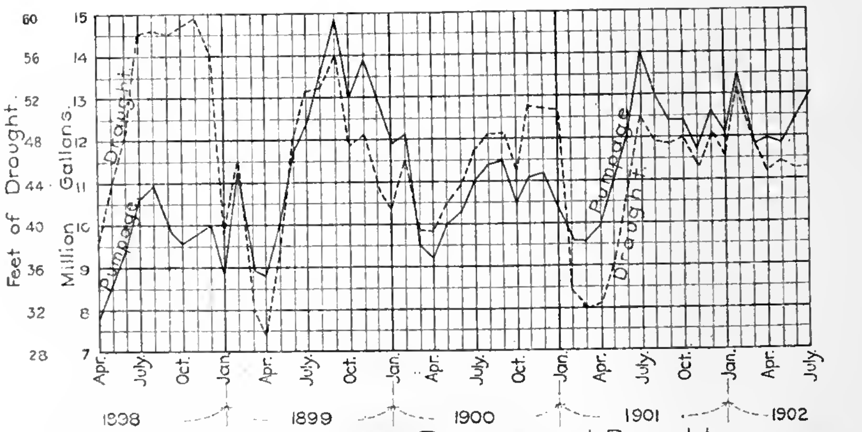


DIAGRAM SHOWING HYDRAULIC SLOPES NEAR PUMPING STATION.



Variation in Condition of Supply and Ultimate Yield of Supply at Suction Limit.



Relation between Pumpage and Draught.

DIAGRAMS SHOWING CONDITION OF SUPPLY.

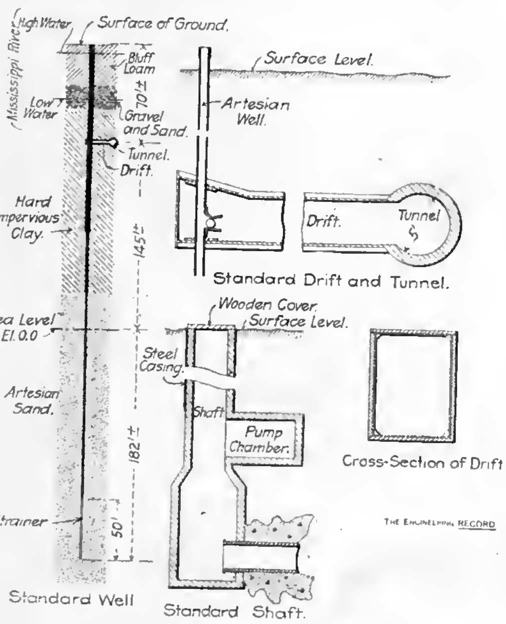
quarter of a square mile sectional area. The quantity of water which could be obtained from such a well can be determined if it be assumed that the quantity of discharge will vary directly as the draught, an assumption known to be erring on the safe side through the commission's range of observation. Data for this estimate were obtained from an observation of the depth of draught in wells bailed off (i.e., tunnel connection closed and water allowed to reach its static level), in close proximity to the area of supply, at various depths of draught in pump well. At a draught of 35 feet in pump well the draught in the bailed off well was 21 feet; at pump well draught of 50 feet the draught in well was about 29 feet, showing a difference of about eight feet of draught in level to 15 feet difference in draught in area of supply. The pump well draughts of 35 and 50 feet represent respectively about 8,750,000 and 15,000,000 gallons per day, or a difference of about 6,250,000 gallons per day which causes the 8-foot increase in draught of static level in areas contiguous to supply area. At maximum supply obtainable, this static level would be reduced to level of supply area, or about 60 feet. In order to do this, a supply of about 800,000 gallons per foot of decrease would have to be disposed of. This indicates an ultimate supply close to 50,000,000 gallons per day as the absolute maximum from a limited area. The economical limit of quantity from a given area, beyond which it would be impracticable to go, is probably in the neighborhood of 25,000,000 to 30,000,000 gallons per day. In providing a supply in excess of the economical limit of the present system, it is well to anticipate the demand by 20 years or more, or to provide for a total supply of 50,000,000 to 60,000,000 gallons per day. This would require an entirely independent system, in many respects a duplication of the present one.

A diagram is given showing the hydraulic surface in the neighborhood of the wells, and also the probable effect of a second similar system located about four miles away. From the diagram it is seen that at a distance of about four miles from the present station, the effect of the draught is very little more than it would be several miles further away, indicating that it might be safe to establish a new supply at this distance from the present station, both stations to yield about 15,000,000 gallons per day. The effect on the slope of the increase in the quantity pumped is plainly indicated by the diagram, which shows the difference in the hydraulic slope in 1898, when about 9,000,000 gallons per day were pumped, and in 1902, when the daily average is about 12,000,000 gallons.

The probable cost of an independent system is given as follows:

50 10-inch wells at $3,000	$150,000
10,000 feet drifts at $8	80,000
5,000 feet 5-foot tunnel at $18	90,000
Shafts, auxiliaries, gates, etc.	45,000
Pump pit, etc.	40,000
Building and stacks	55,000
Boilers, pumps, machinery, etc.	215,000
Additional main, 10,000 feet at $10	100,000
Engineering and contingencies	116,250
Total	$891,250

The chief expense of an artesian system, outside of interest and ordinary operating expenses, which are assumed in this case to be about equal for all systems, is in the maintenance and depreciation of the wells. This item in recent experience amounts to about $20 per month per well for maintenance, and, allowing $17 per month for depreciation, the total expense is about $4 per million gallons,



Details of Well and Connections.

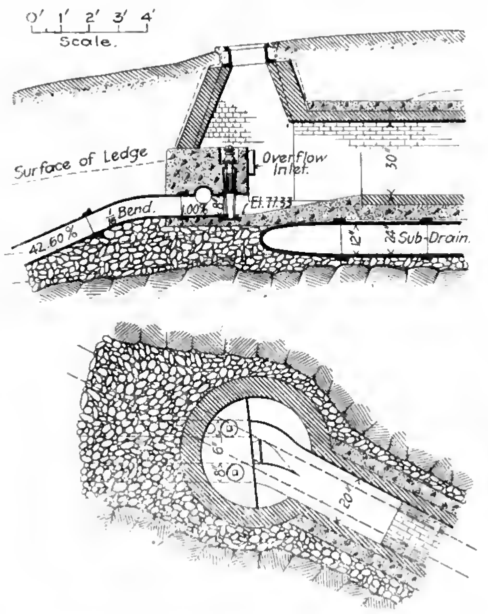
on a basis of 300,000 gallons per day per well. Comparing this with the corresponding extra expense of the slow filtration of the Mississippi River water, a conservative estimate shows a difference in cost in favor of the artesian supply of about $1 per million gallons. Disregarding this small difference in cost, in the event of the city acquiring the present plant, on account of the indicated ample supply of artesian water, its known purity and healthfulness, and the feasibility of obtaining it, the commission of engineers recommended its continued use, by enlarging the present plant and supply, and later on when the needs of the city require it, the construction of an independent station, located at least four miles from the present station.

Erratum. In the article on the Rio Grande Bridge, published November 8, corrections should be made as follows at the top of the first column on page 434. The three lines just below the formula should read: H = total horizontal thrust; S_0 = total stress in a member from horizontal unit reaction only; S_1 = total stress in a member from vertical unit reaction only.

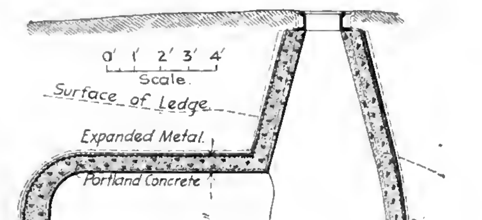
Difficult Sewer Construction at Newton, Mass.

In the extension of the main sewer through Hemlock Gorge, for the Newton Upper Falls district, many obstacles had to be overcome, the physical features of this section presenting many difficulties which made the work slow and expensive. Ledge and water were encountered throughout the whole distance of about 1,750 feet. The work was briefly described in the last annual report of the city engineer of Newton, Mr. Irving T. Farnham, from which report the following account has been prepared:

From the point in Boylston Street where the trunk sewer built in 1900 ended, the extension passes through a rock tunnel 193 feet long as a 20x30-inch egg-shaped sewer; then follows along the bed of the Charles River as a 20-inch cast-iron pipe to Echo Bridge,



Inlet End of Inverted Syphon.

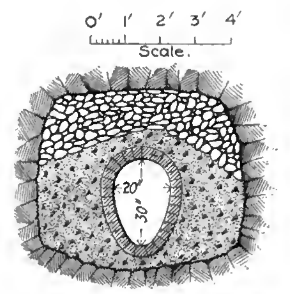


Discharge End of Inverted Syphon.

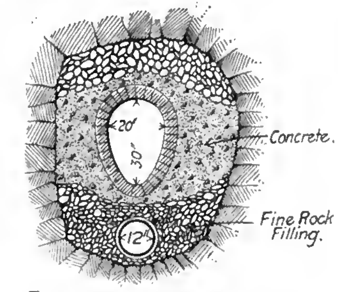
crosses the river by an inverted syphon under the bridge, consisting of two lines of iron pipe, one 6 inches and the other 8 inches in diameter, and each about 250 feet long. From the end of the inverted syphon the sewer, again 20x30-inches in size, passes through a second rock tunnel 389 feet long and follows along the bank of the river on the Needham side nearly to Elliot Street, where it turns and recrosses the river. This crossing is a gravity sewer of 16-inch iron pipe. Near this point the extension proper ends, being connected with the lateral system which provides for the drainage of nearly all the village of Newton Upper Falls.

At the upper river crossing of 16-inch pipe the grade of the sewer is well below the bed of the river, and connection was made through the ledge to the river bottom for the purpose of flushing the sewer when necessary. As far down as the second river crossing there is a 12-inch subdrain under the main sewer, which discharges into the river near the inlet end of the inverted syphon.

As the sewer is from 6 to 12 feet below the surface of the water in the river, great care had to be taken in the construction to build the sewer and manholes perfectly water-tight. This was accomplished by the use of cast-iron pipe laid with leaded joints, and by the use of concrete and steel in the construction of the manholes. In some cases the manholes, in addition to being reinforced with expanded metal near the outer surface, were lined inside with ⅜-inch boiler iron. The accompanying illustrations show the principal details of the manholes at each end of the inverted syphon. The section



Typical Section in First Tunnel.



Typical Section in Second Tunnel

through the manhole at the inlet end shows where the subdrain leaves the main sewer to discharge into the river. As the bed of the river is ledge a trench was excavated 5 or 6 feet deep, and the syphon pipes bedded in loose stone at the bottom.

In order to insure the tunnel portions of the sewer being water-tight, the brick rings were surrounded by the thick mass of concrete shown on the typical cross sections. As the city owned no air compressor or other equipment for tunnel work, it was thought best to advertise this part of the work; and specifications were drawn up for driving the tunnels and building the sewer therein. Only one bid was received, and as that was not satisfactory in amount, it was rejected and the work undertaken by the city forces. A 12x16-inch Rand air compressor rated to give 251 cubic feet of free air per minute was rented and placed on the Needham side of the river. This compressor was run continuously day and night, and supplied air to the three headings in the tunnels. The work of driving the tunnels and constructing the sewers was in charge of Mr. R. K. Porter, as inspector. There were used on the work 6,150 pounds of dynamite, and no accident of any kind occurred.

The Best Aluminum Wire Joint, out of 28 different types, is made as follows, according to Mr. W. M. Morrison, in a paper presented to the Institution of Electrical Engineers: The two ends of the wires are bent round each other, or simply butted together, they are then surrounded by a cigar-shaped mould in two halves which are clamped together and molten aluminum run in at a hole in the top. The mould is then removed.

The Vouvry Water-Power Development of 3,117-Foot Head.

At Vouvry, Switzerland, there is a water-power plant now in operation which bears the distinction of possessing the highest head of all water-power developments yet attempted, certainly on a large scale. It has a total head of 950 meters, or 3,117 feet, and plans have been completed to utilize a total of 10,000 horse-power. Although construction work has in general been carried on to realize ultimately this capacity, the present installation comprises but one-fifth of the total contemplated power. Supplementing a brief reference that was made to this plant in The Engineering Record of May 17 may be added the following interesting information gathered from an article in a recent issue of "Le Génie Civil."

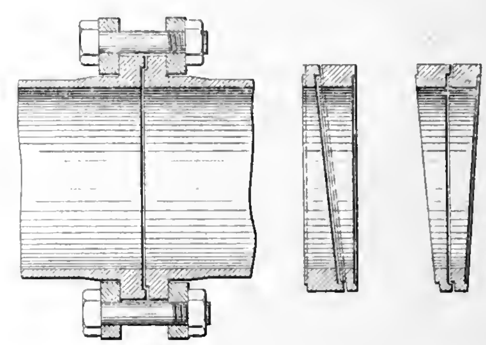
The plant receives the water from Lake Tanay and the works are located at Vouvry, on the left bank of the Rhone, a short distance above the place where that river empties into Lake Leman. The surface of Lake Tanay is at elevation 1,416 and the turbines in the power-house are at elevation 466, so that the available head attains 950 meters. The lake has a superficial area of 111 acres and its watershed, an area of 1,850 acres. According to M. Boucher, the author of the project, the total volume of water will amount to 2,900,000,000 gallons annually, or 12.3 cubic feet per second. Under a fall of 3,117 feet and allowing for turbine and other losses, the normal power of the fall would be, with a constant rate of discharge, 3,100 horse-power. This would amount in a year to 27,150,000 horse-power-hours. Lake Tânay can be regarded, however, as a natural reservoir, so that if water is drawn, say during only 1,000 hours per year, the power available during that period would be 27,150 horse-power. Similarly, if power is required during 2,000 hours, the average output figures 13,575 horse-power; if during 3,000 hours, 9,050 horse-power. The Vouvry plant has been exploited to aid a 2,500 horse-power water-power plant at Vuargny on the other side of the Rhone. Electric energy is distributed to a large number of towns in the valley of the Rhone by means of transmission lines which aggregate in length some 80 miles, supplying 63 stations with 97 transformers. In all 20,000 lamps of 10 candle-power are served and 450 horse-power in motors. The equipment of the two new plants has been selected so that the output of both can be transmitted on the one system of conductors, both plants possessing alternators of the same voltage and periodicity.

The intake at Lake Tanay will consist of a heading driven at an elevation 85 feet below the normal level of the lake into a well 100 feet deep, into which the water now enters near the top. From this well runs a tunnel of slight pitch, the entrance to which consists of five openings in a masonry wall provided with iron-covered stop-planks. Three of the openings hold short cast-iron pipes 15.75 inches in diameter, each fitted at the mouth with a sort of conical cast-iron stopper acting as a gate or valve; the fourth is a manhole 31 inches in diameter and the fifth is a by-pass pipe 4 inches in diameter for setting up a counter-pressure when it is desired to open the main pipes, that is, to lift the stoppers. When the level of the lake is at its maximum, a force of about 3 tons would be required to lift each stopper, which is suspended by a lifting chain, were it not for the by-pass.

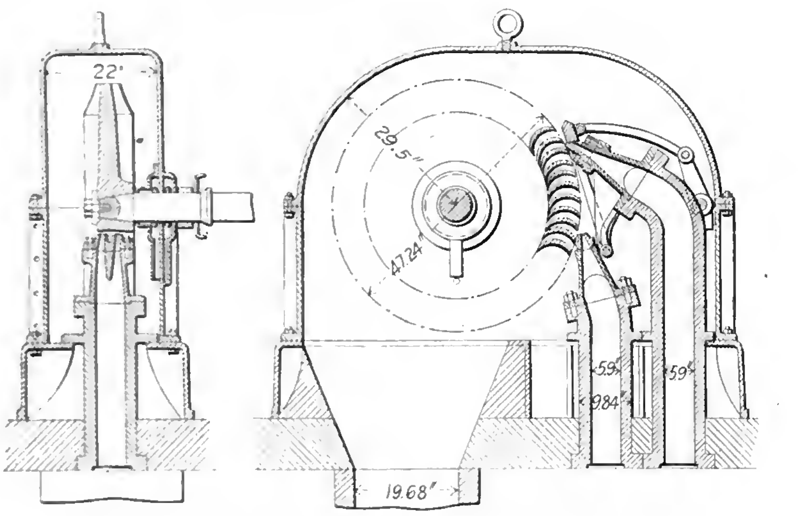
The tunnel is 984 feet long and has a cross-section of 32.3 square feet. About 100 feet from its lower end an overflow tunnel runs from it at a right angle. A little above the point of intersection of these tunnels, the intake tunnel appears to be closed off, except for three 15.75-inch openings, two fitted with float valves and the third with an emptying valve. A little below the intersection there is a small dam forming a basin of water. When the turbines are operating, there is a call for water, the water level lowers, the floats of the valves drop and the corresponding openings discharge. When the works shut down there is no demand for water from them, the floats rise and the flow of water ceases. To lower the level of the lake, in order to prevent passing the maximum level, the counterweights of the float valves are loaded and if this does not suffice the emptying valve is opened and the water passes through the overflow tunnel.

The lower end of the intake tunnel is of masonry and provided with an emptying valve. Here begins the pressure conduit of sheet-steel pipe 31.5 inches in diameter and 325 feet long, followed by a pressure tunnel about 1,000 feet long. From the latter the 31.5-inch steel pipe continues, with an inclination of about 5 per cent., for 3,900 feet, terminating in three branch pipes 19.7 inches in diameter. From one of these the conduit descends to the works, while the two others are closed to be used when future needs require them. At this point the head has scarcely attained 69 feet, but from there on it increases very rapidly. Here an automatic valve has been provided to close off the conduit in case of a break below, and there is an air pipe 15.75 inches in diameter and 82 feet high.

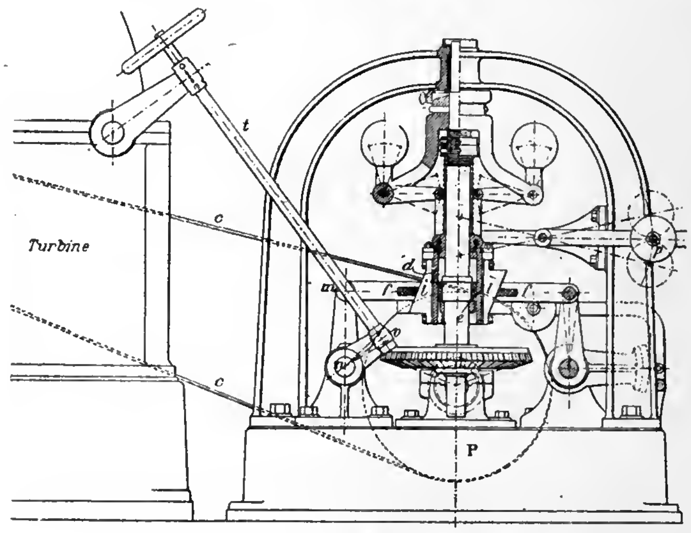
The length of the conduit on the steep slope is 6,360 feet and the corresponding difference of level 2,952 feet. For 2,083 feet the conduit has an outside diameter of 19.7 inches and a thickness varying from 0.27 to 0.45 inch. It then subdivides into two branches 13.4 inches in outside diameter and 4,260 feet long, with a thickness of 0.31 to 0.71 inch. The pipes subjected to heavy pressure are of Siemens-Martin steel, without riveting; the largest are welded by hand, the others in the rolling mill. The pipe joints are made by the use of bolts through loose rings held on each pipe section, as indicated in an accompanying illustration. Water tightness is obtained by the introduction in the joint of a ring of copper enveloping a ring of asbestos having the form of the interior half of a torus, that is, a ring of half-round cross-section, and an initial thickness of 3 millimeters, 0.12 inch, and reduced, after tightening, to a fraction of a millimeter.



Straight and Angle Pipe-Joints.



Sections of the Duvillard 500-Horse-Power Turbine.



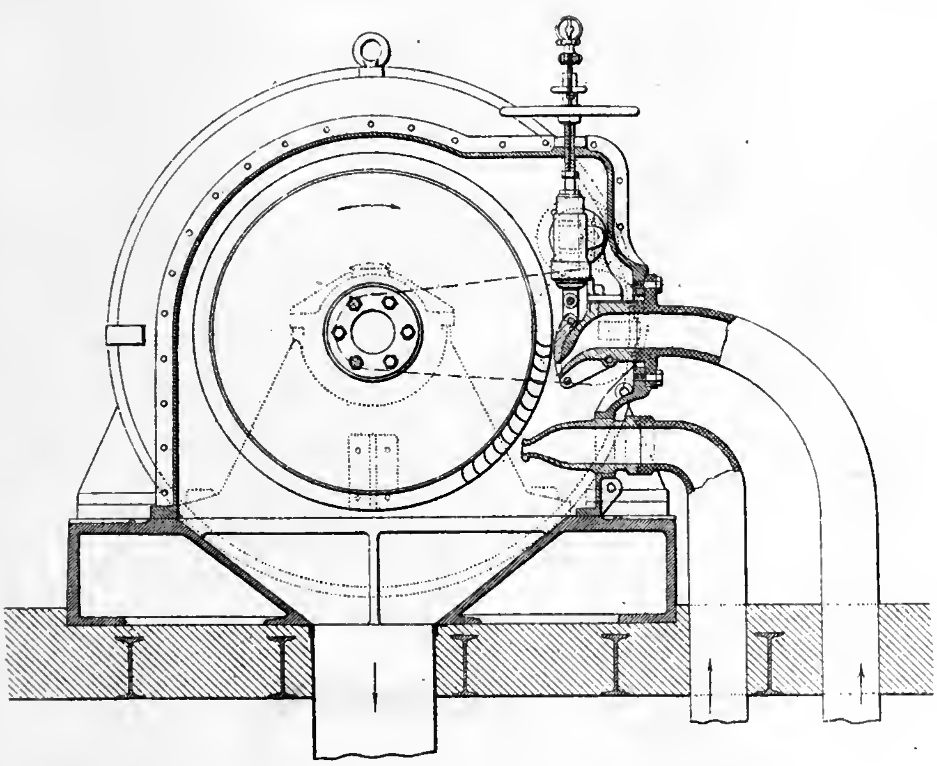
Elevation of the Michaud Governor.

The conduits are buried in a trench 5 feet deep to prevent freezing when the flow of water is interrupted. They thus follow the contour of the ground, which makes necessary a considerable number of changes of direction. The method of providing for these changes is indicated in an accompanying drawing. It is obtained by means of a pair of false joints composed of two similar pieces with slanting faces, which by turning one on the other can make the adjoining connecting pieces of pipe assume any desired angle, as much as 10 degrees. The pressure attained at the lower part of the pressure conduit system amounts to 10,667 pounds per square inch. The conduit being laid underground neither anchors nor massive piers were necessary. The different sections, or lengths, of pipe weigh from 1,760 to 2,200 pounds and are 16.4 to 32.8 feet long. They were carried to place by means of an aerial cableway, which has been left for the future installation. Each conduit has at its lower end a hand operated valve with by-pass.

The power-house is 46x216 feet, and large enough to house twenty generating units of 500 horse-power each. The roof of the building is of tile supported by iron trusses and the whole structure was designed to be fire-proof. The piping and the valves commanding the turbines are placed in the basement. In addition to a stop valve, the supply pipe to each turbine has a hydraulically operated valve controlled from the station switchboard. The piping subdivides into two branches after leaving the hydraulic valve, one branch supplying two turbines built by the Societe de Constructions mecaniques de Vevey and the other supplying two turbines made by M. Duvillard, of Lausanne.

The turbines are of the Pelton type constructed of cast-iron disks carrying cast-iron curved blades on both sides near the rim. Both turbines are shown in the drawings. Each turbine of both makes is supplied with two nozzles, one fixed and the other capable of regulation. Each of the nozzles is designed to discharge 1.85 cubic feet per second, which will furnish 500 horse-power. The turbine is put in operation by means of the regulated nozzle and when normal conditions have been reached, this nozzle is cut out and the turbine operated from the fixed nozzle alone, which, having no moving pieces, is less liable to wear. Experience has shown that this precaution was unnecessary as the wear on the turbines and nozzles proved much greater from the impurities in the water than from its high velocity. Each nozzle has two converging orifices corresponding to the two sets of blades on the two faces of the rim of the moving wheel. The pipe which supplies each turbine is 5.9 inches in diameter, has a hand valve and divides into two branches corresponding to the two nozzles. Each branch is likewise 5.9 inches in diameter, and is fitted with a hydraulic piston valve operated from the switchboard. Each turbine is mounted on the alternator shaft; it is 47¼ inches in diameter and runs at 1,000 revolutions per minute.

For regulation, the Duvillard turbines are controlled from a governor shown in one of the drawings. The apparatus is driven from the turbine by means of a belt, c, and actuates the regulated nozzle by means of a rod, t. It consists of a base carrying at its lower part a pair of bevel gears which are moved by means of the belt. The gears turn a vertical shaft carrying a small eccentric, e. The same shaft supports a fly-ball governor attached to a sleeve, d, to which is fastened a steel cam, i, this forming a parallelogram of which the oblique sides are finely toothed. The eccentric gives the sleeve a movement in a horizontal plane and this in turn communicates the movement to the cam. Around the cam is a steel frame which has a slightly greater play than the stroke of the eccentric, which is 0.118 inch, and to this frame is connected the rod t, and also a system of links, m, n and o. When the balls of the governor change their position, the sleeve and the cam are moved. This being freely balanced within the frame, f, it encounters one of the oblique sides, engages on one side or the other but only communicates to the frame, at each throw of the eccentric a displacement less than the throw. When this small movement is accomplished, the cam becomes again completely free and rises or descends without exacting any effort on the part of the fly-ball mechanism. The jets from the nozzle exercising a certain reaction upon the tongues or blades, by which the regulated nozzle is cut off, the tongues would have a tendency to open during the fraction of a turn when the frame is free from the cam. This has been remedied by a small counterweighted brake actuated by the links, m, n and o. The fly-ball portion can also be regulated and there are two counterweighted levers to arrange for a variation within chosen limits of the number of revolutions desired.


Cross-Section of the Vevey 500-Horse-Power Turbine.

The alternators produce single-phase current under a pressure of 5,500 to 6,000 volts with a frequency of 50 cycles per second. Including the acquisition of the water rights, the installation cost about $160,000, which for 2,000 horse-power, means $80 per horse-power. With the additional 2,000 horse-power now in course of installation, the cost per horse-power is about $55.

An Unusual Blasting Accident.

An unusual, if not unique, accident occurred recently near Niagara Falls. The following account of the blast and its results is taken principally from the description published in "The Iron Age":

The Ontario Power Company are excavating a power house site at the water's edge on the Canadian side, not very far below the Horseshoe Fall. The site is immediately opposite Goat Island, of the New York State reservation. The river at this point is the widest below the falls. Heavy blasts were used in order that the excavated material might be thrown into the river and thus do away with handling it. The talus, as well as a portion of the solid base of the cliff, was being broken away, and as the river is very wide, fully 2,500 feet, and the New York cliff was expected to act as a stop for any stones that might be carried across the river, no effort was made to hold the blasts down. The work was in direct charge of the Ontario Power Company.

At noon on Tuesday, October 28, a blast of unusual size was to be discharged, and word was sent to the New York State reservation officials to keep people away from the Goat Island bluff immediately following the noon hour. Such warning was given. At 12.15 o'clock the blast was discharged. It hurled a wonderful mass of rock and dirt into the air, and so terrific was the force of the blast that a tremendous shower of rock fell upon Goat Island, having been carried all the way across the river and 200 feet up in the air to the island surface. The river, usually clear and green, had its color turned to that of mud, and people who stood at Table Rock, on the Canadian side, state that the New York shore was hidden by the curtain of rock that ascended high above the cliff tops.

One 200-pound slab, 32 inches long, nearly 9 inches thick and about 14 inches wide, ascended very high in the air and whirled round and round like a wheel as it flew across the river, up over Goat Island to a point fully 500 feet back in the forest growth, making a flight of fully half a mile. In descending it cut a big limb off a tree and plunged downward, striking two reservation employes, who were walking side by side along an island path. Both died from their injuries.

At the coroner's inquest it developed that the blast contained 2,500 pounds of powder and between 200 and 300 pounds of dynamite. Both black and granulated powder were used. The general direction of the blast was at right angles with the water. In one drift and shaft combination were placed 60 kegs of powder and 100 pounds of dynamite. In a small shaft tunnel 37 kegs of powder and 50 pounds of dynamite were placed. Besides this there were two large bowlders, a box and a half of dynamite and three kegs of powder. In addition to this there were drill holes. All the charges were tamped.

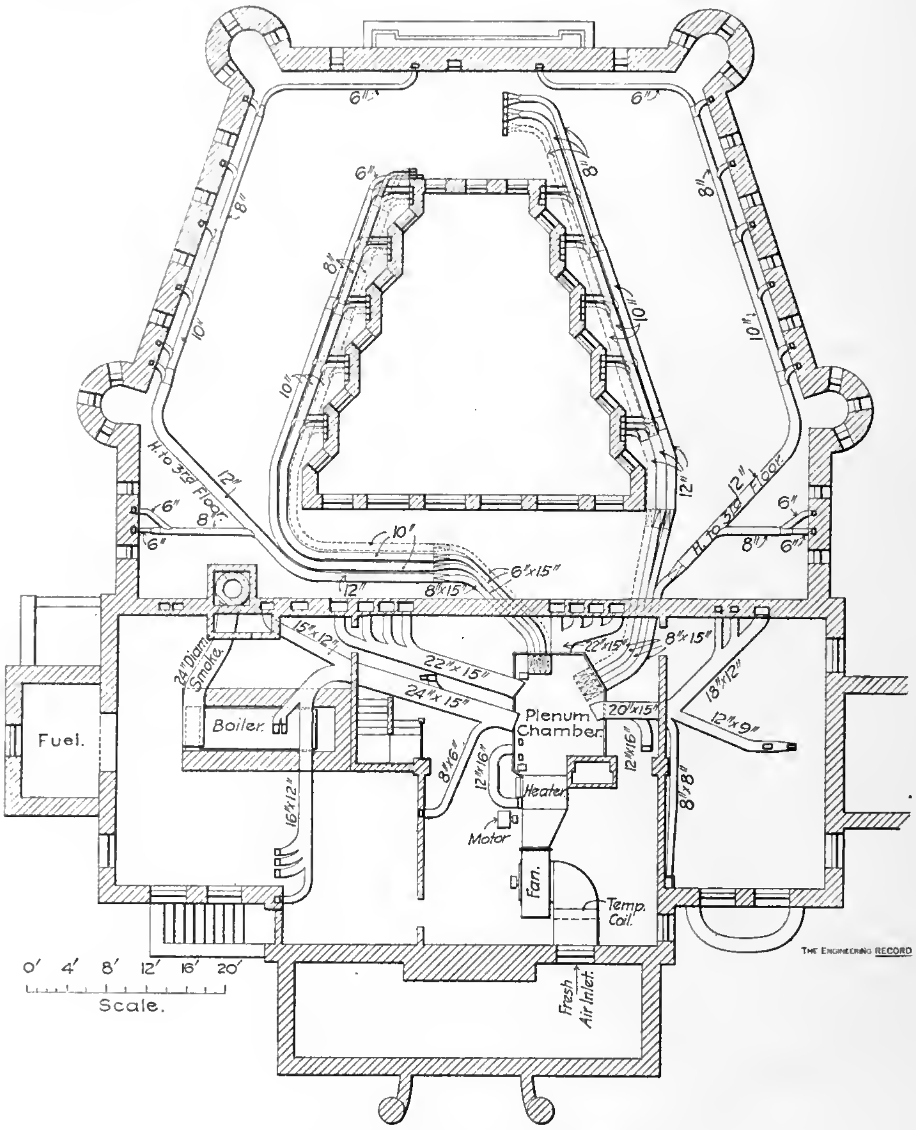
The American Society of Mechanical Engineers will hold its 46th meeting at its house in New York, Dec. 2 to 5. The following list of papers has been announced: "A Rational Solution of the Problem of Weights and Measures," by Prof. Sidney A. Reeve; "The Metric System," by F. A. Halsey; "Entropy Analysis of the Otto Cycle," by Prof. S. A. Reeve; "Apparatus for Obtaining a Continuous Record of the Position of an Engine Governor," by J. C. Riley; "Flywheel Capacity for Engine-Driven Alternators," by W. I. Slichter; "Heat Resistance the Reciprocal of Heat Conductivity," by Wm. Kent; "A Forty-four-Foot Pit Lathe," by J. M. Barnay; "Finer Screw Threads," by Chas. T. Porter; "A Surveying Instrument in the Machine Shop," by C. C. Tyler; "Gift Propositions for Paying Workmen," by Frank Richards; "Deflections of Beams by Graphics," by W. Trinks; "Rotary Pumps," by J. T. Wilkin; "Filing System for Office Use," by H. M. Lane; "Analysis of Commercial Value of Water-Power per Horse-Power per Annum," by A. F. Nagle; "Centrifugal Machines," by B. Viola; "Oil-Testing Machine and Results," by Prof. A. Kingsbury. For topical discussions the following subjects have been presented: Smoke consumption, elastic resistance, oil burners, oil separation from steam and oil-tempering of steel.

Heating and Ventilating the Akron, O., Jail.

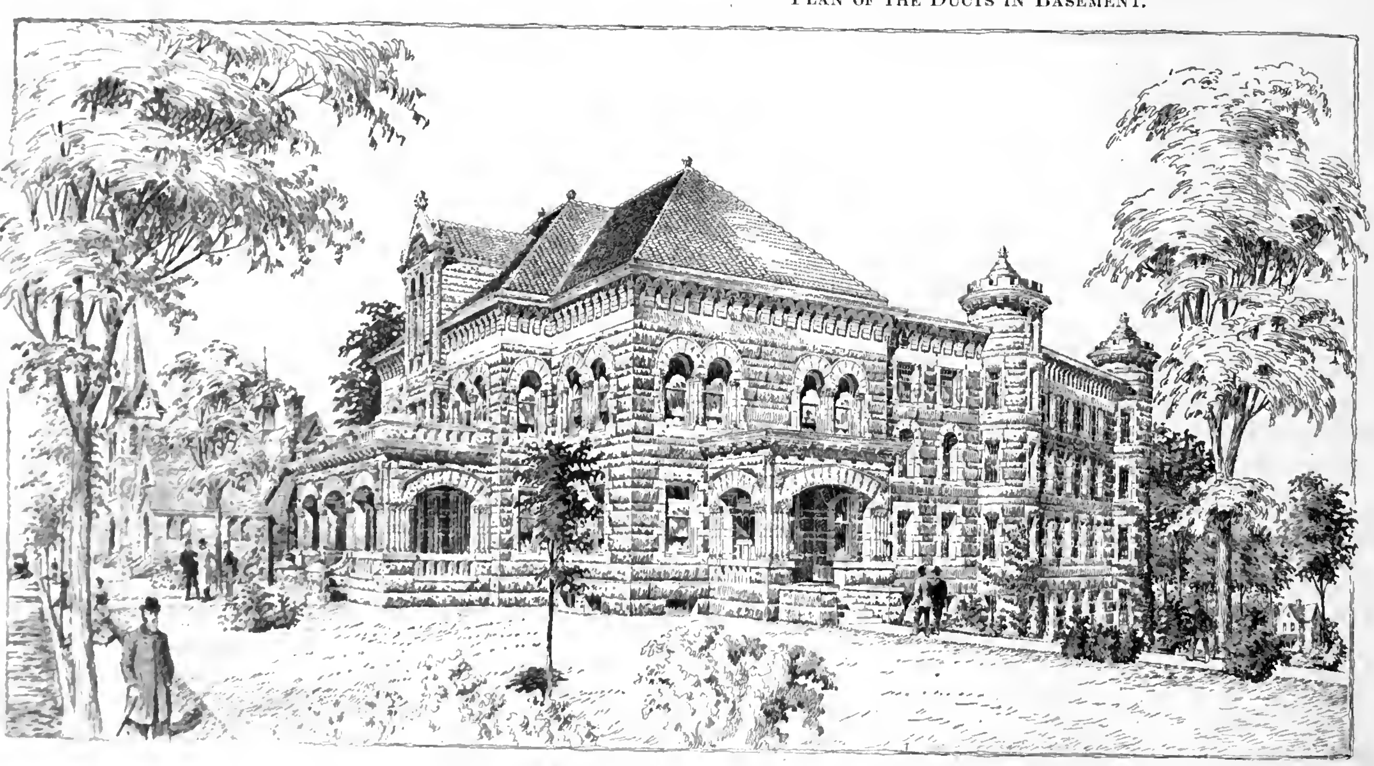
A county jail is nearing completion at Akron, which is a radical departure from the general plan of prison buildings, it being so arranged that while the inmates cannot see one another, they are plainly visible to the turnkey at all times. This allows for a separation of the prisoners, which prevents any intercourse between them. It has also been the aim in this building to produce an agreeable and attractive exterior, to disguise as much as possible the purpose of the structure. The interior is designed with special attention to making it sanitary and fireproof, and besides its commendable features as a prison has an extensive ventilating and heating system. The building is in two parts with separate entrances; the front part constitutes the sheriff's quarters and consists of two stories, a basement and attic; the rear, or prison, section is trapezoidal in plan and encloses a triangular court open to the sky. The prison contains four stories, including the basement, of which all but the upper floor are for men. The top story is the prison for boys and females, and is slightly different in construction from the plan here shown. The basement of the residence half is utilized for the ventilating and heating plant for the entire building, and a part of the second floor over the sheriff's office is fitted up as the prison hospital ward, with adjoining attendants' rooms and complete toilet conveniences.

The open triangular court in the prison portion is faced with white enameled brick so as to reflect as much light as possible to the cells and to allow of washing down the walls with a hose. There are six cells on both sides of each men's story, making in all a total of 36 cells. Each cell has a window into the court, but is inaccessible from any outside rescue, as the court can only be reached through the jail corridors. The windows are arranged in a series of receding bays and staggered in such a manner as to prevent the prisoners seeing one another, but to enable them to see and hear any one addressing them from the speaker's gallery. This makes it unnecessary to assemble them in one room, where they would be able to communicate with one another. The cell windows are to be heavily grated from the inside on a plane with the inner steel lining of the cells, while the sashes are on the court side of the wall, wholly inaccessible to the prisoners; they will have patent locks which are manipulated by the keeper from the balcony extending around the inner court. The floors of these balconies will be of glass so as not to cut off the light to the cells beneath.

There will be provided in each cell a small lavatory bowl and an extra heavy, buff-colored earthenware water-closet, which, for sanitary reasons, will have no wooden seat. All pipes, valves and fittings will be located in pairs in the triangular compartments at the corners of the two contiguous cells they supply, and may be reached by the plumbers, through a locked door, from the corridor. The fixtures will be operated by push buttons from the cells, with

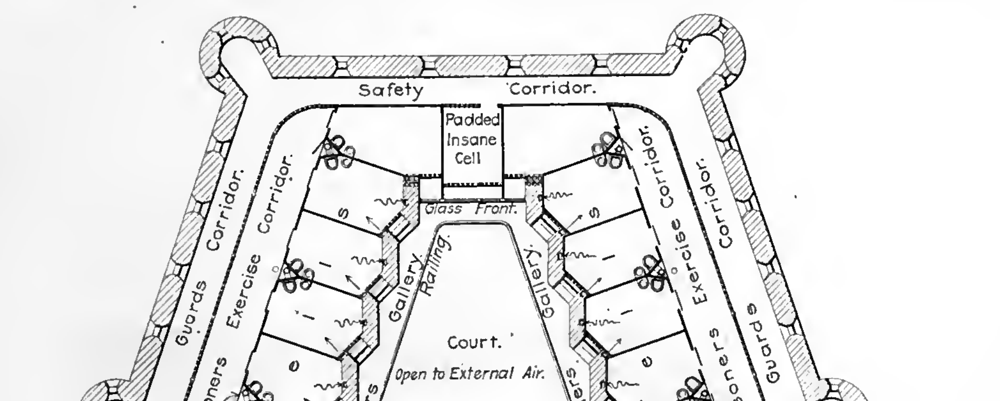


PLAN OF THE DUCTS IN BASEMENT.



THE SUMMIT COUNTY JAIL, AKRON, O.

nothing in the cells which the prisoners can mutilate or destroy, and the water will be supplied by time tanks, flushing only at the specified hours at which they are set, to prevent any malicious waste of water. An electric transmitter will be located just outside each cell window, connected with a sensitive megaphone receiver in the jailer's office, which will report any communication of prisoners through their cell windows, or any unusual noises, such as filing, sawing or other indications of attempts at escape. A similar device will be placed in the padded insane cells to detail all of the ravings or relapses of the inmates to the office. There will be one of these insane cells on each of the three men's floors located at the apex of the court. On the court side they will have glass fronts backed with iron



Plan of First Floor.

bars, allowing unobserved inspection, day or night, from the jailer's corridor.

In the main partition between the jail proper and the sheriff's apartments there will be a number of conical shaped peep-holes through which the authorities may survey all parts of the jail without being seen by the prisoners. The prisoners in any row of cells will be permitted to exercise one at a time in a caged corridor running the length of the row, from the end of which they may talk across the guard's corridor to their visitors, who are allowed to come only as near as the visitors' cage. The exercise corridor is divided off from the outer guards' corridor by an open barred grating and both will be lighted by narrow windows in the external walls, which will be too small to permit of a person crawling through, but will afford convenient port-holes to defend the jail in case of a mob attack. The source of light to the cells being from the windows on the court side, the cell doors are made of solid plate with no gratings; therefore a prisoner in the exercise corridor cannot see or talk to any other prisoner. The doors will be opened and closed by locking devices operated by levers in the guards corridor. Food will be served on trays through traps in the cell doors, and will be elevated from the kitchen to the different floors by a dumbwaiter.

A shower bath and a laundry tray for the prisoners to do their own washing will be located at the forward end of each exercise corridor, with hot and cold water mixing chambers and measuring tanks in the outer corridor so that the keepers may control and limit the use of water. Instead of the usual iron cots, hammocks of heavy duck bound with leather will be used in the jail, for economical as well as sanitary reasons, as they can be readily fumigated or burned if unfit for further use, and may be cheaply replaced. The top floor is divided into two parts, one-half being for boys and the other for women. There are four cells in each section, and they are arranged along the outer walls instead of the court walls. As these cells depend on the exterior windows for their light, the top row of windows are made wider and are protected by substantial ornamental grilles. Their great distance from the ground could, however, offer no chance of escape. To eliminate as far as possible all prison appearances, the cells for the retention of boys and women will have plastered walls and oak doors and floors.

The ventilating and heating of the entire building, including the jail and sheriff's residence, is done by a combined forced and induced hot-air system. The circulation is established by a large motor-driven blower of the Buffalo Forge Company's make, which takes its air through an inlet 14 square feet in area and containing a steam coil for slightly tempering the air in the severest weather. The blower discharges partly through a heater and partly through a by-pass into a plenum chamber. The hot and cold air are kept apart in this chamber by a diaphragm and are mixed upon entering the ducts which convey air to the various prison sections. Each row of cells on each floor has its individual main duct in the subbasement from which a riser is taken to each cell. The temperature in each of these mains is automatically regulated by two mixing dampers at the plenum chamber, which are controlled by a thermostat located in one cell of each group, and in such a manner that it cannot be tampered with. The risers to the men's cells are in the court wall, and those to the women's and boys' cells in the external wall. There are four sets of the former; one carries vitiated air from the basement cells; the next supplies the basement with fresh air and is then blocked off, and the remainder of the flue vents the first floor cells. Similarly, the next flue supplies the first floor and vents the second, and the last supplies the second floor. Each duct is carried in a chase in the wall and is but 4x8 inches in area, so that it offers the prisoners no possible means of escape. To give a uniform or any desired distribution of air to the separate cells the branch to each riser is provided with a damper to regulate the quantity passed. The vent flues of all cells and other rooms lead to the attic and are there connected to a 42-inch disk fan, which is driven by a direct-connected 3½-horse-power General Electric motor.

The accompanying basement plan shows the location of the blower, heater, etc., and the form of the main distributing ducts in the basement. The plenum chamber is divided by a diaphragm to separate the hot and cold air, and each duct is provided with two mixing dampers, one opening into each compartment. These two dampers are connected together so that opening one closes the other and vice versa, the extent and direction of the movement being determined by the thermostat. It will be seen from the plan that the residence part of the building is supplied for the most part by systems of rectangular ducts of tree form, as distinguished from those for the prison division, which, as was shown, are in the form of continuous mains, cylindrical, except near the plenum chamber, where they are rectangular, and decreasing in diameter as risers are led from them. The ducts and risers for the sheriff's department are of various sizes, according to the volume and location of the rooms they supply. They are taken from the upper or hot-air part of the plenum chamber, and the temperature is regulated with automatic thermostats, which operate on volume dampers placed in the flues running to these rooms.

The blower is a 90-inch fan with a 64x32-inch wheel and runs at 225 revolutions per minute. At this speed its capacity is 13,000 cubic feet per minute, which is sufficient to change the air in the entire building once in every ten minutes. The fan is belted to a 5-horse-power motor, built by the Akron Electrical Manufacturing Company. The tempering coil contains 180 square feet of heating surface and tempers the air to about 45 degrees. It is only used in the coldest weather. The regular heater consists of five sections of 1-inch pipe coils, giving a total of 900 square feet. Steam is supplied to the heater and tempering coils by a 48-inch horizontal tubular boiler, 12 feet long, made by the Pennsylvania Boiler Works, of Erie, Pa. The boiler is located near and delivers its gases of combustion to a cylindrical stack 2 feet in diameter.

The combined area of all the ducts opening into the plenum chamber is 16 square feet, and the velocity of the air entering them at this place is, on the average, 815 feet per minute. From this rate of discharge the velocity into the cells is reduced to about 400 feet per minute, and the quantity discharged into each cell can, on this basis, amount to 90 cubic feet in one minute. In the corridors the velocity is less, the air entering at about 250 feet per minute. The corridor registers are all in the front end and are supplied by flues in the dividing wall between the jail and dwelling. The vent flues and registers are at the other end in the exterior wall. It may be interesting to note in accordance with this calculation that of the total air supplied only 17½ per cent. goes to the residence portion. In other words, the prison receives nearly five times as much air as the sheriff's apartments.

Mr. F. O. Weary, F. A. I. A., of Akron, is the architect of the building, and the patentee of the type of prison described. The ventilating and heating apparatus was designed and supplied by the Buffalo Forge Company, of Buffalo, N. Y., and the complete equipment was installed by Kraus, Kirn & Company, of Akron.

A Large Power Distribution Scheme has been authorized by Parliament to supply power to the industrial region of the lower Clyde River in Scotland. The district extends about ten miles on each side of the river and about twenty miles up and down stream from Glasgow. The area covered is about 700 square miles, and three generating stations are to be erected. The scheme has been prompted by a group of manufacturers to obtain cheap electrical power. This part of industrial Scotland contains about 1,200 works, many of which are large iron and steel works, coal mines, shipbuilding yards and chemical works. The three generating stations are to be built at Motherwell, Yoker, and Crookston, but it will not be necessary to construct the third station immediately. It is intended to install in each of the first two stations a plant of about 4,500-kilowatts capacity. A radius of 14 miles from these stations covers practically the whole district in which the company will be allowed to distribute its power, but a large proportion of the works are located within a radius of 6 or 7 miles of the stations. When the stations are in operation, they will probably be coupled together electrically, enabling them to share the loads and average up their power factors or to supplement or aid each other in any emergency. The capacities of the respective stations will ultimately be about 10,000 kilowatts each at Motherwell and Yoker, and 5,000 at Crookston. Of the 710 square miles covered by the scheme, only 13 are at present supplied by electricity. The authorized capital of the Clyde Valley Electrical Power Company is $4,500,000, with borrowing powers of $1,500,000. The total cost for plant on the transmission lines is estimated at over $2,000,000. The electrical apparatus, which will comprise polyphase alternating-current generators and transformers for high voltage power distribution, rotary converters for the supplying of direct current, etc., has been contracted for with the British Westinghouse Electric & Mfg. Co. Messrs. Strain & Robertson are the engineers of the Clyde Valley Electrical Power Company. Mr. Robert Robertson, of that firm, has recently spent some time in the United States investigating systems and methods of power transmission.

A New Drafting Machine.

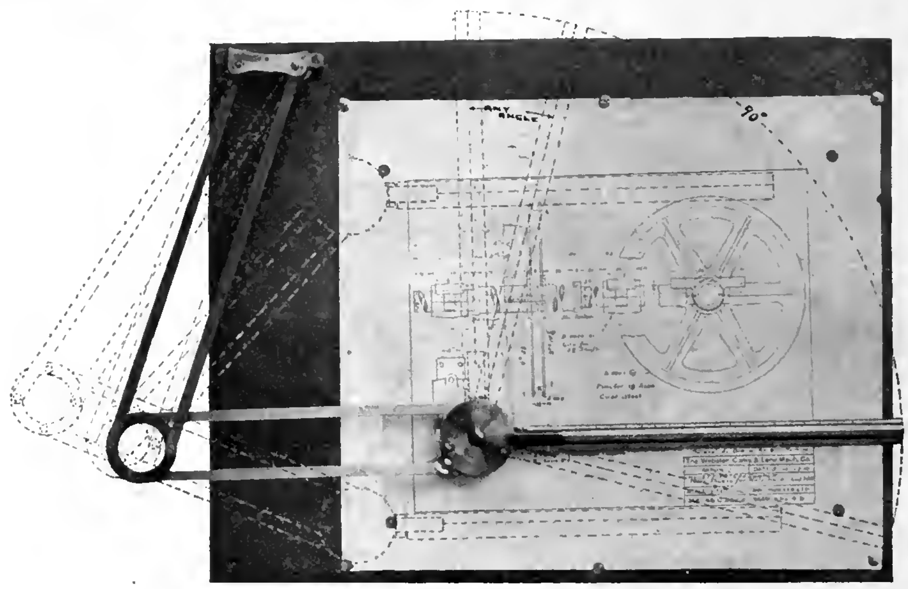
A drafting machine of considerable merit, because of its simplicity and adaptability to all kinds of drawings, has lately been put on the market by the Universal Drafting Machine Company of Cleveland, O. This new instrument is called "The Rapid Sketching Device," and is similar in construction to a larger and more expensive Universal Drafting machine manufactured by the same company. The striking advantage of the machine at first glance is that it combines the T-square, triangles, protractor and scale all in one. The manufacturers claim that a saving of half the time required by ordinary means is effected by their apparatus, since with it the draftsman can draw a line the exact required length at one operation, and may do angular work with as great facility as straight.

The apparatus consists of an ordinary drawing board, to the upper left hand corner of which is attached a mechanism for maintaining a movable scale always in positions parallel with its first setting. This is accomplished by two pivoted parallelograms, which in their action may be compared with the arm, elbow and hand of a man with his shoulder at the corner of the board, and possessing the ability scale will, as a consequence, lie flat on the paper, but may be raised slightly in moving from place to place, to avoid the rubbing of fresh ink lines.

The feature of the machine which is of greatest importance to its perfect working order is the tightness of the joints in the arms. After trying a number of kinds, the makers have finally adopted a hardened ground joint, which, on account of the slight pressure and speed with which it is used, will last indefinitely. The pin for the stops is made conical to compensate for wear. All parts are finished in nickel except the rods, which are coppered and oxidized.

The boards are regularly furnished 19x23 inches in size to accommodate sketches 18x20 inches, but by special order may be had in any size. The dealers will also supply for use with the machine, scales of any type, size or graduation.

The principal points of difference between this machine and the larger one are the use in the latter of two scales at right angles with each other instead of one, and a hinge at the corner where the mechanism is fastened allowing it to be swung entirely clear of the board. The head also has a hand wheel so that the moving and turning of the scales may be



METHOD OF USING THE RAPID SKETCHING DEVICE.

to move the scale to any part of the board, while continually pointing it in the same direction. The hand feature consists of two circular plates, between which, and on a stud through their centers, is mounted a lug carrying the scale. The lower plate is pivoted to the rods of the arm and cannot rotate. The upper plate serves as a protractor and may be revolved to any position and clamped by a set screw. It carries two stops on its lower face, which are adjustable to provide for wear or disarrangement. The scale, which may be of either the triangular or flat type, is fastened to the head by a chuck and may be readily removed, replaced or turned around so as to bring the desired edge into use. The scale moves freely between the two stops, with spring stops at 30, 45 and 60 degrees, these being the angles most frequently used. It is thus possible for the manipulator to set his scale at these positions quickly without referring to the protractor to be sure of their accuracy. In changing the setting of the protractor, all of the stops are simultaneously revolved, and the common relations of lines may be readily established on the new base. The flat horizontal placing of the rods in the arm gives rigidity where necessary, but also allows a desirable flexibility in a direction perpendicular to the plane of the paper. The done with the left hand, without touching either scale. The use of two scales saves some time and inconvenience because a horizontal or vertical line may be drawn without the swinging of the scale which is necessary in the other machine. The smaller one, however, has the advantage of compactness and portability, rendering it valuable for field work.

Brick Pavements as laid in Grand Rapids, Mich., have received particular attention in order to secure a smooth surface. City Engineer L. W. Anderson states in his last report that the sand cushion has been increased in depth and changed to a fine, soft sand. The brick, after being laid, are rolled with a hand roller, thoroughly culled, and then rolled with a 7-ton steam roller. It was feared that the heavy roller would chip the bricks, but such does not prove to be the case to any material extent. The pavement so laid, with joints well filled with Portland cement grout, gives a surface as smooth as asphalt blocks, although somewhat more noisy. The brick pavement is laid with a 5-year maintenance guaranty by the contractor. The contract prices for this brick paving on a concrete foundation for the year ending April 30, 1902, varied from $1.35 to $2.25 per square yard.

Removal of the Old South Tenth Street Bridge, Pittsburg, Pa.

By Willis Whited, Assistant Engineer, Department of Public Works.

The South Tenth Street bridge, formerly known as the Birmingham Bridge, was built in 1856 by the Birmingham Bridge Company, and crossed the Monongahela River about 1¼ miles above its confluence with the Alleghany. The bridge consisted originally of six covered Howe truss spans, about 220 feet long each, reinforced with arches. The crowns of the arches were somewhat below the top chords of the trusses and the springing lines about 10 feet below the bottoms of the trusses. The roadway was 20 feet wide, and the two overhanging sidewalks were each 5 feet wide. The banks of the river were gradually built out with slag from the numerous furnaces and with other materials, until the spaces under the two southerly spans and the north span were filled in and occupied by mills and railroad tracks. Then the south span was replaced by two 109-foot iron spans and the north span by an iron viaduct. When the south span was removed, the pier at the north end of it had been filled around so nearly to its top that it had sufficient stability to resist the thrust of the arches. The pier at the south end of the north span, however, was considerably higher, but the filling back of it was not so high, and so heavy timber braces, resting against the first pier of the viaduct, were placed against it when the north span was removed. As the river had been narrowed to but little more than one-half its original width it began to scour and the pier next south of the one which had been braced was undermined at its northwest corner so that it settled, with a movement of its top of two or three feet toward the north. This movement acting through the arches, brought a heavy pressure against the next pier, and, in spite of the bracing, forced the top of it about 18 inches toward the north. The old bracing, which had become considerably decayed, was replaced with new and heavier timber, but the pier continued to move and stones began to fall away from it. Then the bridge was ordered removed, and the contract was awarded to Mr. C. M. Driver, of Allegheny.

The method of removal was quite simple. The roof and sides were taken off first; then all those parts of the arches above the floor were removed, and afterwards the sidewalks, parts of the top and bottom lateral bracing, as much of the floor as could be spared, and the bolts at the intersections of the diagonals were taken away. The top and bottom chords, which were continuous, were cut over the piers, and the span to the south of the undermined pier was first taken down. This span was removed first because it was feared that if the span to the north of it were taken down first the undermined pier, which leaned toward the north, would fall and let down the span to the south of it, thus blocking navigation in a part of one span and the whole of another with a mass of wreckage which would take considerable time to remove. This southerly span was dropped in sections by boring a hole in each timber of each chord about one-third the way from each end of the span, placing a small dynamite cartridge in each hole, and exploding all the cartridges simultaneously. The end sections were moored to the piers with long ropes, and a steamboat which lay in readiness towed the center section immediately to the wharf, and then came for the other sections in turn.

The adjoining span south was next blasted down in the same manner. The third span to the south, being over railroad tracks, had to be taken down with false-work. The remaining span, which was next north of the undermined pier, was then blasted down in the same manner as the other river spans. The undermined pier did not fall, but while it was being taken down it cracked badly in several places. A singular thing happened when this last span was blasted down: the two end sections came down so that their top chords caught against the ends of the top chords of the center section before it fell, forming an arch springing from the ends of the old arches resting against the sides of the piers. Thus the whole span was held up in a very dangerous position. A 2-inch line was made fast about 30 feet from the end of the span and a steamboat pulled till it broke the line, but the span still held. A 3-inch cable was then made fast about 50 feet from the end of the span, and the steamboat, by two or three heavy surges on the cable, pulled the span down.

The contracts for the new bridge had already been let, for the substructure to Mr. C. M. Driver and for the superstructure to the American Bridge Company. The latter company removed the two 109-foot truss spans at the south end with false-work, using a small hand derrick. Cars were run into a siding under the bridge, and the iron was loaded directly on to them. The north approach was a plate-girder viaduct crossing the yard of the Baltimore & Ohio Railroad, and was taken down with the same hand derricks and loaded on to cars beneath. The two river piers and the damaged portion of the north shore pier were taken down with a derrick boat as far as possible and the parts of the two river piers under water were blasted and removed, partly with a dipper dredge and partly with an orange-peel dredge. The piers were built on timber grillages resting on the bottom of the river, so there were no piles to pull. The timbers in the grillages were loosened up with a dipper dredge and lifted out with an orange-peel dredge.

The bridge had always been covered in, but never painted. Aside from ordinary wear and tear, nearly all the wooden truss members and wind bracing were about as sound as when first put into the bridge. The rods might have lasted 100 years longer, so far as could be seen, with a few exceptions. Practically the only woodwork that had decayed to any extent was the portions of each bottom chord over the piers on the down-stream (west) side. Those parts were nearly all very badly decayed. Over two of the piers there was scarcely anything left of the chord for several feet. This was attributed to the fact that rain in this locality is usually accompanied by a west wind and had beaten in under the bridge, on top of the piers, causing the bottom chords and the blocking under them to rot. The only rods or bolts that were badly corroded were the vertical rods which passed through the arches and helped to support the floor. These were about 1¼ inches in diameter and passed through oak blocks under the floor. Many of them were reduced to less than ¾ inches diameter where they passed through these blocks. All the timber in the bridge, excepting these blocks, was pine, and the iron in the pine was no worse corroded than that exposed to the air.

The backing of the piers and many of the face stones were a local blue-stone, the remainder being a local sandstone. Many of the exposed bluestones had crumbled and split considerably, but the sandstone had weathered reasonably well. The mortar, however, had nearly all washed out, in fact it was difficult to determine what it was made of. It was, doubtless, composed of lime and a poor quality of natural cement mixed with river sand. In massive masonry like the piers the air has so little access to the lime that it requires many years for it to harden, and an occasional flood in the meantime will dissolve out nearly all of it, especially if the mortar is mixed too lean. A poor quality of cement is also soon washed away. The grillages on which the piers were built were of pine and apparently as sound as when first put in. The work was carried through without accident by Mr. C. M. Driver, the contractor, under the supervision of the author.

Personal and Obituary Notes.

E. E. Blackwell, chief engineer of construction work on the Texas & New Orleans Railroad, was killed near Nacogdoches, Tex., while making an inspection.

Mr. Samuel Parsons, Jr., of New York, has been engaged as landscape architect to take charge of converting 1,400 acres of land into a park for San Diego, Cal.

Prof. George C. Caldwell has resigned as head of the chemistry department of Cornell University and has been appointed professor emeritus and lecturer in chemistry.

Mr. Burton J. Ashley, civil and consulting engineer in the founding and building of Zion City, Ill., has resigned as city engineer, after eight years' service in that connection, and has returned to Chicago to resume his private practice.

Mr. Gustave Bottinger has resigned as chief engineer of the Tennessee Central Railroad and the Tennessee Construction Co., and Mr. R. E. Harwood has been appointed to fill his position with the construction company, at Nashville, Tenn.

Mr. Edwin Reynolds, president Am. Soc. M. E., has been made consulting engineer of the Allis-Chalmers Company, and he is succeeded as chief engineer by Mr. Irving H. Reynolds, M. Am. Soc. M. E., heretofore general superintendent.

Mr. W. H. Marshall has been made general manager of the Lake Shore & Michigan Southern Railway, with headquarters at Cleveland, and has been succeeded as general superintendent by Mr. H. S. Storrs, formerly assistant general superintendent.

Mr. H. B. Davis, the present principal assistant inspector of buildings of the District of Columbia, has been promoted to the position of inspector of plumbing, succeeding Mr. O. L. Ingalls, whose appointment as engineer in charge of sewers and water-works in Manila, P. I., was recently announced in this column.

Prof. William H. Burr, of Columbia University, Mr. Rudolph Hering, of New York, and John R. Freeman, of Providence, have been appointed a commission to report on the available sources for the enlargement of the water-supply of New York, throughout the boroughs, and on means for the prevention of water waste.

C. K. Dixon, superintendent of the Omaha Division of the Illinois Central Railroad, at Fort Dodge, Ia., died November 20 at Cherokee, Ia., after five months' illness. He was 56 years of age and had been division superintendent with the Illinois Central for 15 years and in the service of that company for over 30 years.

Since completing the power plant for the Montgomery Water-Power Co., near Montgomery, Ala., Mr. Ethan Philbrick has also established an office in connection with the North & South Engineering & Construction Co., Chalifoux Building, Birmingham, Ala., which conducts a practice in water-power developments, in railway, bridge and foundation work and in industrial plant design.

Another active career, distinguished by many works of importance and prominence, was brought to a sudden end by the death from heart disease of Joseph Miller Wilson, of Wilson Brothers & Co., of Philadelphia, in his office in the Drexel Building, that city, November 24. He was born in Phoenixville, Pa., in 1838, was graduated from the Rensselaer Polytechnic Institute in 1858 and began engineering as assistant engineer with the Pennsylvania in 1860, being engineer of bridges and buildings on that road from 1865 to 1886. During this period, however, he became engaged in the practice of building engineering and designed some of the principal buildings of the Centennial Exhibition, the Drexel Institute, in Philadelphia, the elevated railway station work in New York, and many hospitals and penitentiaries for which he made a special study abroad. For years he was president of the Franklin Institute and was a member of the American Society of Civil Engineers, of the American Institute of Architects, of the Institution of Civil Engineers and of other societies of both art and science.

By the death on November 22 of Friedrich Alfred Krupp the world is the loser of a man who succeeded by the assistance of well selected employes; he made the steel works of Fried. Krupp, at Essen, Germany, world famous, while himself remaining sole proprietor. Although an authority on the art of steel making and an ardent experimenter, as is shown by the award to him early in the present year of the Bessemer gold medal from the Iron & Steel Institute, he delegated the management of his widespread interests to a directorate composed of fourteen men and devoted a great amount of his time, instead, to the amelioration, in housing and education, of his workmen and their families. It is popularly supposed that the steel works have been very largely engaged in the manufacture of armor plate, guns and general war implements, but it is variously estimated that 50 to 70 per cent. of the output of the works was consumed for industrial purposes, a fact which, it is stated, Herr Krupp was always anxious to publish. He was but 50 years of age, and had entire control of the works only since 1887, when his father died.

Details of an Architectural Contest for the plans of a $250,000 church for the city of Patras, Greece, are given in "Consular Reports" No. 266, for November. The architecture is to be Byzantine, and the edifice must accommodate 5,000 persons. Three prizes are offered, $2,000, $800 and $400. Further information can be obtained from Mr. Frank W. Jackson, Consul, Patras, Greece.

An International Fire Exhibition is to be held at Earl's Court, London, from May to October, 1903. Various forms of building construction will be exhibited, as well as fire-extinguishing and life saving appliances, fire stations and their equipment, water-works and their various connections, salvage work, ambulance service and insurance. Details of the scope of this exhibition are given in "Consular Reports" No. 266, for November.

The Louisiana Purchase Exposition, at St. Louis, will be lighted from the plant of the Union Electric Light & Power Company, for which both forced and induced draft will be provided. There are to be 26 boilers of 700 horse-power each, equipped with automatic stokers. There will be four forced-draft fans with 160-inch full housings, driven by 10x10-inch direct-connected vertical engines; and two induced-draft fans with 230-inch full housings driven by 9x10-inch double-cylinder double-acting upright engines. The fan and engine equipment for this work is being built by the Buffalo Forge Company.

The Construction of the Kew Bridge, over the Thames River in England, presents several unique features, which are described at length in "The Engineer." The bridge consists of elliptical masonry arches of 131 feet span and 20 feet rise. The cofferdams used in building the piers were constructed of 14x14-inch squared piles 39 feet long. Grooves were cut into the piles 2 inches deep, into which tongues of 4x2-inch elm were fitted, making a perfectly water-tight dam, requiring no calking except where the tongues had been broken. There were five tiers of cross-bracing, 12x12-inch timber being used mostly. The main ribs of the arch centers were arched steel girders, each varying in depth from its middle to either end, and designed to carry a loading of 600 pounds per square foot.

A Hydro-Electric Power development is proposed by the Snoqualmie Falls and White River Power Company which plans to divert the waters of White River, at a point about 25 miles from Tacoma, Wash., into an 8-mile canal which will discharge into Lake Tapps. The lake will be used as a storage reservoir and settling basin, from which a short canal and tunnel will lead the water to a penstock to feed five steel pipes, only one of which will now be laid, to supply the turbines under 450 feet head. The discharge will be into the Stuck River. The power-house is designed to accommodate a 50,000 horse-power installation eventually, but at present a building sufficient for an equipment of 10,000 horse-power will be built, with a machine shop annex. This plant will be connected with the existing Snoqualmie Falls transmission system by circuits about 5 miles long. The head-works will include a concrete inlet, a submerged dam across White River, and gates for controlling the flow into the canal, which will be 25 feet wide on the bottom, with 1½ to 1 slopes under water and 1 to 1 above, and will have a capacity with 6 feet depth of water sufficient for 60,000 horse-power, theoretical, at 450 feet head.

Duties on Imports into China, as determined by the new Chinese tariff taking effect October 31, 1902, and published in the "Advance Sheets" of Consular Reports, No. 1481, dated October 29, include the following items of interest to manufacturers and users of engineering supplies:

	Duty in cents per 100 lbs.
Iron and mild steel, new—	
Mill iron and forgings for vessels, steam engines and locomotives (25 lbs. or over)	12.54
Angles, bars, rough castings, plates and sheets	6.62
Bolts and nuts, nails (except wire), pipes and tubes	5 per cent.
Pig iron	3.55
Rails	5.92
Rivets and wire	11.83
Galvanized sheet iron	13.01
Steel bars, sheets and plates	11.83
Tool and cast steel, steel wire and wire rope	35.49
Brass bars, sheets, plates and ingots	54.42
Copper bars, sheets, plates and wire	61.53
Belting	5 per cent.
Cement, per cask of 400 lbs., cents	9.46
Hard wood beams	0.95
Soft wood beams, piles and piling (including Oregon pine and California redwood, on a thickness of 1 inch), per 1,000 superficial feet, cents	72.57
Materials for railways, the free import of which was provided for by agreements antedating the peace protocol	Duty free

Note.—The above values were converted from haikwan taels per picul. The picul equals 133 1/3 pounds. The value of the haikwan tael fluctuates, but was estimated by the U. S. Mint at 63.1 cents on October 1, 1902, which value was used in the conversions.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xv, xviii and xxvii.

WATER.

New Britain, Conn.—Water Comrs. have voted to construct a reservoir on Wolcott mountain in Southington, to occupy 56 acres and cost $75,000. The capacity will be 1,500,000 gals.

New Castle, Pa.—The West Pittsburg Water Co. has been organized by New Castle and Pittsburg capital. W. K. Hugus, of New Castle, is one of the incorporators, and is attorney for the Co., which will install a water system at the new town of West Pittsburg, near New Castle.

Buffalo, N. Y.—The Water Com. has reported in favor of rejecting bids, received some time ago, for hydrants and asking for new bids.

Lancaster, Pa.—At a meeting of the Special Water Com. of the Council held Nov. 19 to consider the proposition of the American Spring Water Co. to furnish the city with water for a period of 30 years at a cost of $30,000 per year, it was decided to refer the question to a sub-committee of four, they to consult an expert engineer, to pass upon the practicability of the proposition.

Massena, N. Y.—The taxpayers will vote on the question of the village purchasing the plant of the Tupper Lake Water Co. for $56,000.

South Atlantic City, N. J.—The contract for installing $30,000 water works is reported to have been awarded to Henry A. Miller, of Wilmington, Del.

Philadelphia, Pa.—Bids are wanted Dec. 2 for supplies for the Bureau of Water, Dept. of Pub. Wks., including brass fittings, cocks and valves (made in Phila.), wrought iron pipe, iron and steel, bricks, lime, cement and Belgian blocks, fire brick and clay, cast iron water pipe and castings, American refined lead, meters Class A A, asphalt and granolithic walks, electrical supplies, etc. Wm. C. Haddock, Dir. of Dept.

Meadville, Pa.—City Engr. W. A. Doane writes that the Councils have accepted the bid of the Phoenix Iron Wks. for 2 150-H.-P. vertical Manning boilers for the new pumping station.

Hudson, N. Y.—Engr. in Charge H. K. Bishop writes that plans for water works estimated to cost $225,000 will be completed about Mar. or Apr., 1903.

Oakland, Md.—The City Council has under consideration the proposition of H. G. Frederick, of Millersburg, Pa., for the construction of a system of water works, with 25-year franchise.

New York, N. Y.—Prof. Wm. H. Burr and Rudolph Hering, of New York City, and John R. Freeman, of Providence, R. I., have been appointed a Comn. to report on the available sources for the enlargement of the water-supply of this city, throughout the boroughs, and on means for the prevention of water waste.

Allegheny, Pa.—The Council has voted a joint resolution for a special committee, of which Morris Einstein and Chas. Kirschler are members, to confer with a committee from Pittsburg Councils regarding the connection of the water mains of the two cities.

East Orange, N. J.—The Condemnation Comrs. appointed last April by Chief Justice Gummere, consisting of Amzi Dodd, J. William Clark and Eugene Vanderpool, to appraise the value of the East Orange system of the Orange Water Co., which East Orange is desirous of acquiring, has reported the value of the plant at $425,000.

Summit, N. J.—The Common Council has appointed a committee, consisting of Wm. J. Curtis, J. G. Van Cise, and others, to confer with the Essex Union Water and Light Co., and learn the price at which the Co. will sell its water and light plants to the city.

Troy, N. Y.—Bids will be received Dec. 5 by the Bd. of Contract and Supply, for furnishing F. O. B. cars Troy, 5,900 tons of 30-in. cast iron water pipe and about 114,000 lbs. special castings. Bids will also be received on same date for constructing about 7 miles of 30-in. conduit line for conveying water to the city of Troy; alternate proposals for constructing a 30-in. cast iron conduit and a 33-in. riveted steel conduit. John Phelan, Comr. of Pub. Wks.

Niagara Falls, N. Y.—In a recent communication to the Bd. of Pub. Wks., City Engr. Walter McCulloh recommends municipal ownership of the water works; he estimates that about five acres of land are necessary for a slow sand filtration plant, each acre providing filtration facilities for about 6,000,000 gals. of water, and suggests that the present city plant be used as a water plant for the development of electrical power, the power to be transmitted to a new plant on the upper river. In said report the City Engr. states that the source of supply should be the Canadian channel on the far side of Grand Island; the estimated cost of plant suggested is placed at about $500,000, outside the expense of the purchase of the plant of the Niagara Falls Water Works Co.

Atlanta, Ga.—The Senate has passed the bill authorizing Atlanta to issue $400,000 bonds, to perfect the present system of water works.

Summerville, Ga.—The Senate has passed a bill authorizing this village to issue $25,000 bonds for water works improvements.

Bristol, Va.—The city has purchased the Moore and Mumpower lands, 3 miles north of the city, thus securing 8 mountain springs that will afford a water supply of 400,000 to 600,000 gal. a day. Local press reports state that the city will begin at once the construction of catch basins near these springs, and next spring a storage reservoir will be constructed.

New York, N. Y.—The following bids were opened Nov. 20 by R. G. Monroe, Comr. of Water Supply, for furnishing and laying water mains in various streets:

Items and Quantities.	Robt. L. Christie.	Norton & Dalton.	Jno. Cornwell, Jr.	F. Thilemann, Jr.	Henry Lipps, Jr.
Straight pipe, 1,700 tons	$31.00	$31.50	$30.00	$31.50	$32.00
Branches, 65 tons	58 00	57.00	60.00	58.00	58.00
Rock excavation, without blast, 10 cu. yds	5.00	5.00	.10	5.00	10.00
Rock excavation, 1,950 cu. yds	300	.30	35	3.00	.38
Earth excavation, 26,200 cu. yds	.30	.30	.35	.27	.38
Filling, 26,000 cu. yds	.20	.30	.35	.27	.38
20-in. pipe, 5,400 ft	.50	.50	.80	.55	.50
12-in. pipe, 16,000 ft	.30	.25	.40	.35	.35
6-in. pipe, 24,000 ft	.15	.18	.20	.24	.20
74 stop cocks, total	4,770.00	4,770.00	6,220.00	4,770.00	4,898.00
133 hydrants, total	8,645.00	9,145.00	13,025.00	9,709.00	9,090.00
Brick masonry, 100 cu. yds	10.00	10.00	12.00	5.00	10.00
Concrete masonry, 25 cu. yds	4.50	5.00	6.00	4.00	5.00
Asphalt pavement, 4,760 sq. yds	4.00	4.00	4.50	4.00	5.00
Brick pavement, 10 sq. yds	.50	3.00	1.00	4.00	5.00
Granite block, relay, 100 sq. yds	1.40	1.50	1.00	1.75	2.50
Macadam, relay, 1,900 sq. yds	.50	.50	.75	.60	.40
Pavement and flags, relay, 2,225 sq. yds	.25	.40	.50	.50	.30
Wood block, relay, 130 sq. yds	.20	2.00	4.00	3.00	5.00
Curb, reset, 1,200 ft	.11	.10	.01	.10	.10
Boxing, 6-in. pipe, 25 ft	1.00	3.00	4.00	4.00	10.00
Totals	122,052	121,305	134,977	129,703	133,830

Birnamwood, Wis.—Village Clk. S. A. Sprague writes that at the recent election it was voted to construct water works at a cost of $5,000.

Odell, Ill.—Press reports state that $5,500 water bonds have been offered for sale.

Crete, Ill.—The Council is said to be considering the matter of installing a water system.

Milwaukee, Wis.—In a recent report City Engr. Poetsch stated that a total of $37,457 is to be returned to the water fund for special water main extensions.

According to figures given out by the City Engr., the cost of the larger improvements which this city will make within the next 12 months will be $3,686,000. Among the larger undertakings will be the Kinnickinnic flushing tunnel which will cost $145,000; a new 20,000,000 gallon engine in the water works at a cost of $200,000 with the improvements; a $33,000 pumping station on the West side; Muskego Ave. bridge, $93,000; Broadway bridge, $125,000; Jones Island bridge, $125,000; track elevation and depression, $175,000; Washington Ave. viaduct, $400,000; First Ave. viaduct, $500,000, and a municipal lighting plant, and the conduits and appurtenances, $1,000,000. In addition to this there will be school improvements aggregating $865,000.

New Bremen, O.—This village has voted $28,000 bonds for the construction of water works.

Fremont, O.—The Fremont Water Works Trus. are reported to have closed a contract with the Shaw-Kendall Co., of Toledo, to install a pump plant at the local water works to pump the deep water wells. The new plant means an outlay of $10,000, and the Ingersoll-Sergeant Drill Co., of Cleveland, will furnish necessary air compressor and machinery.

Moline, Ill.—The City Council has accepted the bid of the New York Continental Jewell Filtration Co. for a filter plant to be built according to plans of Consulting Engr. Daniel W. Mead, of Chicago, Ill., at a total cost of $67,377; the contract calls for a concrete clear water reservoir, 750,000 gals. capacity; concrete filter tanks, 5,000,000 gals. capacity; filter equipment, 4,000,000 gals. capacity; and filter building, "steel truss roof," size, 130x72 ft.

Joliet, Ill.—A correspondent writes that this city is about to let the contract for constructing a 1,000,000 gal. reservoir at the water works. Estimated cost, $10,000. H. A. Stevens, City Engr.

Tenstrike, Minn.—This village is said to contemplate installing a system of water works in the spring.

Muskegon, Mich.—Local press reports state that the capacity of the city water works plant on Lake Michigan will probably be doubled by the installation of a 10,000,000 gal. per day additional pump without cost to the city. The Central Paper Co. has offered to install the pump if the city will supply them 4,000,000 gal. per day.

Sioux City, Ia.—The Water Works Trus. are said to be considering the advisability of erecting a new plant for the special protection of the stock yards district.

Marlinton, W. Va.—The Pocahontas Water, Light & Power Co. has been incorporated to supply Marlinton, Durbin and other places with water, light and power. The capital stock is $25,000. E. M. Arbogast and others, of Marlinton, are the incorporators.

Menasha, Wis.—The Common Council is said to be considering the question of installing a water works system.

Cleveland, O.—Water Works Supt. Bemis has asked the Bd. of Control for permission to advertise for 15,000 more water meters.

Marinette, Wis.—According to press reports the Menominee Water Co. desires to build and equip a pumping station at Poplar Point, and only awaits the action of the City Council in designating the source of supply and how far out in the bay the pipes shall be laid.

Kansas City, Mo.—John A. Rodgers, Secy. Fortuna Land & Mining Co., 502 B'way, writes that said Co. proposes to construct in the near future a pumping plant to drain ground for leasing purposes, and an electrical power plant.

Perry, Okla. Ter.—City Clk. F. F. Busch writes that at the recent election it was voted to issue $50,000 bonds for water works.

Ft. Morgan, Ala.—See "Government Work."

Geary, Okla. Ter.—Water works bonds to the amount of $27,000 are reported to have been sold.

La Harpe, Kan.—This place has engaged Burns & McDonnell, Kansas City, Mo., to make plans and specifications for a concrete dam, and extensions to the water-works system.

La Junta, Colo.—Bids are wanted Dec. 1 for $100,000 water bonds. G. S. Thompson, City Clk.

Renton, Wash.—Water works bonds to the amount of $4,500 have been sold, and the Council has adopted plans for a new system.

Sugar City, Colo.—The City Council has awarded to Holme & Allen, of Denver, the contract for a $20,000 water works system.

Pueblo, Colo.—The Colo. Fuel & Iron Co. is reported to be planning to irrigate over 10,000 acres of land adjacent to Pueblo; the proposed ditch to be 50 miles long and include many miles of 6 ft. wood pipe.

Alameda, Cal.—The Pure Water Co., principal place of business, Alameda, has been incorporated by M. French, H. H. Linnell, A. Linnell, A. J. Chamberlain, and others. Capital stock, $30,000.

Colorado Springs, Colo.—In a recent report relative to proposed improvements of Seven Lakes and the High Line reservoir, City Engr. E. W. Case estimates the cost of improvement at Seven Lakes, which include a tunnel through the Dead Lake divide and 2 reservoirs, at $15,000; in regard to the High Line reservoir, Mr. Case states that the Fairley site will sustain an 18,000,000 gal. reservoir, cost $13,000; and that the Brewer property can accommodate a 25,000,000 gal. reservoir, cost $20,000.

Platte, S. D.—Town Clk. W. F. McCall writes that the only bid received Nov. 17 for the construction of a system of water works was from the International Const. Co., of South Bend, Ind., at $6,750.

Fargo, N. D.—Deputy City Aud. N. C. Morgan writes that the question of either filtering the present water supply or securing a new supply is under consideration, but no action has as yet been taken.

Basalt, Colo.—City Clk. I. H. Mitchell writes that on Nov. 12 it was voted to construct water works at a cost of $11,000.

Salt Lake City, Utah.—Surveys have been started of the site of proposed reservoir in Parley's Canyon; the dam to be built across Parley's Creek will, it is estimated, form a reservoir which would store 1,000,000,000 gal. of water.

San Diego, Cal.—The Council has directed the City Engr. to prepare plans and estimates for an improved water system, cast-iron pipe to be used, the entire cost not to exceed $200,000.

Corona, Cal.—The Corona Power & Water Co. has been incorporated with a capital stock of $250,000, by T. P. Drinkwater, L. R. Curtiss, E. N. Currier, and others.

Los Angeles, Cal.—The Peck Ranch Water Co., principal place of business Los Angeles, has been incorporated with a capital stock of $15,000. Directors: H. T. Coffin, L. A. Pratt, N. Williams, and others.

Seattle, Wash.—Estimates for water mains have been filed as follows: Fourth Ave., south, $13,300; Laurel Shade Ave., $4,250; and Lee St., $1,400.

Canon City, Colo.—Arrangements are said to have been practically completed for a supply of water for this city, from artesian well south of Chandler, belonging to the Colorado Springs & Florence Oil Co., which is represented in Canon City by Augustus Macon and G. R. Gwillim.

Port Perry, Ont.—City Clk. W. H. Harris writes that on Jan. 1 the by-law providing for the construction of water works at a cost of $30,000 will be voted upon in this city.

Honolulu, H. I.—The San Francisco "Chronicle" states that a dam, capable of holding 2,560,000,000 gal. of water for irrigation purposes, is soon to be built across the Kaukonahua River, near the western end of this island. Estimated cost of dam, $250,000. The Waialua Agricultural Co. is said to be interested.

Sault Ste. Marie, Ont.—Press reports state that the Tagona Water & Light Co. will install a new pump of 6,000,000 gal. capacity.

St. John, N. B.—Water mains are to be extended, at a cost of $9,100. Wm. Murdoch, Supt. Water and Sewerage.

SEWERAGE AND SEWAGE DISPOSAL.

Portland, Me.—Bids are wanted at the Office of Constructing Quartermaster, Portland, until Dec. 27 for constructing a sewer system at Ft. McKinley, Great Diamond Island, as advertised in The Engineering Record.

Holyoke, Mass.—The Bd. of Pub. Wks. has voted to construct a 24-in. sewer, in Hampden St., 1,200 ft. in length.

Roselle Park, N. J.—Higginson & Shannon of Jersey City are stated to have received the contract for constructing a system of sewers for $44,441.

Syracuse, N. Y.—Local press reports state that the Bd. of Contract and Supply has rejected the only bid received, which amounted to $43,000, for the Teall Ave. sewer, and new bids will be asked.

Penn Yan, N. Y.—A vote will be taken on the proposition to expend $500 to have a competent engineer draw up plans and specifications for a complete sewerage system, his report to specify how the sewage can be disposed of.

Camden, N. J.—It is proposed to build sewers in numerous streets. Levi C. Farnham, City Engr.

Titusville, Pa.—Bids are wanted Dec. 1 for constructing a sewer in 1st St.; bids are also wanted at the same time for building a 12-in. tile sewer in Oak St. W. M. Dame, City Clk.

Lansdowne, Pa.—City Secy. H. L. Warren writes that on Nov. 5 it was voted to issue bonds as follows: $4,000 for sewers; $8,000 for paving, and $12,000 for sites for City Hall and engine house.

Albany, N. Y.—Bids are wanted Dec. 1 for the construction of a 15-in. vitrified stoneware pipe sewer in Livingston Ave. Isidore Wachsman, Clk. of the Bd. of Contract and Supply.

Harrisburg, Pa.—Bids are wanted Dec. 5 for the construction of 4 relief sewers. A. C. Stamm, Secy. Bd. of Pub. Wks.

Bloomfield, N. J.—The Sanitary Com. of the Bd. of Health of this city has been directed to confer with the Newark Bd. of Wks. with a view to having Newark join with Bloomfield in the construction of a sewer along Bloomfield Ave.

North Plainfield, N. J.—The Boro. Sewage Comn., B. A. Hegeman, Jr., Chmn., has made a preliminary report to the Council, in which 2 methods of sewage disposal are said to be practicable for this Boro., the first and most desirable being to carry sewage to tile water, the Com. was unprepared to report approximate cost of this system, still having the matter under investigation; the other method of sewage disposal was by the septic tank system, the total estimated cost of which would be approximately $87,400 for the plant, including mains, laterals and flush tanks, as planned by the Municipal Engineering Co. of New York City.

Patchogue, L. I., N. Y.—The construction of a sewerage system for the entire village is said to be under consideration.

Oneida, N. Y.—The Bd. of Pub. Wks. will on Dec. 2 receive separate bids for constructing 8-in. vitrified pipe sewers in West and Broad Sts., and for constructing a Portland cement concrete culvert on Higinbotham Brook at Main St. Address J. F. Connor, City Clk.

Norristown, Pa.—Bids are wanted Dec. 22 for constructing a sanitary sewer on Markley St. (diameter of pipe 18-in.), with necessary laterals, manholes, outfall cribbing and trestling. John H. Rex, Chmn. Sewer Com.; S. Cameron Corson, Boro. Engr.

Erie, Pa.—The Council has under consideration an ordinance providing for the construction of a main sewer on the line of Pennsylvania Ave., to cost $13,000.

New York, N. Y.—The lowest bid opened Nov. 25 by Boro. Pres. Jacob A. Cantor for an extension to outlet sewer at foot of W. 72d St. was from E. W. Robinson, at $26 per ft. for 371 lin. ft. of wooden barrel sewer 4 ft. interior diameter, Class I.; $16.40 per ft. for 79 ft. of brick sewer 4 ft. interior diameter, Class II.

Long Island City, N. Y.—The Bd. of Estimate and Apportionment, New York City, has adopted a resolution providing for amendments to the sewerage system in the 1st Ward.

Hoboken, N. J.—Local press reports state that Township Engr. Bond has completed plans and specifications for the outlet sewer and pumping station.

Buffalo, N. Y.—This city is to issue bonds to the extent of $100,000 to pay for the construction of a sewage pumping plant. Plans for same are being now made by the Bureau of Engineering.

Richmond, Va.—The Street Com. has recommended an immediate appropriation of $8,000 for the repair of the trunk sewer at 31st and Broad Sts.

The City Council has adopted a resolution asking that an additional $500 be appropriated in order to secure the services of Rudolph Hering, of New York City, as Consulting Engr. for the Atlanta sewer improvements.

Atlanta, Ga.—The Senate has passed the bill authorizing Atlanta to borrow $400,000 to extend the trunk sewers of the city.

Toledo, O.—Bids will be received Dec. 15 by Chas. H. Nauts, City Clk., for furnishing material and constructing a 15-in. circular pipe sewer, 8 and 10-in. inside diameter in portions of 4 alleys.

Akron, O.—Bids are wanted Dec. 2 for constructing a main trunk sewer in Dist. No. 4, also for a local sewer in Pearl St. Chas. H. Isbell, City Clk.

Milwaukee, Wis.—See "Water."

Chicago, Ill.—The Drainage Bd. has, according to local press reports, sold $1,500,000 drainage bonds.

Ottawa, Ill.—The City Council is considering the question of a sewerage system for the west side.

Bellefontaine, O.—According to local press reports the City Council may raise funds and construct a system of sewerage, purchasing a sewage farm and erecting a pumping station, without submitting the question to a vote of the people.

Kankakee, Ill.—The Council is said to be taking steps towards building lateral sewers.

Emmetsburg, Ia.—This city is said to be agitating the question of a sewerage system.

Crandon, Wis.—Press reports state that a sewerage system is to be constructed for this place.

Barberton, O.—The City Council has engaged J. E. Collins to prepare plans for sewers on Third and several other streets.

Chicago, Ill.—The Gage Park Improv. Asso. is in favor of the construction of a sewer in Western Ave. from 39th to 55th Sts.

Wabash, Ind.—Bids are wanted Dec. 22 for constructing sewers in Still and Miami Sts. John Hilty, City Engr.

New Orleans, La.—Bids are wanted by the Sewerage and Water Bd. until Feb. 2 for the construction of approximately 96 miles of sewers and appurtenances, of which 7 miles will be brick or concrete sewers, from 72 to 27-in. in diameter, laid from 10 to 24-ft. in depth, and 89 miles will be pipe sewers 36 to 8 in. in diameter, laid from 5 to 20 ft. in depth; with approximately 1,100 manholes and 450 flush tanks, as advertised in The Engineering Record.

St. Joseph, Mo.—According to press reports bonds to the amount of $200,000 will be issued next year for the purpose of extending main sewer and improving the electric light plant.

Topeka, Kan.—Plans have been prepared for the proposed Sewer Dist. east of the Santa Fe tracks. The sewer as planned will start with a brick main oval in shape, the greatest diameter being 80 in., subordinate mains will be 45 and 36 in. in diameter, with laterals 24 to 18 in. in diameter. Estimated cost, $80,000.

Enid, Okla. Ter.—This city has engaged Burns & McConnell, of Kansas City, Mo., to make surveys, and prepare plans and specifications for a system of sewerage.

Pasadena, Cal.—Local press reports state that bids have been asked for the construction of the outfall sewer to be 8,300 ft. long, a large part of which will have to be tunneled, for which $35,000 was voted.

Tacoma, Wash.—The City Council has adopted a resolution for the construction of sewers in several streets and alleys.

Lewiston, Idaho.—A correspondent writes that the new sewerage system comprising nearly 6 miles of pipe will be ready for bids about Jan. 1. Address Councilman C. A. Hastings, City Engr. Briggs or City Clk. Chas. McDonald.

Houston, Tex.—City Engr. Dormant has prepared plans and specifications for a tunnel sewer under Maury St. in the 5th Ward, estimated to cost $60,000.

Loveland, Colo.—The contract for constructing 10 000 ft. of sewer is reported to have been awarded to Dunigan & Palmer, of Shenandoah, Ia., for about $11,000.

Toronto, Ont.—In his recent report City Engr. Rust recommends, in regard to the Woodbine Ave. sewage disposal, that necessary disposal works for pumping and treating the sewage and the sewers proposed to be laid in the said district be constructed as a local improvement on the initiative principle. Estimated cost, $45,000.

BRIDGES.

Gloucester, Mass.—Preliminary steps are being taken looking to the erection of a $12,000 steel bridge over Gloucester Canal, to replace present wooden structure. W. L. Webber, City Engr.

Warehouse Point, Conn.—According to press reports surveyors are at work on Terry's Island planning for the construction of a bridge for the N. Y., N. H. & H. R. R., to have a double track, and cost about $1,000,000. Colon M. Ingersoll, Jr., Ch. Engr. of R. R., New Haven.

New Kensington, Pa.—A correspondent writes that an overhead bridge, 10 ft. wide and about 150 ft. long, may be built over the R. R.

New Castle, Pa.—See "Railroads."

Doylestown, Pa.—The Co. Comrs. are reported to have awarded the contract for building a bridge at Leatherman's Ford, in Bedminster Township, to Nelson & Buchanan Co., for $7,792.

New York, N. Y.—Bids are wanted Dec. 11 for furnishing the labor, materials and plant necessary for the construction of the tower foundation in the Boro. of Manhattan of the Manhattan Bridge No. 3, over East River, as advertised in The Engineering Record.

Coatesville, Pa.—The Pa. R. R. is reported to have awarded to John Goll & Co., of Philadelphia, the contract for a stone arch bridge to cross the west branch of the Brandywine at Coatesville; said bridge to be 54 ft. wide, to accommodate 4 tracks, and will consist of 9 semi-circular spans, 2 of which will be 86 ft. long, the others 78 ft. long each.

Harrisburg, Pa.—Contracts for the erection of 8 State bridges to take the place of bridges carried away by freshets last spring are reported to have been awarded by the Bd. of Pub. Buildings & Grounds as follows: Penn Bridge Co., Beaver Falls, bridge over Big Esquimaok Creek, Wayne Co., $34,889, and bridge over Sinking Creek, Centre Co., $6,847; W. H. Gulick, Phoenixville, bridge over Wallenpanyunk Creek, Wayne Co., $16,950; York Bridge Co., bridge over Wallenpanyunk Creek, $21,987, and Fisher's bridge, Columbia Co., $15,097; National Bridge Co., Pittsburg, bridge over Larry Creek, Lycoming Co., $17,900; King Bridge Co., Cleveland, Nuss bridge, Columbia Co., $22,750; Nelson & Buchanan, Chambersburg, bridge over Juniata River, Perry Co., $144,680.

Allegheny, Pa.—Local press reports state that a bridge is to be built across the Ohio from lower Allegheny to McKees Rocks; proposed length of bridge is said to be 300 ft., and cost about $300,000. John Murphy, Gen. Supt. of the Pittsburg Railways Co., is reported to be at the head of the incorporation which proposes to build the bridge.

Buffalo, N. Y.—Mayor Knight has approved the application of the Goodyear Co. to cross Hamburg turnpike with a canal and also to build and maintain a bridge over the canal.

Syracuse, N. Y.—Local press reports state that plans will be prepared by City Engr. Frank J. Schnauber, and contracts let so that work can be started early in the spring on the construction of 2 bridges—one over Onondaga Creek and the other over Oswego Creek.

Depew, N. Y.—The bridge on St. James St., over the B., N. D. & L. trolley line, is reported to have been condemned by the village authorities.

Jersey City, N. J.—Local press reports state that the wooden bridge over the Hackensack on the Newark Plankroad will soon have to be replaced by a steel bridge, at a probable cost of $250,000.

Reading, Pa.—Plans for approaches and superstructure for a $30,000 bridge, to be built on Front St. by the Reading Ry. and the United Traction Co. (S. D. Missimer, Ch. Engr., Reading), have been completed and are on file in City Engr. Murdoch's office; the superstructure is to be 1 span of 88 ft., and the south approach is to be 200 ft. long.

Pittsburg, Pa.—Local press reports state that all bridges on the Low Grade Div. of the Buffalo & Allegheny Valley Grand Div. of the Pennsylvania R. R. are to be strengthened and in some cases rebuilt, at an approximate cost of $800,000. There are in all about 12 2-span bridges from 75 to 80 ft. in length. Chas. P. MacArthur, Principal Asst. Engr., B. & A. Valley Div., Buffalo, N. Y.

Northeast, Md.—Asst. Treas. of the Co. Comrs. R. H. Logan, Elkton, Md., writes that at the Jan. meeting of the Bd. bids will be opened for the county bridge to be built over Northeast Creek at Northeast, at a cost of $6,000 to $8,000. W. D. Bratton, of Elkton, Engr. in Charge.

Bradford, Pa.—The Co. Comrs. may replace the bridge over the Tuns, which has a 106 ft. span, with a steel structure.

Cumberland, Md.—Bids will be received Jan. 5 by the Bd. of Co. Comrs for constructing the superstructure of several steel highway bridges. John N. Frantz, Clk.

Miami, Fla.—The Co. Comrs. are reported to have asked for bids for making approaches to the new steel bridge which is to be built over Miami River, at Avenue D; also for bids for the mason work.

Remington, Va.—Bids will be received Dec. 11 by John K. Taliaferro, Comr., for constructing 3 68-ft. steel spans, 1 stone abutment and 2 stone piers, fills on both sides of river, and raising the present spans 3 ft. higher with repairs to same.

Parkersburg, W. Va.—The Little Kanawha R. R., J. T. Blair, Pres., Parkersburg, and the Wabash R. R. Co., Jos. Ramsey, Jr., Pres., St. Louis, Mo., propose to build a suspension bridge across the Ohio from Parkersburg to Belpre; cost, $500,000.

Fowler, Ind.—Bids are wanted Dec. 2 by the Comrs. of Benton Co. for the construction of a bridge, 73-ft. span, 2¼ miles south and ½ mile west of Chase. Jas. D. Smyth, Aud.

Chippewa Falls, Wis.—Local press reports state that on Nov. 14 the railway bridge of the Omaha road extension over Yellow R., which has just been completed, was destroyed by floods.

Merrill, Wis.—Press reports state that the Council has unanimously voted to build a new bridge across Prairie River on 1st St.

Little Falls, Minn.—It is stated that at the recent election $5,000 bonds were voted to complete the Broadway bridge.

Reading, O.—The Co. Comrs., Cincinnati, have voted to issue $10,000 bonds to build a bridge over Mill Creek, between Reading and Lockland.

Milwaukee, Wis.—The Common Council Special Com. on the First Ave. viaduct on Nov. 20 received the repetition of an offer from Pres. John I. Beggs, of the St. Ry. Co., to pay the city $50,000 cash toward the erection of a new viaduct and a further offer in lieu thereof to pay the city an annual rental for use of viaduct equal to interest on $100,000 of the bonds sold to build structure. The rental will be paid yearly by the Co. until its franchise has run out in 1934. City Engr. Poetsch places the estimated cost of the viaduct at $550,000.

Milwaukee, Wis.—See "Water."

Cincinnati, O.—Bids are wanted by the County Comrs., Christian Bardes, Pres., until Dec. 13, for the purchase of Hamilton Co. bonds to the amount of $10,000, to be known as Clark and Davis St. bridge bonds.

Columbia City, Ind.—It is stated that bids are wanted Dec. 17 for constructing 9 steel bridges. Wm. H. Carter, Co. Aud.

Butler, Mo.—Bids are wanted Dec. 2 for constructing a steel bridge, 60 ft. long over Walnut Creek. R. E. Johnson, R. & B. Comr.

Walnut Springs, Tex.—Bids are wanted Dec. 3 for a steel bridge 2 miles southwest of Walnut Springs, bidders to submit plans. J. L. Mingus, Co. Clk., at Meridian, Tex.

Castroville, Tex.—The Co. Commissioners' Court, Hondo, Tex., is reported to have selected S. A. Oliver, of Houston, to prepare plans and supervise the construction of an iron wagon bridge across Medina River at Castroville.

Knoxville, Tenn.—The bridge which is proposed for the crossing of Clinch Ave. or some other avenue over the yards of the Knoxville, LaFollette & Jellico R. R., will, it is estimated, cost $60 000. A vote will be taken on the question of issuing $15,000 bonds, the city's portion of the cost of said bridge.

Harriman, Tenn.—The Cincinnati Southern R. R. is said to be arranging to build a steel viaduct over New River, in Scott Co., Tenn., near Harriman.

Beeville, Tex.—D. Troy, Clk. of Bee Co., writes that on Nov. 4 said county voted to issue $5,000 bonds for the construction of a bridge over Medio Creek.

Mendota, Mo.—It is reported that bids will be received Dec. 2 by Geo. W. Dickson, of Yuma, for a steel bridge.

Fairbury, Neb.—Bids are wanted Dec. 4 for constructing all bridges in Jefferson County for 1 year. W. S. Diller, Co. Clk.

Laurel, Mont.—The County bridge over the Yellowstone at Laurel, is said to be in an unsafe condition. Address Co. Comrs., Yellowstone, Mont.

Douglas, Wyo.—The Co. Comrs. have arranged for measuring and sounding North Platte River at Douglas, in order that plans may be prepared for a steel bridge to span the river at Center St.

Tacoma, Wash.—The City Council has passed a resolution providing for the construction of an iron bridge across the gulch adjacent to the city reservoir, to cost not more than $4,000.

San Francisco, Cal.—Stone Bros., of San Francisco, are reported to have secured the contract to build a $100,000 concrete bridge for the Salt Lake R. R.; the bridge is to be 800 ft. long and 80 6-ft. arches will be used in its construction; time for completion, 18 months.

Webster, S. D.—Bids will be received Jan. 7 by the Bd. of Co. Comrs. for constructing a 1-span steel bridge 24 ft. long and 18 ft. wide over Blue Dog Lake. Wm. Egeland, Co. Aud.

Caldwell, Idaho.—Edgar Meek, Clk. of the Bd. of Co. Comrs., writes that on Nov. 4 it was voted to build a bridge at Emmett St.

Georgetown, Colo.—It is stated that bids are wanted Dec. 30 for a steel bridge over Clear Creek. H. O. Walker, Co. Clk.

Sault Ste. Marie, Ont.—See "Railroads."

PAVING AND ROADMAKING.

Boston, Mass.—City Engr. Jackson estimates the cost of widening Atlantic Ave., without the construction of 2,100 ft. of sea wall as at first proposed, at $50,000 to $100,000; estimated cost with sea wall, $225,000.

Hartford, Conn.—Bids are wanted Dec. 10 for sheet asphalt paving, about 5,605 sq. yds., as advertised in The Engineering Record.

Lansdowne, Pa.—See "Sewerage and Sewage Disposal."

Long Island City, N. Y.—The Bd. of Estimate and Apportionment, New York City, has approved a resolution from the Local Bd. of Newtown, indorsing a petition to grade, curb and pave with asphalt St. Nicholas Ave. Estimated cost, $9,000.

Long Island City, N. Y.—Bids are wanted Dec. 4 by Boro Pres. Jos. Cassidy for grading, curbing and flagging Hamilton Ave.; the engineer's estimate calls for 24,500 sq. ft. of bluestone flagstone; also for grading, curbing, flagging and paving with asphalt on concrete foundation in Flushing and Davis Sts., engineer's estimate, 4,500 sq. yds. of asphalt and 6,000 sq. ft. of flagstone.

Buffalo, N. Y.—Comr. of Pub. Wks. Ward is in favor of the construction of a permanent stone (elevated) highway over Hamburg turnpike, for which he roughly estimates the cost would be $750,000, exclusive of the cost of pavement, which would be perhaps $100,000 additional; Col. Ward places the estimated cost of a highway built of stone abutments and steel superstructure at about $750,000, including the cost of pavement.

Bids are wanted Dec. 5 for paving Elam Pl., Richfield and Roberts Aves., and Ellicott St. Francis G. Ward, Comr., Dept of Pub. Wks.

Scranton, Pa.—Local press reports state that Dir. of Pub. Wks. Roche in preparing his estimates for the coming fiscal year has decided to ask the Councils for $50,000 to permanently improve a number of the city's unpaved streets and repair other streets.

Belair, Md.—Extensive highway improvements are in prospect for Harford County, surveys for some of the work having already been completed. A. N. Johnson is Highway Engr. of the Geological Survey.

Cortland, N. Y.—Cortland County Superv. have voted to build about 3 miles of good roads.

Canandaigua, N. Y.—Village Clk. Wm. E. Martin writes in regard to contemplated street improvements that there is under consideration a proposition for the appointment of a Bd. of Pub. Works; also a proposition to bond for general street paving, but nothing definite will be done before the annual election in Jan.

Somerville, N. J.—It is stated that contracts will be let Dec. 16 for the construction of macadam roads in Somerset Co. Wm. J. Logan, Dir.

Poughkeepsie, N. Y.—The Bd. of Co. Superv. has passed resolutions for the improvement of a road in the town of North East and for a road in Pawling. Plans and specifications have been received by said Bd. from the State Engr. for about 3½ miles of road in Hughsonville, estimated cost $28,050; also for over 3 miles of road (South Road) from Poughkeepsie city line to Casper Creek, estimated cost $30,400.

Niagara Falls, N. Y.—The Common Council has adopted a resolution providing for the paving of Niagara Ave. with bituminous macadam.

Brooklyn, N. Y.—Bids will be received Dec. 10 by J. Edw. Swanstrom, Boro. Pres., for improving portions of Bradford St., with 2,750 sq. yds. of trap block pavement, with sand joints and 6,400 sq. ft. of cement sidewalk; also for 11,860 sq. ft. of cement sidewalk on several other streets.

Allegheny, Pa.—The Council has passed an ordinance to submit to popular vote the proposal to increase the bonded debt $48,460 for the paving of Fleming Ave.

Jamestown, N. Y.—The Common Council has voted to pave a portion of Steele St. with brick at a cost of about $20,000.

East St. Louis, Ill.—Local press reports state that the Bd. of Local Improv. will soon let contracts for paving several streets in the eastern part of this city with vitrified brick.

Davenport, Ia.—City Engr. Murray has prepared estimates of the cost of paving a number of streets which it is proposed to improve next year.

Charleston, W. Va.—An ordinance is reported to have been passed providing for the issue of $70,000 street improvement bonds.

Cincinnati, O.—Bids are wanted Dec. 15 for improving a portion of Glen Parker Ave. by grading, setting curbs, flagging and macadamizing. Robt. Allison, Pres. Bd. of Pub. Service.

Minneapolis, Minn.—The City Council will ask the Legislature for authority to issue $700,000 municipal bonds; of this amount $500,000 is to be devoted to street improvements and $200,000 to grade schools.

Cleveland, O.—Local press reports state that Front St. is to be repaved in the spring.

Sioux City, Ia.—The approximate estimate of the cost of paving proposed for next spring as furnished by City Engr. is as follows: Nebraska St., 15,000 yds., asphalt, $35,000; Jackson St., 35,000 yds., probably with asphalt, $70,000; Sixth St., 6,000 yds., probably with brick, $12,000; W. 3d St., 25,000 yds., with either brick or asphalt, $60,000; total, $177,000.

Continental, O.—Bids are wanted Dec. 16 for the purchase of $13,500 street improvement bonds.

Kenosha, Wis.—H. S. Van Ingen, of 1323 Chamber of Commerce, Chicago, Ill., writes that it is proposed to construct the "Sheridan Drive" from Ill. State line to Kenosha; asphalt or macadam will be used; contracts will be let next year. Estimated cost, $500,000.

Fond du Lac, Wis.—The Council is said to be investigating the most desirable material for paving streets in this city.

Columbus, Ind.—Local press reports state that the City Council is receiving bids for the repair of asphalt pavements.

St. Paul, Minn.—It is stated that the Bd. of Pub. Wks. will soon let contracts for paving Nina and 9th Sts. with asphalt and Eagle St. with sandstone. Total cost to property owners, $75,000.

West Duluth, Minn.—A petition is being circulated asking the Council to pave 55th Ave.

Ft. Dodge, Ia.—Mayor S. J. Bennett writes that bids will be opened Dec. 17 for paving with Trinidad Lake asphalt. C. U. Reynolds, Engr. in Charge.

Galion, O.—Bids are wanted Dec. 19 for furnishing material and improving with brick portions of 2 alleys. J. O. Ross, City Clk.

Laporte, Ind.—Bids will be received Dec. 11 by the Bd. of Comrs. for constructing a series of macadamized roads in Center and Coolspring Townships, in all 6 4/10 miles. John R. Weaver, Chmn.

La Crosse, Wis.—Asst. City Engr. W. S. Woods writes that the Common Council has recommended for the coming year 58 blocks of granite top macadam, and 12 blocks of brick pavement. Bids for same to be received early next year.

Ann Arbor, Mich.—City Engr. Groves estimates that it will cost $32,000 to pave State St.

Bloomfield, Ind.—It is stated that bids are wanted Dec. 10 by the Comrs. of Geene Co. for the construction of gravel and macadamized roads.

Toledo, O.—Bids will be received Dec. 22 by Chas. H. Nauts, City Clk., for furnishing material and repaving portions of Erie St. and Avondale Ave. with block.

Birmingham, Ala.—City Engr. Julian Kendrick writes that ordinances are being prepared for about 25,000 cu. yds. of brick paving and 30,000 sq. yds. of asphalt paving.

Louisville, Ky.—The lowest bid received for asphalt paving on Peterson Ave. was from the Barber Asphalt Paving Co., at $1.48 per sq. yd.; total, $7,400.

New Orleans, La.—The City Council has adopted ordinances as follows: Directing the City Engr. to prepare plans and the Comptroller to let contracts for repaving a portion of St. Charles St.; directing the Comptroller let contracts for repaving Toulouse St.

Denver, Colo.—The Bd. of Pub. Wks. has recommended an ordinance creating a sidewalk district in southwest Denver. The estimated cost of the work is $54,600.

San Diego, Cal.—Bids will be received Dec. 4 by the Bd. of Pub. Wks. for paving with asphalt that portion of "Plaza" in block 42 known as Witherby St.

POWER PLANTS, GAS AND ELECTRICITY.

Brooklyn, N. Y.—Comr. R. G. Monroe, of the Dept. of Water Supply, Gas & Electricity, has issued an order to the effect that all telegraph, telephone and electric light companies in Brooklyn must place their wires underground at once. He also directed the Brooklyn Rapid Transit Co. to place underground its feed wires and all other wires except the trolley wires. The Commissioner has given the companies until May 1, 1903, to finish this work.

Niagara Falls, N. Y.—The Lower River Power Co. is stated to have petitioned the Bd. of Aldermen for a franchise.

Huntington, L. I., N. Y.—The contract for constructing the electric light plant for the Huntington Light & Power Co. is stated to have been awarded to Bunce & Holmes, of Huntington.

Jersey City, N. J.—The Montgomery Light & Water Power Co. has been incorporated; capital, $2,000,000. Incorporators: Chas. N. King, W. Mondo Green and Saml. E. Renner. Office of company, 243 Washington St.

Reading, Pa.—Rudolph Meiehling is stated to have been selected to make an estimate of the cost of constructing and maintaining an electric light plant.

Sellersville, Pa.—The Boro. Council is reported to be considering the advisability of establishing an electric light plant.

Erie, Pa.—The Edison Electric Light & Power Co. is stated to have secured the contract for lighting the city for 5 years at 16 cts. per lamp per night for enclosed lamps.

Brooklyn, N. Y.—Bids were opened Nov. 25 by Homer Folks, Comr. Pub. Charities, Ft. of E. 26th St., N. Y., for installing a heating and power plant, Kings Co. Buildings, as follows: Thos. G. Carlin, 215 Montague St., $49,133; James Curran Mfg. Co., $56,500; E. Rutzler, $58,000; United Heating Co., $58,220; Blake & Williams, $61,964; Donnelly & Merritt, $67,500.

Bids were opened at the same time for the installation of an electric lighting plant, Kings Co. Buildings, as follows: Peet, McAnerny & Powers, 225 4th Ave., N. Y., $20,179 (bid protested on acct. of insufficient security); Frank G. Blanchard, 45 Willoughby St., $20,469; Weiderman & Conklin, $20,530; United Engineering & Contr. Co., $21,000; Western Electric Co., $22,097; A. D. Granger Co., $26,698.

New York, N. Y.—Plans have been filed for a 3-story brick gas retort house, 109x115 ft., to be erected by the Central Union Gas Co., 138th St. and East River. Architect, Louis Brown, 40 Cedar St.

West Seneca, N. Y.—The General Electric Co., of Buffalo, N. Y., has secured the contract for lighting the town at $75 per light per year.

Summit, N. J.—See "Water."

Philadelphia, Pa.—Only one bid for electric street lighting for next year was received at the Dept. of Pub. Safety Nov. 24. It was from the Brush Electric Light Co., the prices being the same as those paid to it for the present year. The whole number of electric lights to be provided for is 9,284, which were maintained this year at a cost of $1,009,358. Prices per light per night for arc lights range from 28 to 35 cts.

Middletown, N. Y.—T. E. McGarr, Secy. State Comn. in Lunacy, Albany, writes that the contract for electric wiring and fixtures for Pavilions Nos. 1 and 2, Middletown State Hospital (bids opened Nov. 19), has been awarded to F. L. Frost, of Albany, for $5,409.

Philadelphia, Pa.—Bids are wanted Dec. 6 for erecting a gas holder, with 75,000 cu. ft. capacity in steel tank. John V. Shoemaker, Pres. Dept. of Charities and Correction.

Norristown, Pa.—A press report states that the United Power & Transportation Co. contemplates erecting here in the spring a power plant, to cost $150,000.

Baltimore, Md.—Robt. J. McCuen, Supt. Lamps & Lighting, writes that the following bids were opened Nov. 5 for installing and maintaining naphtha street lamps for a term of years; prices are per lamp per year, for 1, 2, 3 and 5 years respectively: American Lighting Co., Baltimore, $23.45, $23.45, $23.45, $23.45; Union Lighting Co., Washington, D. C., $24.40, $24.95, $25.85, $26.35; Welsbach St. Lighting Co. of Amer., Philadelphia, Pa., $29.50, $29.50, $29.00, $28.50. The contract was awarded Nov. 15 to American Lighting Co., term of 3 years; no minimum number of lamps stated in specification, but there are 1,068 naphtha lamps in service at present time. The contract for 200 c. p. gasoline lamps was awarded at the same time to the Wellington Lighting Co. for 1 year, at $49.89 per lamp per year.

Richmond, Va.—Supt. Knowles in a report to Council, Nov. 18, recommends the construction of a new gas tank or holder, and estimates the cost, with a capacity of 2,000,000 ft., at $200,000.

Michigan City, Ind.—City Clk. Edw. J. Heise writes that the City Council has awarded the contract for all-night lighting of the city with 125 electric arc lamps of 2,000 nominal c. p. to the Michigan City Electric Co., of Michigan City, at $75 per lamp per annum.

Albion, Mich.—Chas. B. Kelsey, of Grand Rapids, Mich., Pres. of the Albion Gas Co., writes that said company contemplates installing next spring a new holder with a capacity of from 40,000 to 50,000 cu. ft. Local Mgr., Richard Schadellee, Albion.

Muncie, Ind.—City Clk. R. G. Kickok writes that M. J. McGuff, C. M. C. Shanks and E. B. Steck are the Com. of Council in charge of proposed improvements to city electric light plant. W. M. Warner, Supt.

Colfax, Wis.—The Town Clk. writes that the municipal electric light plant is to be rebuilt, at a cost of $1,500. C. I. Anderson, Engr. in Charge.

Glidden, Ia.—City Clk. pro tem. H. W. Porter writes that is is proposed to construct a gas plant, but nothing definite has as yet been done. G. W. McNaught, Engr. in Charge.

Odell, Ill.—The Odell Electric Co., of Odell, has been incorporated, to furnish light, heat and power; capital, $5,100. Incorporators: W. M., Anna K. and Wm. N. Buchanan.

Columbus, Ind.—The City Council is reported to have ordered the purchase and installation of a new 150-lamp street electric light plant.

Indianapolis, Ind.—Saml. Shutt, Ch. Engr. of the State House, is stated to have reported to Governor Durbin that the cost of a power plant and electrical equipment for the Capitol would be about $150,000. The next Legislature will probably be asked to appropriate this amount.

Milwaukee, Wis.—See "Water."

Holly, Mich.—The Holly Electric Light & Power Co. has been incorporated, with a capital of $10,000.

Kansas City, Mo.—See "Water."

Madisonville, Ky.—The City Council is reported to be considering the question of constructing an electric light plant, and have asked Mr. Hite, Mgr. of the Henderson Electric Light Plant, to make a survey.

Walnut Ridge, Ark.—See "Electric Railways."

St. Joseph, Mo.—See "Sewerage and Sewage Disposal."

Lead, S. D.—The City Council is stated to have granted the Practical Gas Co. a franchise to construct a gas plant.

Canon City, Colo.—Dr. Bell, of Pueblo, is reported interested in the construction of a gas plant at Canon City.

Albuquerque, N. M.—The Albuquerque Gas, Electric Light & Power Co. has been incorporated, with a capital of $200,000, by Wm. S. Iliff, Maynard Gunsul, Wm. B. Childers and others.

Omaha, Neb.—A. Rosewater is stated to have petitioned the Council for permission to string wires along the streets and build conduits for the transmission of power from the proposed Platte River Canal.

Salt Lake City, Utah.—The Dirs. of the Utah Sugar Co. are reported to be planning to construct a power plant on the Bear River, to furnish power to the new sugar factory, and furnish electric light to other institutions in the Bear River Country.

Sterling, Colo.—Town Clk. C. L. Goodwin writes that on Nov. 18 it was voted to grant a franchise for an electric light plant to O. P. Sells, of Denver.

Minnedosa, Man.—The Council is stated to have granted E. S. Harrison, of Winnipeg, a franchise for an electric light plant.

San Juan, Porto Rico.—Wm. Yeager, representing the Vandegrift Construction Co., Drexel Bldg., Philadelphia, Pa., is stated to have applied to the Executive Council for a franchise to develop the water power and construct an electric railway from San Juan to Ponce.

ELECTRIC RAILWAYS.

Concord, N. H.—The Concord, Dover & Rochester St. Ry. Co. is reported to be surveying for the construction of a line between Dover and Concord, a distance of about 39 miles.

Pittsfield, Mass.—The Dirs. of the Pittsfield St. Ry. Co. are stated to have petitioned for new locations on 10 streets of the city. F. E. Eckerson, Ch. Engr., Pittsfield.

Hartford, Conn.—Thos. G. Perkins is reported interested in the construction of an electric railway between Hartford and Middletown.

Bangor, Me.—The Pushaw Lake Ry. Co. has been incorporated, with a capital of $50,000, to construct and operate a railway from some point on the Penobscot Central Ry. in Bangor, to Pushaw Lake in the town of Glenburn. F. O. Beal, Pres., and E. C. Ryder, Secy., both of Bangor.

Seymour, Conn.—The Connecticut Ry. & Lighting Co. is reported to be making arrangements for the extension of its lines up the Naugatuck Valley to Seymour. J. E. Sewell, Gen. Mgr., Bridgeport.

Brockport, N. Y.—The Village Trus. are stated to have granted a franchise to the Albion Ry. Co.

Syracuse, N. Y.—The Syracuse Rapid Transit Co. is stated to have secured a franchise through the town of Clay. E. G. Connette, Gen. Mgr., Syracuse.

Birdsboro, Pa.—The United Traction Co. is stated to have petitioned the Town Council for a franchise to extend the Black Bear line into the borough.

Pittsburg, Pa.—Charters have been granted to the Bloomfield St. Ry. Co., with a capital of $80,000, to build a line 1 6/10 miles long in Pittsburg, commencing at the intersection of 14th St. and Liberty Ave., and running along Liberty Ave. to Denny St., Lawrenceville; also to the Second Ave. Ry. Co. to construct a line 4 8/10 miles long, beginning at the intersection of Grant St. and 2d Ave., and along 2d Ave. to the line of the Glenwood high bridge, returning by the same route; this company has a capital of $240,000. Incorporators of both companies are: A. P. Weitel, Allegheny; W. O. Anderson, Wilkinsburg, and W. Douglass, of Pittsburg.

Northeast, Md.—The Cherry Hill, Elkton & Chesapeake City Electric Ry. Co. is stated to have petitioned for a right of way through Northeast.

New York, N. Y.—The Brooklyn Rapid Transit Co. has awarded the contract for materials for 4 new loops at Manhattan end of Bklyn. Bridge to the American Bridge Co., and the contract for erection to the Eastern Construction Co., 52 Classon Ave., Brooklyn.

Buffalo, N. Y.—A. E. Leon, of Boston, Mass., is reported to have purchased the Buffalo, Hamburg & Aurora Ry. It is stated that the road will be extended to Aurora and improvements made along the line.

High Point, N. C.—E. D. Steele, of High Point, is reported interested in the construction of an electric railway to connect High Point, Winston, Salem and Greensboro.

Cincinnati, O.—The Cincinnati, Richmond & Muncie Ry. Co. is reported to be making surveys for a new line between Cincinnati and Louisville that will shorten the distance between these two cities to 105 miles.

Troy, O.—The Miami Co. Comrs. are stated to have granted a franchise to the Dayton & Kenton Traction Co. R. E. Kline, Ch. Engr., Dayton.

Marysville, O.—The Toledo, Columbus, Springfield & Cincinnati Electric Ry., through M. B. Earnhart, of Columbus, is stated to have petitioned the Council for a franchise through this city. It proposes constructing a line from Toledo to Columbus, by way of Lima, Bellefontaine and Columbus.

New Albany, Ind.—The City Council is stated to have granted a franchise to the New Albany, Paoli & French Lick Traction Co.

Terre Haute, Ind.—The Co. Comrs. are stated to have granted the Terre Haute St. Ry. Co. permission to use the highway from the city limits to the county line for its proposed interurban line to Clinton.

Elwood, Ind.—The City Council is stated to have granted the Union Traction Co. a franchise on S. 28th St. for the extension of its line to the tin-plate works. W. H. Bloss, Ch. Engr., Anderson.

North Chicago, Ill.—The Village Bd. is stated to have granted a franchise to the Chicago & Milwaukee Electric Ry. Co. B. B. Blyth, Ch. Engr., Highwood, Ill.

Middlefield, O.—The Co. Comrs. are stated to have granted F. B. Morgan a franchise for an electric railway from Middlefield to the State line near Sharon.

Grand Rapids, Mich.—A company is reported organized here, with a capital of $2,500,000, to construct an electric railway from Grand Rapids to Charlotte, Battle Creek and Lansing. Wm. A. Smith and Thos. Hefferan, of Grand Rapids, are among the incorporators.

New Castle, Ind.—The New Castle & Muncie Traction Co. has been incorporated, with a capital of $10,000, to construct a line through the towns of Mt. Summit, Springport, Oakville, Cowan, Cambridge City, Knightstown, Dunreith and Connersville. Incorporators: Ezekiel T. Ice, Mt. Summit; Frank W. Nixon and Clay C. Hunt, New Castle, and others.

Evansville, Ind.—The Vanderburg Co. Comrs. are stated to have granted a right of way to the Evansville, Boonville & Rockport Electric Ry. Co.

Green Bay, Wis.—The East Wisconsin Traction Co. has been incorporated, with a capital of $50,000, to construct and operate a street railway in the cities of Green Bay, Depere, Two Rivers and Manitowoc, and in the Counties of Brown and Manitowoc. Incorporators: Wm. F. Paul, Danfort M. Maxey and Chester D. Cleveland, Jr.

Elizabethtown, Ky.—T. S. Gardner, of Hardin, is reported interested in the construction of an electric railway from Elizabethtown to Bowling Green, via Leitchfield.

Louisville, Ky.—It is stated that the Louisville Ry. Co. will construct an extension of about a mile on its E. Chestnut and Barrett Ave. line. F. M. Miller, Ch. Engr., Louisville.

It is stated that the Falls City Belt Line Ry. Co. is about to petition for a franchise to construct a belt line. Saml. Bowman, Pres.

Shelbyville, Ky.—The Louisville Anchorage & Pewée Valley Ry. Co. has petitioned the Council for a franchise. It proposes extending its line from Lakeland through Middletown and Simpsonville, along the State pike to Shelbyville. P. Moore, Mgr., Louisville.

Walnut Ridge, Ark.—S. C. Dowell and S. Riegler, of Walnut Ridge, are reported interested in the construction of an electric railway between Walnut Ridge and Hosie, and electric light plants at both places.

Natchez, Miss.—It is stated that the Natchez Electric St. Ry. Co. will extend its line south of Main St. to Homochitto St. E. H. Jackson, Mgr., Natchez.

Omaha, Neb.—The Bd. of Pub. Wks. is stated to have granted the Omaha St. Ry. Co. permission to construct a double track railway on 24th, Fort and 30th Sts. W. A. Smith, Mgr., Omaha.

The Omaha, Decatur & Northern Ry. Co is reported organized to construct an electric railway from Omaha to Decatur, Neb. F. W. Bennett, of Bennett & Co., of Toledo, O., is reported to be one of the promoters.

Quincy, Col.—H. H. Yard and A. Ekman, of Aroville, are reported interested in the construction of an electric railway up the North Fork and East Branch, to connect with several mineral locations along these streams.

Bakersfield, Cal.—A press report states that surveys have been completed for the construction of an electric railway from Ventura to Sunset and Bakersfield, a distance of about 165 miles, for the Bakersfield & Ventura Ry. Co. Maj. H. M. Russell, of Los Angeles, is reported interested.

Emeryville, Cal.—The Town Trus. are stated to have granted a franchise to the San Francisco & San Jose Electric Ry. Co.

North Yakima, Wash.—The City Council is stated to have granted a franchise to the Yakima Valley Central Ry. Co.

San Juan, Porto Rico.—See "Power Plants, Gas and Electricity."

Monterey, Mexico.—Sperry, Jones & Co., of Baltimore, Md., are stated to have purchased 2 mule lines, about 30 miles in length, in Monterey and will convert same into electric lines.

RAILROADS.

Buffalo, N. Y.—The State Ry. Comn. is stated to have granted the Buffalo & Susquehanna R. R. Co. permission to construct its line. The new line will be 84 miles in length, connecting Buffalo with the Buffalo & Susquehanna R. R. at Wellsville, N. Y.

Philadelphia, Pa.—Both branches of City Council on Nov. 20 adopted the resolution requesting the Finance Com. to report a bill authorizing a loan of $8,500,000 to abolish grade crossings.

Donora, Pa.—A press report states that the Union Steel Co., of Donora, will construct a railroad from Donora, via South Sharon, to Elk Creek Harbor.

New York, N. Y.—The State R. R. Comrs. on Nov. 24 granted the application of the Pennsylvania, New York & Long Island R. R. Co. to construct a tunnel railroad in this city to connect the Pennsylvania and the Long Island Railroads.

New Castle, Pa.—A press report states that a tunnel will be constructed by the Pittsburg, Lisbon & Western Ry. in effecting an entrance to this city. The tunnel will extend underneath the rocky cliffs of Taylor Township, on the west side of the city and will be driven through a bed of rock for about ⅛ of a mile. Emerging from its mouth the road makes a curve and crosses Shenango River on a $50,000 viaduct that is planned. R. W. Billingsley, Supt., Lisbon, O.

Chicago, Ill.—The Chicago Junction R. R. Co. has been incorporated, with a capital of $50,000, to construct a railroad from a point in the city of Chicago to a point in connection with the South Side Elevated R. R. Co. and other railroads in Cook County. Incorporators: Fredk. R. Babcock, Wm. Raymond and others.

Jasper, Ind.—The Southern Ry. Co. is reported to have decided to construct an extension from Jasper to French Lick Springs, a distance of about 28 miles. C. H. Ackert, Gen. Mgr., Washington, D. C.

Amarillo, Tex.—The Choctaw, Oklahoma & Texas R. R. Co. is reported to have filed an amendment to its charter with the Secy. of State, providing for the immediate extension of that road west from Amarillo, Tex., to Tecumsari, N. M., a distance of about 125 miles, where connection will be made with the Rock Island, El Paso line. S. H. Madden, Vice-Pres., Amarillo.

Burnsville, W. Va.—A press report states that the contract, amounting to $2,500,000, was awarded on Nov. 25 by Jos. Ramsey, Jr., of St. Louis, Mo., Pres. of the Wabash R. R., and J. T. Blair, of Parkersburg, W. Va., Pres. of the Little Kanawha R. R., for 71 miles of line to connect part of the Little Kanawha and the West Virginia Central. Clemens & Co., of Philadelphia, Pa., and J. Henry Miller, of Baltimore, Md., secured the contracts. The line will run from Sandy Bend to Burnsville, W. Va., from which point it will connect with the West Virginia Central at Bellington. Contracts for the remainder of the road, 118 miles, will be let before Feb 1.

Inez, Ky.—The Wolf Creek Ry. Co., of Martin County, is reported incorporated, with a capital of $200,000, to construct a railroad from the mouth of Wolf Creek, a distance of about 20 miles.

Springfield, Mo.—The Missouri Pacific Ry. Co., through Russell Harding, Gen. Mgr., is reported to have submitted a proposition to the citizens of Springfield to build a north and south railroad from Bagnelle to Memphis in consideration of a right of way through Green County and depot grounds. The proposition is reported to have been accepted. H. Rohwer, Ch. Engr., St. Louis.

Dossetts, Tenn.—It is stated that the Knoxville, Lafollette & Jellico R. R. Co. will construct the Oliver Springs & Coal Creek branch from Dossetts into the coal fields of East Tennessee.

Durango, Mexico.—It is stated that Ch. Engr. R. B. Gosuch, of the Mexican International R. R., estimates the cost of constructing an extension of that road from Durango to the Port of Mazatlan, on the Pacific coast, at $17,000,000. The proposed line will cross the Sierra Madras. New York, N. Y., office is 25 Broad St.

Ft. William, Ont.—The Canadian Northern Ry. Co. is reported to have sent out surveying parties from Ft. William to locate a route from there to White River, where the proposed extension easterly from Ft. William will meet the Algoma Central. D. B. Hanna, Gen. Supt., Winnipeg, Man.

Gravenhurst, Ont.—A press report states that the Grand Trunk Ry. is reported interested in the construction of a railroad about 3,000 miles in length, which will cost about $75,000,000. The new railroad will run through a portion of northern Ontario known as New Ontario, starting from North Bay or Gravenhurst, Ont., and extending through Manitoba, the Northwest Territories and British Columbia to Bute Inlet, or Port Simpson, B. C. Chas. M. Hays, Gen. Mgr., Montreal, Que.

Sault Ste. Marie, Ont.—Bids are wanted Dec. 15 by the Manitoulin & North Shore Ry. Co. for grading and bridging, Section 1, between Meaford and Tobermory; Section 2, between Fitz William Island and Gertrude mines, and Section 3, between Gertrude mines and Sault Ste. Marie. W. Z. Earle, Ch. Engr.

PUBLIC BUILDINGS.

New York, N. Y.—Bids are wanted Dec. 4 by the Dept. of Correction, Thos. W. Hynes, Comr., for furnishing all labor and material required for bath tubs, water closets, lavatories, etc.

The lowest bidder Nov. 24 for alterations and additions to electric light wiring in Bellevue Hospital, 26th St. and 1st Ave., was T. F. Jackson, 592 Columbus Ave., his bid being $6,249.

Kingston, N. Y.—Bids are wanted Dec. 1 for the erection of a building for Kingston City library; plumbing and electrical work to be bid on separately. John J. Linson, Chmn. Bldg. Com.

Middletown, N. Y.—Bids are wanted Dec. 10 for plumbing improvements and reconstruction at the Middletown State Hospital, as advertised in The Engineering Record.

Kings Park, N. Y.—Bids are wanted Dec. 10 for plumbing improvements, building B., Long Island State Hospital, as advertised in The Engineering Record.

Philadelphia, Pa.—Bids are wanted by the Dept. of Charities & Correction, Dec. 6 for erection of 6 pavilions for consumptive patients at the Philadelphia Hospital. The sum of $80,000 is reported to be available for this work. John V. Shoemaker, Pres.

Reynoldsville, Pa.—The Congregation of the M. E. Church is stated to have decided to erect a $20,000 edifice on 5th and Jackson Sts.

Allegheny, Pa.—Bids are being taken for a $50,000 edifice which the First Presbyterian Church Congregation contemplates building.

Brooklyn, N. Y.—The following bids were opened Nov. 25 by Homer Folks, Comr. Pub. Charities, Ft. of E. 26th St., N. Y., for erection of a building for heating, lighting and power plant, etc., Kings Co. Buildings: Danl. J. Ryan, 723 3d Ave., $64,000; Thos. G. Carlin, $68,640; John J. Cashman, $74,615; Chris. J. Kenny, $77,896; John R. Sheehan & Co., Inc., $78,800; John Kennedy & Son, $82,950; Myron C. Rush, $97,878; Chas. H. Peckworth, $98,345.

Bids were opened at the same time for erection of a coal storage building for Kings Co. Buildings, as follows: Danl. J. Ryan, 723 3d Ave., $16,000; E. W. Robinson, $17,618; L. E. Brown, $17,646; Chris. J. Kenny, $18,792; John J. Cashman, $18,957; John Kennedy & Son, $19,240; Chas. H. Peckworth, $19,466; Springsted & Adamson, $19,875; Myron C. Rush, $21,125; Thos. G. Carlin, $21,500.

Flushing, L. I., N. Y.—The Congregation of St. George's P. E. Church is stated to have decided to erect a new parish house, to cost about $25,000.

Buffalo, N. Y.—Plans have been filed for a new Polish Catholic Church to be erected on Kent and Clark Sts., to cost $100,000.

Homestead, Pa.—Plans are being prepared by David Platt, of Homestead, for the Greek Catholic Church to be erected on 8th Ave., at a cost of $30,000.

Easton, Pa.—Chas. W. Bolton & Co., Witherspoon Bldg., Philadelphia, are stated to be preparing plans for a brick edifice 100x75 ft. for the Olivet Presbyterian Church.

Perkasie, Pa.—Chas. W. Bolton & Co., of Philadelphia, are reported to have completed plans for a 1-story stone building, 60x110 ft., for St. Stephen's Reformed Church.

Greensburg, Pa.—The Judges of the Common Pleas Court are reported to have disapproved the contract recently let by the Westmoreland Co. Comrs. for the proposed $1,000,000 court house. Bids will probably again be called for in a short time.

Buffalo, N. Y.—The Bd. of Aldermen has directed the Comr. of Pub. Wks. to prepare plans and specifications, and ask for bids for a new Quarantine Hospital. The city was given permission by the last Legislature to issue $50,000 bonds to erect this building.

Lansdowne, Pa.—See "Sewerage and Sewage Disposal."

Richmond, Va.—Noland & Baskerville, Chamber of Commerce Bldg., are stated to have prepared plans for an edifice to be erected on Adams and Franklin Sts., for the Second Baptist Church.

Richmond, Ind.—A press report states that Daniel R. Reid, of New York, will erect and present to the United Presbyterian Church an edifice, to cost about $75,000.

Calumet, Mich.—The Calumet & Hecla Mining Co. is reported to have decided to erect a $30,000 armory for the Calumet Light Guard.

Milwaukee, Wis.—The Museum Trus. are reported to be considering plans for the erection of an addition to the Museum, to cost about $60,000.

Racine, Wis.—A. H. Harcus & Co., of Racine, are stated to have secured the contract for erecting the Carnegie Library, at $41,000.

Fond du Lac, Wis.—Bids are wanted Dec. 16 (extension of date) for constructing a public library, also for heating, plumbing, electric wiring and sewerage work in connection therewith. Van Ryn & De Gelleke, 211 Grand Ave., Milwaukee, are the architects. Address J. W. Watson, Secy.

Milwaukee, Wis.—Local press reports state that the Pub. Library Bd. will receive bids Dec. 20 for the construction of the Carnegie Library.

Chicago, Ill.—Philip Knopf, Co. Clk., writes that Cook County has voted to issue $500,000 bonds, to be used in making necessary improvements in public institutions. According to plans of the Building Committee of the board, the money will be used as follows: For remodeling and erecting additions to the insane asylum, $300,000; for erection of ward for epileptics at County Hospital, $175,000; for installation of new elevator system in County Building, $25,000.

Walker, Minn.—Schmidt Bros., of West Superior, Wis., are stated to have secured the contract for erecting the Cass Co. Court House, for $30,000.

Scotchbridge, O.—Bids will be received Jan. 31 by the Trus. of the U. P. Church for furnishing material and erecting a church. R. S. Davidson, Secy.

Port Huron, Mich.—Bids will be received Dec. 27 by the Secy. of the Port Huron Library Comn., for erecting a stone library. G. L. Harvey, Archt., Port Huron.

Hamburg, Ark.—The contract for erecting the Ashley County Court House is stated to have been awarded to J. W. Detwiler & Co., Des Moines, Ia., for $49,775.

Corsicana, Tex.—The citizens of Navarro County are stated to have voted to issue $150,000 bonds for the erection of a court house.

Henderson, Ky.—Bids are wanted Dec. 6 for erecting a library. S. K. Sneed, Pres.

St. Louis, Mo.—Local press reports state that bids will be received Dec. 4 by Isaac S. Taylor, Dir. of Wks., La. Purchase Exposition, for erecting the Transportation Bldg. It will be 1,300x525 ft. and contain about 4 miles of track.

South Omaha, Neb.—J. H. Wise, of South Omaha, is stated to have secured the contract for erecting the Carnegie Library, for $38,970.

Riverside, Cal.—The contract for erecting the Riverside Co. Court House is stated to have been awarded to O. F. Engstrum, of Los Angeles, for $137,750.

Webster, S. D.—The citizens of Day County are stated to have voted to issue bonds for the erection of a court house, to cost about $50,000.

Wallace, Idaho.—The Grand Jury is reported to have recommended the erection of a court house; probable cost of building, $50,000.

BUSINESS BUILDINGS.

Clayton, N. Y.—Plans for remodeling the Walton House, at a cost of $30,000, have been prepared by D. D. Kieff, of Watertown, N. Y. Hugh Mellon, Prop.

Arverne, L. I., N. Y.—The Arverne Realty Co. is to build a new casino, with bowling alleys and roof garden, on the Boule., between Gaston and Meredith Aves.; estimated cost of building, $20,000.

Jersey City, N. J.—The Merchants' Refrigerating Co., 1st and Warren Sts., is reported to be having plans prepared by V. J. Hedden & Sons for an additional warehouse on its property. The building will be 264x200 ft., and 7 stories high; it will be a brick and steel frame structure, no wood being used, and absolutely fireproof.

New Castle, Pa.—It is stated that the Pittsburg & Lake Erie R. R. Co. will soon erect here a depot, to cost about $100,000. J. A. Atwood, Ch. Engr., Pittsburg.

Grove City, Pa.—It is reported that the Odd Fellows of the Western Pennsylvania district, are about to erect 3 buildings here, at a cost of about $80,000.

Allegheny, Pa.—The Monongahela Trust Co., of Homestead, will soon begin the construction of a $50,000 building on 8th Ave. and Ann St., to be used for stores and offices.

Baltimore, Md.—Jos. E. Sperry, 601 Herald Bldg., Baltimore, and York & Sawyer, 156 5th Ave., New York, N. Y., are stated to have been selected by the Dirs. of the Provident Savings Bank, to prepare plans for a new building on Howard and Saratoga Sts., to cost about $100,000.

Buffalo, N. Y.—Plans have been filed for a 10-story office building to be erected on Main and North Division Sts. for the Richard Realty Co. of New York, to cost $145,000. Architect, Carlton Strong, 170 B'way, New York.

Washington, Pa.—The Pennsylvania R. R. Co. is stated to have decided to erect a $40,000 depot at Washington. W. H. Brown, Ch. Engr., Philadelphia.

McKeesport, Pa.—It is stated that the Baltimore & Ohio R. R. Co. will probably erect a $75,000 depot here, in the spring. J. M. Graham, Ch. Engr., Baltimore, Md.

Atlantic City, N. J.—It is stated that Jos. Fralinger will shortly invite estimates for rebuilding the theater at New York Ave. and the beach. It will have 3 galleries beside the parquette.
W. W. Weeks will erect a hotel in St. James's Pl. It will be 6 stories high, 75x58 ft; cost, $50,000.

Wilmerding, Pa.—R. M. Trimble, Ferguson Bldg., Pittsburg, is stated to be preparing plans for a bank and apartment building to be erected here, to cost about $25,000.

Homestead, Pa.—Plans are being prepared by David Platt, of Homestead, for a corrugated steel building, 200x200 ft., to be built for the Homestead Valve & Mfg. Co., at a cost of about $20,000.
Plans are also being prepared by the same architect for a business block, 30x100 ft., to be built for Laurence Oessner, on 8th Ave., to cost $18,000.

Macon, Ga.—The Trus. of the Masonic Home to be established in Macon, at a meeting Nov. 20 at the office of Julius L. Brown, Brown Bldg., Atlanta, decided to at once secure plans and specifications for the home building. The Trus. have on hand $25,000 to be devoted to the construction of the home, and this will be increased from time to time. It is expected that the home, when completed, will cost about $150,000. Judge M. Meyerhardt, of Rome, Pres. Bd. Trus

Rockford, Ill.—The Chicago, Burlington & Quincy R. R. Co. is stated to have accepted plans for a $50,000 depot, to be erected on S. Main St. W. L. Breckinridge, Ch. Engr., Chicago.

Saginaw, Mich.—Clarence L. Cowles, of Saginaw, is stated to have prepared plans for a 4-story brick store for Smart & Fox Co. It will be 126x90 ft. and cost $30,000.

Indianapolis, Ind.—The Indianapolis Brewing Co. is stated to have awarded the contract for its addition to the Schmidt plant, at McCarty and New Jersey Sts., to the W. P. Jungclaus Co., 825 Massachusetts Ave. It will be of brick and steel, and cost $25,000.

Milwaukee, Wis.—Plans are being prepared by H. C. Koch, 106 Mason St., for a business block to be erected by A. K. Hamilton on Grand Ave., east of the Alhambra Bldg. It will probably be 7 stories high, 75x100 ft.

Sistersville, W. Va.—The Dirs. of the People's Bank, just chartered, are stated to have decided to erect a 3-story brick and stone building on Diamond and Wells Sts.

Fairmont, W. Va.—It is stated that the Fairmont Trust Co. will erect a 7-story brick and stone building, 25x40 ft., on Main St.

Des Moines, Ia.—C. E. Eastman, Observatory Bldg., is stated to have prepared plans for a 4-story warehouse, 44x132 ft., on Court Ave. and 3d St. for Cruzan & Co., of 205 W. Court Ave.

Akron, O.—Local press reports state that the Bd. of Directors of the Y. M. C. A., will receive until Dec. 20 competitive bids for the contract to prepare plans for the Y. M. C. A. Hall, to cost not more than $75,000.

Mobile, Ala.—The Mobile Ry. Terminal Co. is reported organized here by Saml. Spencer, A. B. Andrews and others, to build a depot with terminal tracks, yards, etc., estimated to cost $500,000.

Birmingham, Ala.—It is stated that the Birmingham Livery Co. is to erect a stable on 2d Ave. and 17th St., to cost about $25,000.

St. Louis, Mo.—The M. J. Kelly Estate has secured a permit for the erection of a 5-story warehouse at 917 N. Bway, at a cost of about $30,000. Architect, J. L. Wees, 520 Olive St.
The Murch Bros. Constr. Co., 816 Olive St., is stated to have secured the contract for erecting an addition to the factory of the Hamilton-Brown Shoe Co., on Randolph St. and Jefferson Ave., to cost about $75,000.

San Francisco, Cal.—The Southern Pacific R. R. station and ferry slip is reported to have been destroyed by fire Nov. 20. Wm. Hood, Ch. Engr., San Francisco.

Monte Vista, Colo.—The Hotel Blanco is reported to have been destroyed by fire Nov. 19.

Seattle, Wash.—Bromley & Wells are stated to have secured the contract for erecting a hotel for C. D. Stimson and A. W. Engle on 4th ave. and Union st.; contract price, $42,000.

Edmonton, Alberta, N. W. Ter.—A correspondent writes that McDougall & Secord have in contemplation the construction of a bank building. No orders for plans given as yet.

DWELLINGS.

Syracuse, N. Y.—Chas. D. Wilsey, Sedgwick, Andrews & Kennedy Bldg., is reported to be preparing plans for a 7-story brick and stone, fireproof apartment house, to be erected at 903 James St.

Pittsburg, Pa.—Jas. T. Steen, 219 6th St., is stated to have been selected to prepare plans for an apartment house to be erected by David P. Reighard on Craft Ave. and Ophelia St., Oakland, to cost about $1,000,000. It will be of brick and granite, 8 stories high and have a power plant.

Saginaw, Mich.—Clarence L. Cowles, of Saginaw, is stated to have prepared plans for 3 two-story residences to be erected for M. Mutschelter, to cost in all $75,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Ave D and 7th St, 6-story br tenemt; c, $40,000; o, Saml Greenstein; a, Alfred E. Badt.
48th St and 5th Ave, 5-story and basemt br and stone dwell; c, $75,000; o, Wm L Armstrong; a, Lord & Hewlett.
73d St and 8th Ave, 5 4-story br and stone dwells; c, total, $150,000; o, W W & T M Hall; a, Welch, Smith & Provot.

SCHOOLS.

New York, N. Y.—The following bids were opened Nov. 21 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., for installing electric lights, wiring, etc., school 188, Boro. of Manhattan: T. Fredk. Jackson, $20,995; Fredk. Pearce, 18 Rose St., $16,764; Commercial Constr. Co., $17,167; C. E. Hewitt & Co., $31,147.
The contract for the sanitary work of addition to and alterations in school 89, Boro. of Manhattan (bids opened Nov. 24), has been awarded to Wm. C. Ormond, for $5,445.

Philadelphia, Pa.—Select Council has concurred in the appropriation of $1,200,000 of the recent loan to purchase new sites and erect new schools.
The Property Com. of the Bd. of Educ. on Nov. 25 awarded to Peoples & Welsh, 7000 Woodland Ave., the contract for erecting a 15-room school on 63d St. and Elmwood Ave. for $77,000; and to S. Gourley, Jr., 1808 Gratz St., the contract for a 15-room school on Frankford and Erie Aves. for $75,800. The lowest bid received Nov. 25 for a 20-room school on Morris St. and Moyamensing Ave. is stated to have been submitted by S. Gourley, Jr., for $94,987.

Watertown, N. Y.—Hyde Bros., of Watertown, are stated to have secured the contract for plumbing, gasfitting and tiling for the High School, at $7,494.

Kenosha, Wis.—Local press reports state that this city will soon be obliged to find some way of disposing of its garbage.

San Jose, Cal.—The matter of providing this city with a garbage crematory is said to be under discussion.

GOVERNMENT WORK.

Portsmouth, N. H.—Bids are wanted at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Dec. 27, for furnishing and erecting certain steelwork and skylights in building No. 45, Portsmouth Navy Yard.

Portland, Me.—See "Sewerage and Sewage Disposal."

Newport, R. I.—Bids are wanted Dec. 23 for constructing, plumbing, heating and wiring guard house and other buildings at Ft. Rodman, New Bedford, Mass., as advertised in The Engineering Record.

Fort Hancock, N. J.—Bids are wanted Dec. 16 for the construction, heating, plumbing and electric wiring of an annex to hospital; also construction, plumbing and electric wiring of a dead house at Ft. Hancock. John M. Dunn, 1st Lieut. Art. Corps, U. S. A., Q. M.

Pittsburg, Pa.—The following bids were opened Nov. 22 by Capt. Wm. L. Sibert, Corps of Engrs., U. S. A., for building a lock, 2 guide walls, a guard crib and abutment for dam at Six Mile Island, Allegheny River:

Items and Quantities.	Sheridan Kirk Contract Co., Madison, Ind.	Dravo Contracting Co., Pittsburg.	Evansville Contract Co., Pittsburg.	T. A. Gillespie Co., Pittsburg.	Henry P. Burgard, Buffalo, N. Y.	Robt. A. Cummings, Pittsburg.
Solid rock, 500 cu. yds	$2.00	$1.10	$3.00	$3.50	$1.00	$3.50
Hardpan, 8,900 cu. yds	1.00	1.10	1.50	1.50	1.00	2.00
Gravel, 9,000 cu. yds	1.00	1.10	.70	.80	1.00	1.50
Concrete, 23,396 cu. yds	9.50	7.10	8.00	7.80	8.00	8.80
Oak timber, 54,700 ft., B. M	100.00	62.00	50.00	50.00	60.00	60.00
Hemlock, 121,840 ft., B. M	40.00	46.50	40.00	45.00	40.00	40.00
Stone ballast, 5,400 cu. yds	2.50	3.10	2.00	2.25	3.00	4.00
Paving, 3,000 sq. yds	3.50	4.65	5.00	3.25	2.00	2.50
Iron for drift bolts, 30,000 lbs	.05	.05	.06	.04	.04	.05
Totals	$326,235	$227,598	$243,526	$236,106	$237,123	$280,690

Albany, N. Y.—Bids will be received Dec. 24 by the Bd. of Contract and Supply for furnishing material and erecting school No. 9, including heating, plumbing, drainage work, etc. Wm. J. Obenaus, City Archt., 86 State St.; Isidore Wachsman, Clk. of Bd.

Chicago, Ill.—Archt. Mundie, of the Bd. of Educ., is stated to have completed plans for the Chicago Teachers' College, to be erected on Stewart Ave. and North Normal Parkway. It will be 4 stories high, 185x236 ft., and cost about $325,000.

Minneapolis, Minn.—See "Paving and Roadmaking."

Ames, Ia.—The Trus. of Iowa State College are stated to have decided to erect a central building, to cost $225,000; an agricultural building, to cost $200,000, and a central heating plant, to cost about $65,000.

Milwaukee, Wis.—See "Water."

Mansfield, O.—H. E. Cove, Clk. Bd. of Educ., writes that at the recent election it was voted to issue bonds for the construction of a high school.

Milwaukee, Wis.—Bids are wanted Dec. 4 for the construction of a school in the 9th Ward; separate bids are required on the mason work, cut stone work, carpenter work, plumbing, heating and ventilating, electric work, etc. Chas. J. Poetsch, Comr. of Pub. Wks.

Chicago, Ill.—Bids are wanted Dec. 5 for erecting a school, including masonry, ventilating, heating, plumbing, gas-fitting, sewerage, etc., on Jeffrey Ave. and 74th St. W. B. Mundie, Archt. Bd. of Educ.

Lawton, Okla. Ter.—School bonds amounting to $21,000 are reported sold.

Oklahoma, Okla. Ter.—J. B. Thoburn, Secy. to Commercial Club, writes that on Nov. 4 it was voted to issue $100,000 bonds for the construction of ward school buildings.

Leavenworth, Kan.—City Clk. M. A. Przybylowicz writes that on Nov. 11 it was voted to issue $60,000 school bonds.

University, Miss.—It is stated that the Univ. of Mississippi is soon to erect some new buildings, to cost in all about $60,000.

Baton Rouge, La.—Bids are wanted Dec. 20 for erecting the physical laboratory on the grounds of the Louisiana State University. Farrot & Livandais, Archts., Abraham Bldg., New Orleans. Col. Thos. D. Boyd, Pres.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids are wanted Dec. 6 (readvertisement) for furnishing all labor and material required for the removal of snow and ice of the Boro. of Manhattan, until Apr. 15, 1903. John McG. Woodbury, Comr. of Street Cleaning.

Philadelphia, Pa.—Bids are wanted Dec. 1 for the contract to clean the streets, and remove the garbage for 1903. Separate bids will be received for the removal of snow from streets surrounding the City Hall. Address, Dir. of Pub. Wks. Wm. C. Haddock.

Ft. Getty, S. C.—Bids are wanted Dec. 23 by David Price, Q. M., for constructing garbage crematory and shed therefor at this post, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted at the office of Ch. of Engrs., U. S. A., until Jan. 15 for building steel hull, furnishing and installing pumping and propelling machinery for suction dredge, and for pontoon pipe line, as advertised in The Engineering Record.

Ft. Columbus, N. Y.—Bids are wanted Dec. 16 for installing steam beating plant and making repairs in Castle William. Address S. R. Jones, Q. M.

Annapolis, Md.—Bids will be received Dec. 9 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., to furnishing at the Naval Academy, Annapolis, a quantity of broken stone; also labor and material for sinking an artesian well. A. S. Kenny, Paymaster General, U. S. Navy.

Rome, N. Y.—The following bids were opened Nov. 20 at the Treasury Dept., Washington, D. C., for the construction of the U. S. Post Office at Rome: Thos. C. McDermott, Utica, $45,870; R. Richards, Utica, $47,899; P. Kerner & Son, Utica, $43,900; C. P. Boland, Troy, $55,138; Richardson & Burgess, Washington, D. C., $49,637; Fissell & Wagner, Newark, N. J., $45,577; A. B. Stannard, New York, $46,000; H. H. Edgerton, Rochester, $49,319; Congress Const. Co., Chicago, Ill., $46,943.

Ft. Getty, S. C.—See "Street Cleaning and Garbage Disposal."

Norfolk, Va.—Maj. Jas. B. Quinn, Corps of Engrs., U. S. A., writes that the contract for dredging waterway from Norfolk Harbor, Va., to Albemarle Sound, N. C. (bids opened Nov. 20), has been recommended for award to Fred E. Jones, of Washington, D. C., his bid being 73 cts. per cu. yd., total $15,000.

Savannah, Ga.—Bids are wanted at the U. S. Engineer Office until Dec. 26 for dredging in waterway between Savannah and Fernandina, Fla., and in Harbor at Darien, Ga., as advertised in The Engineering Record.

Norfolk, Va.—Bids will be received Dec. 9 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the Navy Yard, Norfolk, a quantity of paving blocks, steel, motors, pipe, valves, etc. A. S. Kenny, Paymaster General, U. S. N.

Chicago, Ill.—Bids are wanted Jan. 8 (readvertisement) for performing of mail service by pneumatic tubes or other similar devices in this city. H. C. Payne, Postmaster Gen., Washington, D. C.

Mobile, Ala.—Bids are wanted at the U. S. Engineer Office until Dec. 23 for building locks and dams Nos. 1, 2 and 3, Warrior and Tombigbee Rivers, Ala., as advertised in The Engineering Record.

Ft. Morgan, Ala.—Bids are wanted Dec. 4 for sinking an artesian well here. Address L. Cravens, Q. M.

San Francisco, Cal.—Bids are wanted Dec. 16 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Mare Island Navy Yard a quantity of pipe and pipe specials, valves, hydrants, etc.; also refrigerating plant for training station. A. S. Kenny, Paymaster Gen., U. S. N.

Sheridan, Wyo.—Bids are wanted Dec. 20 for constructing, plumbing, heating, gas piping and electric wiring, one field officer's quarters, one double set captain's quarters, 2 double sets lieutenant's quarters, one double barrack and one bakery, all brick. Capt. Thos. Swobe, Constructing Q. M.

Tulalip, Wash.—Bids are wanted at the U. S. Indian Office, Tulalip, for furnishing all labor and material required to construct and complete a wharf at this school. Chas. M. Buchanan, Supt.

Seattle, Wash.—Bids are wanted Dec. 18 for dredging Olympia Harbor; also until the same date for dredging Lake Washington Canal. Maj. John Millis, Corps of Engrs., U. S. A.

Los Angeles, Cal.—Bids are wanted Dec. 12 for repairing and renewing cement conduit and steam and hot water lines at Pacific Branch, Nat. Home Dis. Vol. Soldiers. T. J. Cochrane, Treas.; O. H. Lagrange, Governor.

San Francisco, Cal.—The contract for improving San Pablo Bay has been awarded to Rudolph Axman, of San Francisco, at 11.44 cts. per cu. yd.; total quantity of earth to be removed estimated at 2,721,000 cu. yds.

Vancouver Barracks, Wash.—Bids are wanted Dec. 15 for erecting one double artillery barrack, one double infantry barrack and one set officers' quarters. Address F. H. Hathaway, Ch. Q. M.

Ft. Meade, S. D.—Bids are wanted Dec. 9 for steam heating and plumbing in one double barrack. Geo. E. Pond, Ch. Q. M.

Montreal, Que.—The Government has decided, on the recommendation of Hon. Messrs. Sutherland and Prefontaine, to appoint a commission of three engineers to make investigations and report as to the nature and location of a dry dock for Montreal. There is some $250,000 available for this work.

MISCELLANEOUS.

Brooklyn, N. Y.—Bids will be received Dec. 10 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and dredging, Gowanus Canal, Wallabout Canal, East River, foot of Division Ave., and Newtown Creek, foot of Metropolitan Ave. Engineer's estimate calls for a total of 42,000 cu. yds. scow measurement.

Easton, Pa.—At the spring election this city proposes to vote on a bond ordinance for $250,000 for municipal improvements.

Glassport, Pa.—Improvement bonds to the amount of $20,000 have been sold by this Boro.

Southampton, L. I., N. Y.—The State Park Comn. has decided to recommend the purchase of 7,000 acres of land near Southampton for the proposed State park.

Philadelphia, Pa.—The City Bd. of Surveyors is said to be considering a plan to fill in about 5,000 acres of land in the southern section of the city in order to abolish the present system of dikes and ditches.

Buffalo, N. Y.—Comr. of Pub.-Wks. Ward has asked that the Common Council authorize the issue of $100,000 bonds for the purpose of raising money to abate the nuisance existing in the Main and Hamburg St. canal.

Jersey City, N. J.—The Bd. of Finance has passed a resolution providing for the issue of additional city park bonds to the extent of $600,000, to provide funds for the purpose of acquiring additional land for the enlargement of Riverview Park on Ogden Ave.

Richmond, Va.—The Finance Com. of the Council has adopted a resolution recommending that the James River Improvement Com. be authorized to purchase a dredging outfit, the cost not to exceed $40,000.

Alton, Ill.—Engineers are said to be at work surveying for a levee which is to be built this winter in the bottoms between here and St. Louis to protect several hundred acres of fertile land from devastation by overflows of Cahokia Creek.

Burk's Falls, Ont.—Bids are wanted Dec. 9 for constructing a wharf at Burk's Falls, on the Magnetawan River, Dist. of Parry Sound, Ont. Address, Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa.

NEW INDUSTRIAL PLANTS.

The Eureka Bending Works, East Berlin, Pa., will erect a 3-story, 50x100-ft factory at York, Pa., and are in the market for a 75 to 100-H.-P. engine and a rim bending and spoke machine.

The Warren, O., Sheet Metal Co. has begun the erection of a 42x108-ft. factory and will add other buildings in the spring. The company is in the market for boiler, engine and equipment for making galvanized sheet metal pails, coal hods, tubs, etc.

The Carter-Crume Co., Ltd., Niagara Falls, N. Y., makers of cash sales books, is erecting a 426x290-ft. factory, which it is contemplated to run by electricity; nothing definite, however, has been decided regarding the power.

G. A. Blesch, Menominee, Mich., is interested in the erection of a beet-sugar plant. A 600-ton plant with facilities for increasing to 800 tons is being considered.

Kane & Roach, Niagara & Shonnard Sts., Syracuse, N. Y., makers of carriage and wagon and other special machinery, expect to build an addition of about 60x80-ft. to their plant, to be equipped with a 20-ton traveling crane.

The Diana Brick & Tile Co., Ltd., Beaumont, Tex., which is erecting a plant to having a daily capacity of 100,000 brick, machinery for which has been purchased, expects to add a dry pressed plant for making face brick.

J. W. Kilgour & Bro., Beauharnois, P. Q., Can., will rebuild their recently burned furniture factory. The power plant was saved, and will be used again.

The Quaker Portland Cement Co., 26 Broadway, New York, will erect at Sandts Eddy, Pa., a cement mill, to have a daily capacity of 4,000 bbls. The company desires correspondence regarding labor-saving devices and improved machinery.

The Liberty Brewing Co., Springfield, Mass., will erect a plant to have a storage capacity of 20,000 bbls., and is in the market for an engine of about 200-H.-P.

The Washington, Pa., Chemical Mfg. & Supply Co. is erecting a 120x150-ft. building, and will require a 25-H.-P. gas engine. The company will equip a testing laboratory.

The A. & F. Brown Co., Elizabethport, N. J., founders and machinists, are extending their foundry, which, when completed, will be 181x85 ft., and intend to erect a 200x80-ft. fireproof building, each to be equipped with a 20-ton electric traveling crane. The machine shop will be erected in the spring.

J. J. Franey, Shenandoah, Pa., will erect a 55x175-ft. building of about 8 stories, to contain a 25,000-bbl brewery with a 20-ton ice plant and an electric light plant having 250 arc and 25,000 incandescent lights, a silk knitting mill and other industries.

BUSINESS NOTES.

The York, Pa., Mfg. Co. reports the following among recent orders: Cook & Atchley, Trenton, N. J., 15-ton ice plant; R. Greene, Greenville, N. C., 10-ton ice plant; Flat Top Ice & Cold Storage Co., North Fork, W. Va., 15-ton ice plant; Dover Brewing Co., Canal Dover, O., 30-ton ice plant; Queen City Ice & Cold Storage Co., East St. Louis, Ill., ice machinery; Heckle & Kellogg, Cape Charles, Va., 15-ton ice plant; D. J. Crowley, Georgetown, S. C., 25-ton ice-making machine and 10-ton freezing and distilling outfit; Augusta, Ga., Brewing Co., 50-ton brine tank and coils; Beare Bros., Humboldt, Tenn., 15-ton freezing and distilling plant; West Virginia Brewing Co., Huntingdon, W. Va., direct expansion piping for addition and re-piping of old storage room; Bee Hive Hygeia Ice Co., Brooklyn, N. Y., 25-ton plate freezing plant.

Hales & Ballinger, s. w. corner 12th and Chestnut Sts., Philadelphia, architects and engineers, have awarded a contract to Edward Fay, Philadelphia, for a 2-story, 50x180-ft. factory building of slow-burning construction for the Lester, Pa., Piano Co. They have also awarded a contract to Kaighn & Draper, Camden, N. J., for a 4-story, 30x100-ft. addition to the plant of the Victory Talking Machine Co., Camden.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Chartier Brewing Co., Carnegie, Pa., an engine direct-connected to a 30-Kw. Westinghouse generator; Northern Electric Mfg. Co., Madison, Wis., a 125-H.-P. engine direct-connected to a 75-Kw. Northern generator; City of Fayetteville, N. C., 125-H.-P. engine for electric plant.

The district office managera of the Westinghouse Electric & Mfg. Co., representing all the principal cities of the United States, spent the week ending Nov. 22 in their usual annual visit to the works and offices of that company at East Pittsburg.

The New York office of the Harrisburg Foundry & Machine Works at 203 Broadway, which was formerly under the management of W. P. Mackenzie, will be conducted by the firm of Mackenzie & Quarrier.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Dec. 1.	East Dundee, Ill.	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 2.	Supplies, Philadelphia, Pa	Nov. 29
Dec. 4.	Well, Ft. Morgan, Ala	Nov. 29
Dec. 4.	Meridian, Miss.	Nov. 22
Dec. 4.	Boston, Mass.	Nov. 15
	Adv., Eng. Record, Nov. 15.	
Dec. 5.	Troy, N. Y.	Nov. 29
Dec. 20.	Pumping engines, Louisville, Ky	Oct. 25
	Adv., Eng. Record, Oct. 25 to Nov. 29.	
Dec. 29.	Gillett, Wis.	Nov. 15
Jan. 1.	Sacramento, Cal.	Nov. 22

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 1.	Titusville, Pa.	Nov. 29
Dec. 1.	Albany, N. Y.	Nov. 29
Dec. 2.	Akron, O.	Nov. 29
Dec. 2.	Pipe sewer, Oneida, N. Y.	Nov. 29
Dec. 2.	Culvert, Oneida, N. Y.	Nov. 29
Dec. 2.	Massillon, O.	Nov. 22
Dec. 2.	Des Moines, Ia.	Nov. 15
Dec. 2.	South Orange, N. J.	Nov. 15
	Adv., Eng. Record, Nov. 15, 29.	
Dec. 5.	Harrisburg, Pa.	Nov. 29
Dec. 5.	Walnut, Ill.	Nov. 22
Dec. 7.	Dixon, Ill.	Nov. 8
Dec. 10.	St. Petersburg, Fla.	Nov. 22
Dec. 12.	Cincinnati, O.	Nov. 22
Dec. 15.	Toledo, O.	Nov. 29
Dec. 15.	Montevideo, Uruguay	Sept. 13
Dec. 29.	Pumping Station, Washington, D. C.	Nov. 15
	Adv., Eng. Record, Nov. 15.	
Dec. 22.	Norristown, Pa.	Nov. 29
Dec: 22.	Wabash, Ind.	Nov. 29
Dec. 27.	(Ft. McKinley) Portland, Me	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Feb. 2.	New Orleans, La	Nov. 29
	Adv., Eng. Record, Nov. 29.	
———	Pasadena, Cal.	Nov. 29

BRIDGES.

Dec. 2.	Butler, Mo.	Nov. 29
Dec. 2.	Fowler, Ind.	Nov. 29
Dec. 2.	Mendota, Mo.	Nov. 29
Dec. 2.	Unionville, Wis.	Nov. 22
Dec. 3.	Walnut Springs, Tex	Nov. 29
Dec. 3.	Piers, Osceola, Mo	Nov. 22
Dec. 4.	Fairbury, Neb.	Nov. 29
Dec. 4.	Long Island City, N. Y.	Nov. 29
Dec. 9.	Franklin, Pa.	Nov. 15
Dec. 11.	New York, N. Y.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 11.	Remington, Va.	Nov. 29
Dec. 15.	Sault Ste. Marie, Ont	Nov. 29
Dec. 17.	Columbia City, Ind	Nov. 29
Dec. 17.	Chicago, Ill.	Nov. 1
Dec. 30.	Georgetown, Colo.	Nov. 29
Jan. 5.	Cnmberland, Md.	Nov. 29
Jan. 7.	Webster, S. D.	Nov. 29

PAVING AND ROADMAKING.

Dec. 2.	New York, N. Y.	Nov. 22
Dec. 2.	Des Moines, Ia	Nov. 15
Dec. 3.	Baltimore, Md.	Nov. 22
Dec. 4.	San Diego, Cal.	Nov. 29
Dec. 5.	Buffalo, N. Y.	Nov. 29
Dec. 8.	Laporte, Ind.	Nov. 29
Dec. 8.	Toledo, O.	Nov. 15
Dec. 10.	Brooklyn, N. Y.	Nov. 29
Dec. 10.	Bloomfield, Ind.	Nov. 29
Dec. 10.	Hartford, Conn.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 11.	Green Bay, Wis.	Nov. 22
Dec. 11.	Guthrie, Okla. Ter.	Nov. 1
Dec. 15.	Cincinnati, O.	Nov. 29
Dec. 16.	Somerville, N. J.	Nov. 29
Dec. 17.	Ft. Dodge, Ia	Nov. 29
Dec. 19.	Galion, O.	Nov. 29
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	

POWER, GAS AND ELECTRICITY.

Dec. 2.	St. Paul, Minn.	Nov. 22
Dec. 2.	North Amherst, O.	Nov. 15
Dec. 4.	Ft. Monroe, Va	Nov. 8
	Adv., Eng. Record, Nov. 8.	
Dec. 6.	Philadelphia, Pa.	Nov. 29
Dec. 6.	Hot Springs, Ark.	Nov. 15
Dec 20.	Philadelphia, Pa.	Nov. 22
Jan. 15.	Rome, Ga.	Oct. 11
Mar. 4.	Franchise, Manila, P. I.	Nov. 15

GOVERNMENT WORK.

Dec. 2.	San Francisco, Cal	Nov. 15
Dec. 2.	Dredging, Boston, Mass	Nov. 1
	Adv., Eng. Record, Nov. 1, 8, 29.	
Dec. 3.	Kiowa Agency, Okla. Ter	Nov. 15
Dec. 3.	(Rappahannock River, Va.) Wash., D.C.	Nov. 8
	Adv., Eng. Record, Nov. 8 to 29.	
Dec. 3.	Emporia, Kan.	Nov. 1
	Adv., Eng. Record, Nov. 1, 8.	
Dec. 4.	Well, Ft. Morgan, Ala	Nov. 29
Dec. 4.	Ft. Monroe, Va	Nov. 8
	Adv., Eng. Record, Nov. 8, 22.	
Dec. 6.	Dredging, Philadelphia, Pa.	Nov. 15
Dec. 6.	Ft. Rosecrans, Cal.	Nov. 15
Dec. 6.	(Breton Bay, Md.) Washington, D. C.	Nov. 8
	Adv., Eng. Record, Nov. 8 to 29.	
Dec. 6.	Smithery, Boston, Mass.	Nov. 8
Dec. 6.	Dredging, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 29.	
Dec. 8.	Newport, R. I.	Nov. 8
	Adv., Eng. Record, Nov. 8 to 29.	
Dec. 8.	New York, N. Y.	Nov. 8
	Adv., Eng. Record, Nov. 8 to 29.	
Dec. 9.	Ft. Meade, S. D.	Nov. 29
Dec. 9.	Annapolis, Md.	Nov. 29
Dec. 9.	Norfolk, Va.	Nov. 29
Dec. 10.	Jetty work, Galveston, Tex	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 15, 29.	
Dec. 11.	Chilocco, Okla. Ter	Nov. 22
Dec. 12.	Los Angeles, Cal	Nov. 29
Dec. 12.	Detroit, Mich.	Nov. 15
	Adv., Eng. Record, Nov. 15 to 29.	
Dec. 12.	Wheeling, W. Va.	Nov. 15
	Adv., Eng. Record, Nov. 15 to 29.	
Dec. 13.	Dover, Tenn.	Nov. 22
Dec. 15.	Wilmington, Del.	Nov. 22
Dec. 15.	Cement, Duluth, Minn	Nov. 15
	Adv., Eng. Record, Nov. 15 to 29.	
Dec. 16.	Ft. Hancock, N. J.	Nov. 29
Dec. 16.	San Francisco, Cal	Nov. 29
Dec. 16.	Ft. Columbus, N. Y.	Nov. 29
Dec. 16.	Snagboat and barge, Montgomery, Ala.	Nov. 15
	Adv., Eng. Record, Nov. 15 to 29.	
Dec. 16.	Towboat, dredge, etc., Montgomery, Ala.	Nov. 15
	Adv., Eng. Record, Nov. 15 to 29.	
Dec. 17.	Baltimore, Md.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29.	
Dec. 17.	Mobile, Ala.	Nov. 22
Dec. 18.	Olympia Harbor, Seattle, Wash	Nov. 29
Dec. 18.	Lake Wash. Canal, Seattle, Wash.	Nov. 29
Dec. 18.	Milwaukee, Wis.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29.	
Dec. 19.	Steam tenders, Nashville, Tenn.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29.	
Dec. 20.	Sheridan, Wyo.	Nov. 29
Dec. 20.	Charleston, S. C.	Nov. 15
Dec. 22.	Savannah, Ga.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29.	
Dec. 23.	Garbage crematory, Ft. Getty, S. C.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 23.	(Ft. Rodman) Newport, R. I.	Nov. 29
Dec. 23.	Mobile, Ala.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 26.	Dredging, Savannah, Ga.	ov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 27.	Portsmouth, N. H.	Nov. 29
Dec. 27.	Sewers (Ft. McKinley), Portland, Me.	Nov. 29
Jan. 15.	Machinery for dredge, Wash'ngton, D.C.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
———	Wharf, Tualip, Wash.	Nov. 29

BUILDINGS.

Dec. 1.	Library, Kingston, N. Y.	Nov. 29
Dec. 2.	Hospital, Binghamton, N. Y.	Nov. 22
Dec. 2.	Htg. Pub. Bldg., Bellaire, O.	Nov. 15
Dec. 2.	Capitol work; St. Paul, Minn.	Aug. 16
Dec. 3.	Pub. Comft. Stations, Brooklyn, N. Y.	Nov. 22
Dec. 3.	Hospital, New York, N. Y.	Nov. 22
Dec. 3.	Court house, St. Francisville, La.	Nov. 15
Dec. 4.	(See Pub. Bldgs.) New York, N. Y.	Nov. 29
Dec. 4.	Pub. Bldg., St. Louis, Mo.	Nov. 29
Dec. 4.	School, Milwaukee, Wis	Nov. 29
Dec. 5.	School, Chicago, Ill.	Nov. 29
Dec. 6.	Hospital, Philadelphia, Pa	Nov. 29
Dec. 6.	Library, Henderson, Ky.	Nov. 29
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Dec. 9.	Church, Birmingham, Ala	Nov. 15
Dec. 10.	Hospital, Middletown, N. Y.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 10.	Hospital, Kings Park, N. Y.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 10.	Bus. Bldg., New Kensington, Pa	Nov. 22
Dec. 15.	School, Cincinnati, O.	Nov. 15
Dec. 15.	Htg. Capitol, Columbia, S. C.	Oct. 4
Dec. 16.	Library, Fond du Lac, Wis	Nov. 29
Dec. 19.	Almshouse, Scranton., Pa.	Nov. 22
	Adv., Eng. Record, Nov. 22.	
Dec. 20.	Library, Milwaukee, Wis.	Nov. 29
Dec. 20.	Y. M. C. A. Hall, Akron, O.	Nov. 29
Dec. 20.	School, Baton Rouge, La.	Nov. 29
Dec. 20.	Armory Plans, Brooklyn, N. Y.	Nov. 8
Dec. 24.	School, Albany, N. Y.	Nov. 29
Dec. 27.	Library, Port Huron, Mich.	Nov. 29
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11
Jan. 15.	Library plans, Binghamton, N. Y.	Nov. 15
Jan. 31.	Church, Scotchbridge, O.	Nov. 29

MISCELLANEOUS.

Dec. 1.	Street cleaning, etc., Philadelphia, Pa.	Nov. 29
Dec. 6.	Removal of snow, New York, N. Y.	Nov. 29
Dec. 9.	Wharf, Burk's Falls, Ont.	Nov. 29
Dec. 9.	Concrete Walls, Columbus, O.	Nov. 22
Dec. 10.	Dredging, Brooklyn, N. Y.	Nov. 29
Dec. 15.	Railroad Work, Sault Ste. Marie, Ont.	Nov. 29
Dec. 15.	Excav. & Const. R. R., San Francisco	Nov. 15
Dec. 19.	Garb. Disp., Kansas City, Mo.	Nov. 22
Jan. 2.	El. R. R. Franchise, Vallejo, Cal.	Nov. 22
Jan. 14.	Dredging, Chicago, Ill.	Nov. 22
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15

THE ENGINEERING RECORD.

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Some Features of the Discharge of Large Pipes.

Although some excellent work has been done in the measurement of the discharge of pipe lines of large diameter during the past eight or ten years to say nothing of the work done prior to that time, there remains still to be ascertained considerable information not only of interest to engineers but bearing directly upon the volume of discharge for a given diameter and hydraulic gradient. It was but a comparatively short time ago that the effect of the rivet heads of a riveted steel pipe on its discharge was brought to the attention of civil engineers in a very forcible manner. It has been established beyond question that the presence of the rivet heads and of the unavoidable joints in such a pipe has far too great a resisting effect upon the flow of the water to be neglected; at the same time much yet remains to be determined by actual test before tne elements of the problem as a general one can be considered established in a complete and quantitative way. Indeed it is an open question whether such resistances as those alluded to in a riveted steel pipe result from actually obstructive effects to the velocity parallel to the axis of the pipe, or whether the result is due to the deflection of the molecules of the water in a direction more or less nearly at right angles to that axis, thus producing eddies and checking the progressive general motion of flow. In reality that question may arise in connection with a considerable class of similar resistances, and there is practically little or no definite information available on which to base a reply.

The principles on which the standard treatment of sudden contraction or enlargement of the flow of a limited or enclosed stream of water is based are of course familiar to every student in hydraulics, but the conditions of the actual problem as it occurs in large pipes are so different from those assumed in the text book analysis that a vast amount of investigation of the circumstances under which water moves through a pipe is imperatively needed before anything like an exact knowledge of this class of resistances can be acquired.

It is perfectly well known by every civil engineer who has had any sensible amount of hydraulic experience that the progressive motion of water in any closed pipe or open channel is but one element of probably the most complicated mass of motions found in nature. Although the flow of water in such channels and in accordance with "the principle of continuity" is assumed to be a case of parallel motions not even the roughest approximation to that condition of things is ever found within the limits of velocity in which water moves in connection with any engineering work. It is a little singular therefore that in all the current meter observations which have been made in large pipes and open conduits this feature of the flow has not received more experimental attention, especially as it cannot fail to affect materially the discharge. It would be interesting if not of immediate practical importance to ascertain the disturbing effect of this character of rivet heads and plate joints in a closed steel pipe as compared with similar eddying motions or velocities in open channels with comparatively smooth sides and bottom like those of large conduits. It is altogether probable, if not certain, that the flow would be far less disturbed in the latter class of channels than in the former, but the hydraulics of discharge would gain materially in its quantitative features with the attainment of exact information in this direction.

An excellent paper on "The Flow of Water in Wood Pipes" in the August number of the Proceedings of the American Society of Civil Engineers by Mr. Theron A. Noble, M. Am. Soc. C. E., not only suggests in its reading the inquiries which have been outlined above, by the current meter observations which he made in his 54-inch stave pipe, but also other features of discharge which are likely to occur in a pipe line of larger diameter subject to distortion. As usual the meter was used to determine only those components of velocity parallel to the axis of the pipe. The interior of a well made stave pipe is so smooth that the exciting causes of eddying cross-currents are probably reduced nearly to a minimum, yet they exist to some extent. It would add much to the technical value of such careful and extended investigation in the actual discharges of large conduits to make the velocity observations complete and it would add little either to the cost or the time required to attain that end. The considerable variations in the coefficients of Chezy's and other formulas observed at different times for the same class of pipe, and in the same condition, and for essentially the same velocities might receive much illumination if these experimental observations were completed in the manner indicated.

Mr. Noble, in the paper already cited, gives among other things the results of a large number of measurements of the interior diameters of the 54 and 44-inch pipes with which he experimented and they indicate marked distortion of shape, so much so in fact that the average cross-section employed by him was elliptic in outline rather than circular. The influence of this distortion, which, of course, was widely varying in different points of the line, was probably not much, and yet it is scarcely safe to ignore an effect of that kind without the possession of positive data justifying such a course. It is practically certain that the failure to recognize distortion in shape like that occurring in the curves of a line of fire hose, has led to serious errors in conclusion in at least one or two prominent instances. There can be little doubt of the fact that the adjustment of the conditions of flow in such flexible pipes have eliminated in some cases the resistance characteristic of sharp curves.

The plotted results of Mr. Noble's tests reveal one important and interesting relation in which it is shown that according to his experiments the velocity head throughout a considerable range of velocities was found directly proportionable to the friction head in the pipes. There is nothing new in this relation and yet it is an interesting as well as important confirmation of some of the fundamental concepts in practical hydraulics. There may, however, be some doubt as to the advisability of the general formula largely empirical which he proposes for the velocity of flow in circular pipes. The whole field of empirical formulas for such purposes has been pretty well worked over and if a new one is to be discovered it must certainly be based on a much wider range of experimental determinations than those connected with the Seattle stave pipe line.

The Boiler Shops of the Babcock & Wilcox Company.

For many years a certain part of the Bayonne shore of the Kill von Kuil, as the busy channel that separates northern Staten Island from New Jersey is called, has been occupied by a number of handsome residences with lawns and shade trees separating them from the river bank. To the east of this property the water front has been built up by manufacturing enterprises of one kind or another attracted by the excellent shipping facilities that the location offers. About three years ago the Babcock & Wilcox Company had for some 25 years been manufacturing water-tube boilers at their shops at Elizabethport, N. J. Finding the conditions there made impossible the enlargement that their increasing business demanded, investigation discovered the advantages of the property on the shore of the Kill von Kull at Bayonne, and there a tract of partly unimproved land was purchased. The property has a water front of some 900 feet, extends backward about 2,000 feet from the water and includes several residential sites. Quite a little filling and grading was done, after which the construction of immense boiler shops was begun upon the middle of the property, the residences, lawns and shade trees being undisturbed save for the additions and alterations to the largest residence necessary to convert it into an administration building for the operating staff and drawing rooms for the engineering department.

A map of the property purchased by the company is shown in one of the illustrations. Along the water front a bulkhead for shipment by lighter has been constructed, giving a depth at mean low water of 18 feet. A dock has also been built for vessels of deeper draft. A branch of the Central Railroad of New Jersey enters the north end of the property, and a system of tracks for shipping runs into the various buildings and passes the various places in the yard where the raw material and finished products are stored. These are indicated on the map. Heavy raw materials are unloaded and finished products loaded on cars by two locomotive cranes. Small Baldwin switch engines are provided to move cars about, although the locomotive cranes may also be used for this purpose. The sizes of the buildings are given on the plan. All are of brick and steel construction with curtain walls and steel roof trusses supported by steel columns. Monitors and skylights give ample light and ventilation. Warren-Ehret slag and asphalt roofing is used. The machine and drum shops are divided into three bays by interior rows of columns. The middle bay in the machine shop is fitted with a 50,000-pound electric traveling crane built by the Niles Tool Works Company and a 10,000-pound Shaw crane built by Manning, Maxwell & Moore. There is a 10,000-pound Niles crane in the middle bay of the drum shop and also a Shaw crane of the same capacity. In the side bays the heavy parts are handled by jib cranes attached to the building columns or to the machines they serve. Most of these consist of a horizontal beam on which is a horizontally moving trolley, the vertical leg of the crane being the extension of an hydraulically operated piston for raising and lowering it. These cranes are arranged to swing about the vertical leg as an axis.

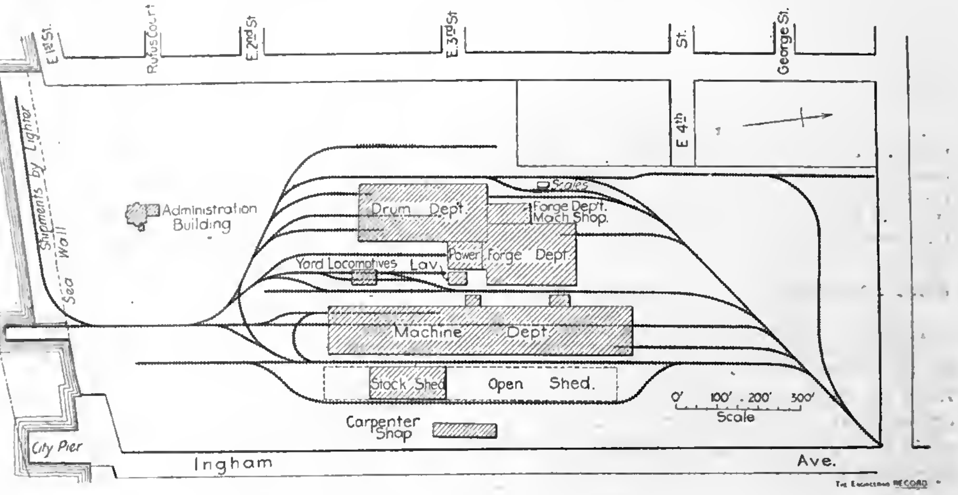
In the construction of the Babcock & Wilcox stationary boilers, which are of the sectional water-tube type, the work, for the purpose of this description, may be divided into three separate operations. One of these is the construction of the drums and cross boxes, the latter being forgings riveted to the drums to which the vertical pipes from the tube sections are connected. The second operation is the construction of the tube sections comprising the forging and machining of the headers, hand hole covers, etc., the assembling and testing of the sections, each of which consists of a pair of headers connected by a number of 4-inch tubes. The third is in the construction of wall fittings, fronts, grates, etc. The stationary boilers are not assembled complete until they arrive at their destination, although the marine boilers are assembled completely and tested before shipment. The headers are of cast iron or of wrought steel; the percentage of boilers with wrought-steel headers is rapidly increasing, and those with cast-iron headers, diminishing. The plan of the buildings shows the location at which the raw materials are stored.

Forge Shop.—The work done in this shop may be divided into three classes: First, the forgings which are required in the construction of the steam drums, such as cross boxes, drum doors, frames, etc., used on marine boilers. The forged-steel buckstave has been developed by this company to overcome the objections which always occur in the casting and transportation of the long cast-iron buckstaves which are ordinarily used. Arrangements are made for utilizing the waste heat of the two furnaces in which the header and cross box plates are heated for heating the small plates required for hand-hole fittings.

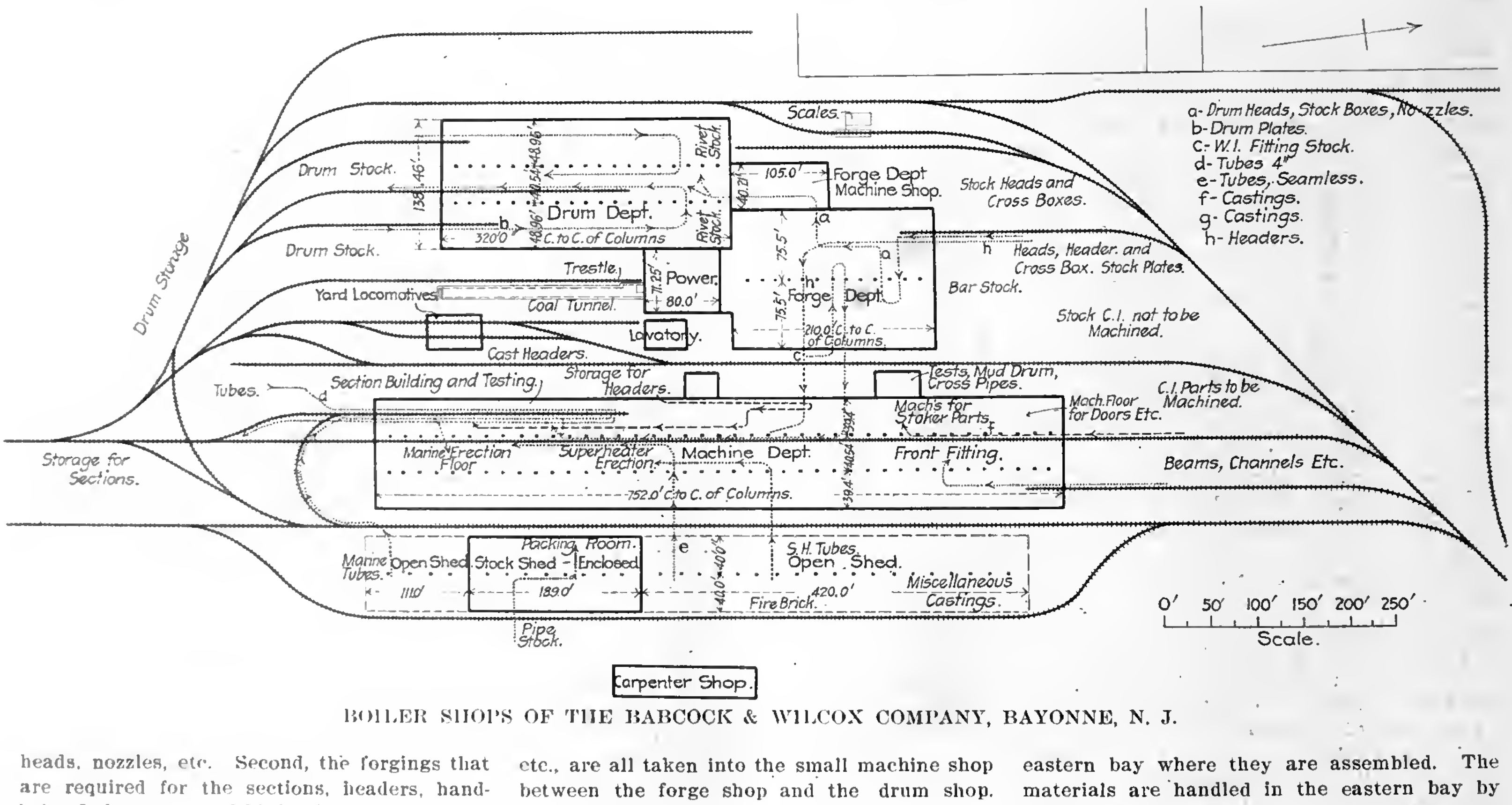
The only tools in this shop are the shears for trimming the rough edges of the cross boxes and the grinding machines for finishing these edges. After these two operations are finished, the cross boxes, drum heads, nozzles, the operations connected with the riveting to them of the parts mentioned.

The operations in connection with the manufacture of the headers consist in scarfing, folding, welding, corrugating, flanging of the hand holes and welding in of the ends. For all of these operations special machinery has been developed. After these operations are completed in the forge shop the headers pass into the machine shop for the finishing, which will be described.

Machine Shop.—The northern end of the machine shop is devoted to the fitting and assembling of the boiler fronts, supports, etc. The beams, channels and plates required enter the



MAP OF BABCOCK & WILCOX PROPERTY.



BOILER SHOPS OF THE BABCOCK & WILCOX COMPANY, BAYONNE, N. J.

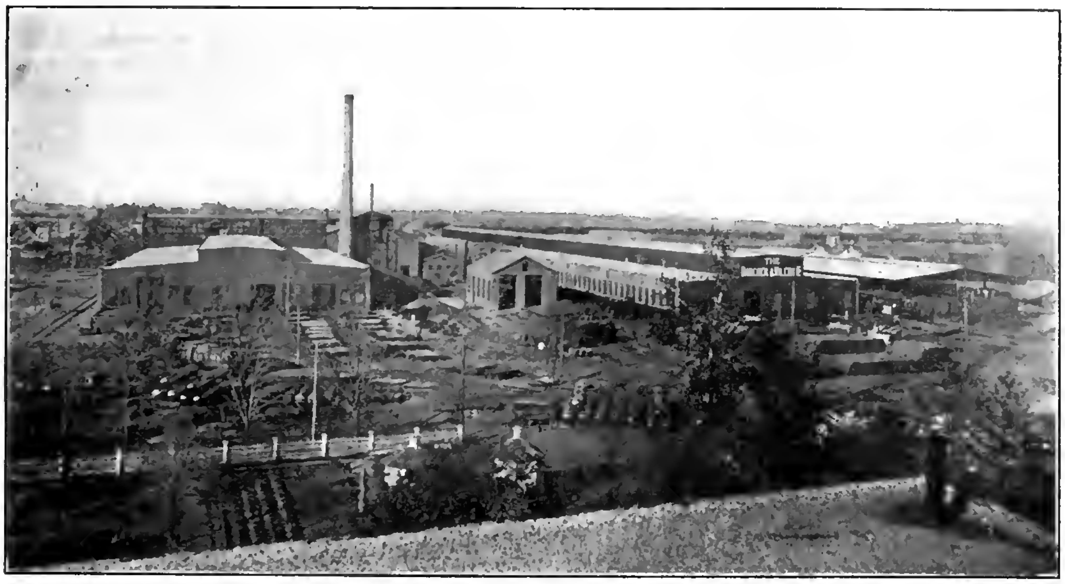
heads, nozzles, etc. Second, the forgings that are required for the sections, headers, hand-hole fittings, etc. Third, the miscellaneous forgings required for non-pressure parts for special work like doors, buckstaves, and work of that character. The extreme north end of this shop is occupied by the blacksmiths' fires, and adjacent to these are the furnace and presses required for making the drum heads, cross boxes and nozzles. The south end of the building is occupied by two welding furnaces with the necessary presses required for shaping and corrugating the headers. In addition to the aforementioned machinery, the forge shop also contains presses for the manufacture of the forged-steel buckstaves and the forged fire-etc., are all taken into the small machine shop between the forge shop and the drum shop. This contains a number of lathes, radial multiple drills, planers, boring mills, etc., for facing and drilling drum heads, nozzles, man-hole plates, etc. The circumferential flange of the drum head and the inwardly projecting man-hole flange are dressed off in a boring mill, both operations being performed at the same time. A multiple machine for boring the several tube holes in the cross box where the tubes enter it is shown in one of the photographs. The completed nozzles, drum heads and cross boxes enter the drum shop at the north end at a point where the drums have been rolled, assembled and riveted ready for eastern bay where they are assembled. The materials are handled in the eastern bay by hydraulically operated jib cranes attached to the columns of the building or to the machines in which the various operations are performed. In the middle bay, the fronts, supports, etc., are handled by the traveling cranes by which they are loaded on cars for shipment when finished. In the north end of the west bay the machine work and the assembling of the mechanical stokers is accomplished, and also the machine work upon furnace doors, etc. About two-thirds of the west bay is devoted to the machine work upon the headers. The cast-iron headers have the tube holes bored out and the hand-hole openings bored and ground.

The wrought-steel headers are of two types, those in which the cap covering the hand-hole is outside and those in which it is placed inside the header. The tube holes and hand-hole openings in both types are made in multiple cutters. On some of the headers, those with the hand-hole plates on the outside, the opening is flanged outward, dressed and then ground so that the metal joint will be tight without a gasket. With vertical headers having inside hand-hole plates, each hand-hole opening has to be elongated in a vertical direction to make an elliptical opening so that the tube may be drawn through it. This is done by drawing through it by means of hydraulic pressure a die of elliptical cross-section. The inner edge of the opening has to be dressed and ground, as does the bearing edge of the plate, which is of wrought steel pressed into shape by an hydraulic press. After the machine work on the headers and hand-holes is completed, the sections are formed by placing the tubes in the headers, then a section is laid upon a slightly inclined table and a workman at each end of a section expands the tubes into the headers by means of an expander driven by a flexible shaft operated from a carriage that moves on a bed lying parallel to the headers. The hand-hole plates are then put in place and hydraulic test pressure is applied to the section. If inspection shows it to be tight, it is lifted by a jib crane to a car, where it is painted and then conveyed to the storage for sections.

In the central part of the main bay of the machine shop, which is served by the traveling cranes, are a number of heavy tools largely used in constructing machinery for the works. South of this is the section devoted to the machine work and the assembling of the superheaters, which consist of U-shaped seamless tubes connected at each end to headers through which the steam enters and leaves. The south end of the east and middle bays is devoted to the machine work upon the marine boilers and to erecting and testing them. The erecting department is in the middle bay, and when they are completed they are lifted by a traveling crane and placed on cars for shipment. The enclosed stock-shed east of the machine shop contains brass tubing, water gauges, gauge cocks, blow-off and feed valves and other details that are supplied with a boiler. They are packed here and shipped on cars from covered loading platforms on each side of the storehouse.

Drum Shop.—Material enters the southeast corner of the drum shop on small flat cars. It is first marked so as to show the rivet spacing and the lines to which it is to be trimmed. It is then lifted by hydraulically operated jib cranes to the punches. These are of Hillis and Jones make, and are provided with a table with rolls on which the plate rests, and a sliding carriage to which the plate is clamped serves to advance the plate in the punch. A rack and pawl device insures the rivet spacing being of the proper pitch. The plate then passes to the shears where the edges of the plate are trimmed. They are then beveled on the edges in a machine where a horizontally moving tool cuts the edges, the plate being held in position by hydraulically operated pistons. The plates are then rolled into cylindrical shape. The frame supporting the bearing for one end of the upper of the three rolls is moved out of its position hydraulically so that the rolled sheet can be drawn out of the rolls endwise.

By this time the plates have reached the north end of the shop and there gap riveters are used to rivet the longitudinal seams in the drum sections and also to punch out the holes in the sections for the cross boxes, steam outlets, nozzles, etc. In some cases the cross box is riveted to an end section of the drum. While the riveting is being done the drum sections are suspended from a trolley moving on a horizontal I-beam that is itself suspended at both ends by wire ropes carried up and over pulleys and attached to the piston of a cylinder in which hydraulic pressure serves to raise or lower the drum section. Horizontal motion of the drum is secured by means of the trolley



VIEW OF BABCOCK & WILCOX SHOPS.

VIEW OF EAST BAY OF DRUM SHOP.

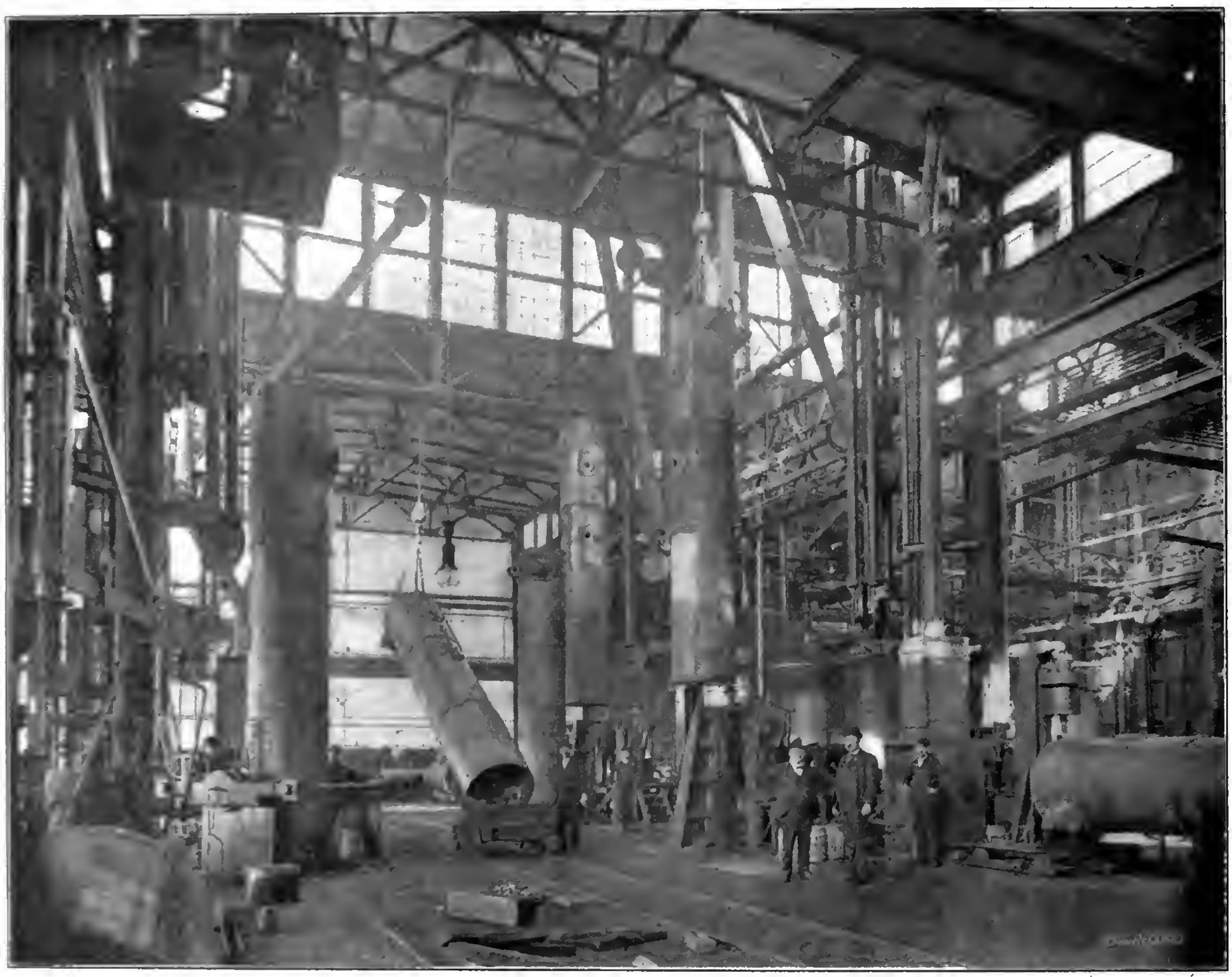
referred to. The riveting of the circumferential seams between the middle and the end sheets is accomplished in the riveting tower which occupies the north end of the drum shop. At the north end of the center aisle, forming part of the riveting tower mentioned, there are four riveters. Two of them are of about 7 feet gap and can be used for the circumferential seams or for riveting on the cross boxes if they are not put on before the sections are assembled. Each of the other riveters is of special design; they have a gap of 24 feet and a stake over which a 36-inch drum can be placed all the way down. The spring which would ordinarily come on this stake is obviated by pitching the rivet holes diametrically opposite and driving the two opposite rivets at the same time. The drum is held in a vertical position, and extending upward on the inside is a mast used to exert pressure against the inner heads of the rivets.

The drums are supported by a boom derrick, so that by raising or lowering the boom, which is done by hydraulic power, the drum is moved away from or toward the mast of the derrick. The mast of the derrick with its attached boom can also be raised or lowered by an hydraulically operated piston so that any desired movement of drum can be accomplished easily and with precision.

The drum heads are dished and as there is a manhole in each head, it is possible to rivet both heads to the shell at once. The shell is laid horizontally on two pairs of rollers so that it may be revolved about its axis. At each end is a riveter resting upon a carriage that can be moved in a longitudinal and also in a transverse direction with respect to the drum. The riveter is mounted upon a vertical support, and it can be moved on this in a vertical direction by means of hydraulic power, so that the lower jaw of the riveter after it is introduced in the man hole opening can be seated on the lower head of the rivet while the upper end is being headed up. As both ends of the drum are riveted at the same time, the work is done quite rapidly.

When the riveting is completed the drums are deposited in the center aisle of the drum shop and are then picked up by traveling cranes and conveyed to the middle of the shop, where they are caulked by pneumatic tools. Before they leave this department, they are tested at 50 per cent. above the working pressure and leaks stopped. They are then painted and lifted on cars and taken to the drum storage in the yard or shipped immediately if necessary. The west aisle of the drum shop is of comparatively recent construction made necessary by the demands of the business. Generally speaking, it will be similar to the east side and the raw materials will enter at the south end and pass northward toward the riveting tower. This part also contains a number of multiple drills used to drill rivet holes out of the solid plate without punching.

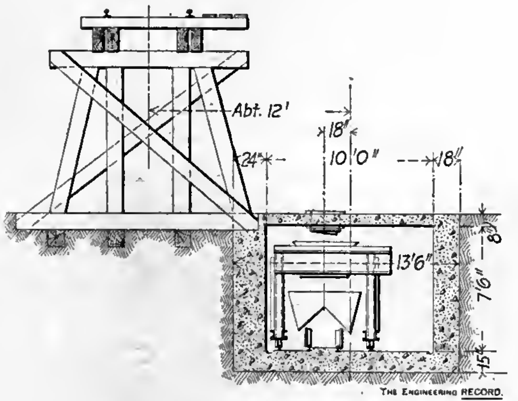
Power Plant.—Power for the shops is generated in a central power station located as shown on the plan. It contains the main engine, which transmits power to the drum shop, to the machine shop in the forge department, and to the forge shop, by means of a system of belts connected to a jack shaft belted from the engine. Belts from this same shaft lead to electric generators that supply current to motors driving the machine shop, carpenter shop, electric traveling cranes and other small machines about the plant that could not be conveniently driven from the belting and shafting system. The power house is divided into an engine and boiler room and the plan and sections of each are illustrated. The boiler room contains two 300-horse-power Babcock & Wilcox wrought-steel boilers suitable for 200 pounds steam pressure. Each is equipped with a Babcock & Wilcox superheater, and a Green economizer is placed in the smoke flue, which discharges the gases into a chimney 6 feet in diameter and 153 feet high. The latter is of the radial brick type, and was constructed by the Alphons Custodis Chimney Construction Company. The boilers are also equipped with two Sturtevant fans driven by a steam engine and discharging air in the ash pits of the furnaces. The fans can be used to augment the draft of the chimney should it become necessary, and they also enable boiler tests to be made at extraordinarily high rates of combustion. There is an additional Babcock & Wilcox boiler and superheater over the plate heating furnaces in the forge shop, and also one over the welding furnaces. The four boilers are connected to a system of steam pipes supplying the engines, pumps, etc., in the engine room.



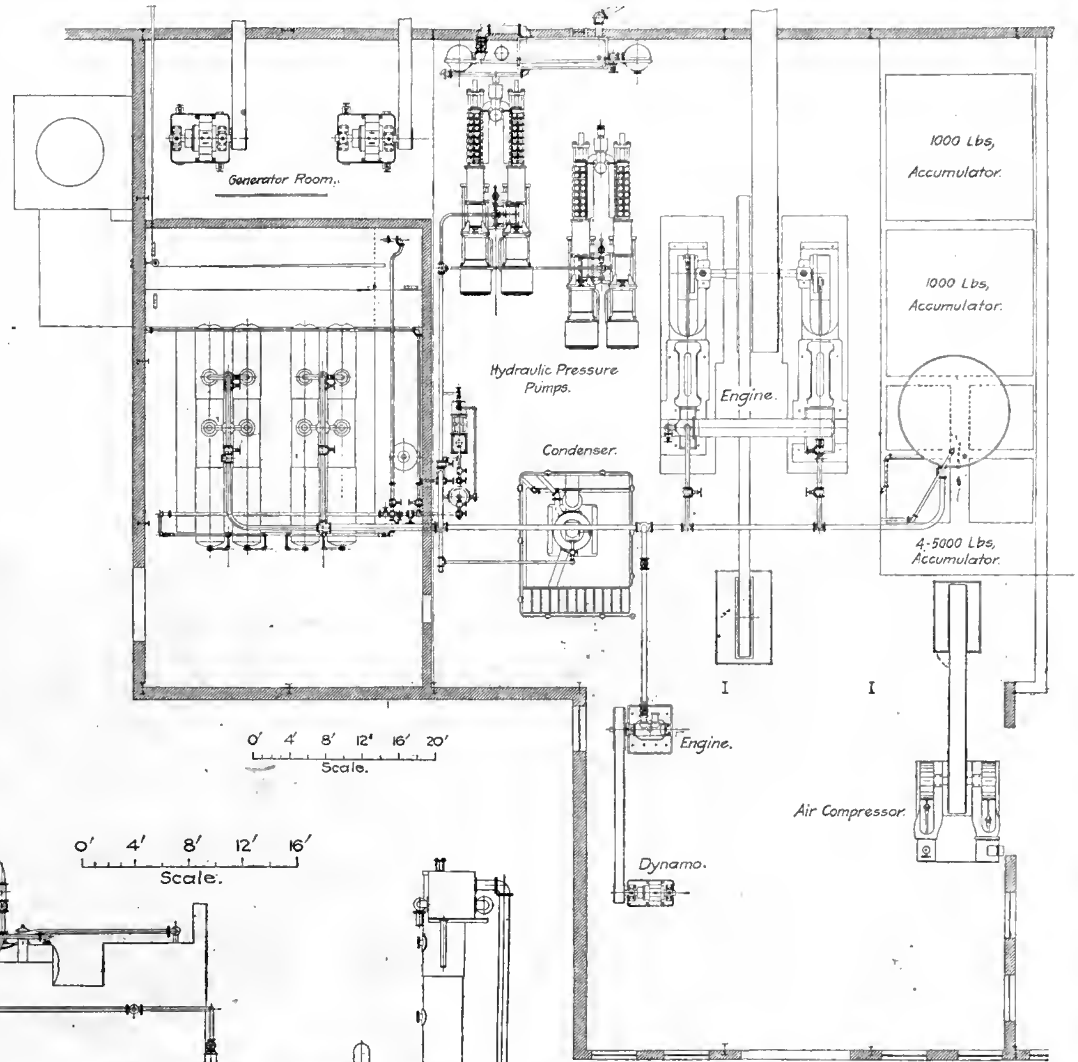
VIEW OF RIVETING TOWER.

Coal enters the plant on cars and is run upon a trestle from which it is dumped in a pile in the yard. Beneath this coal pile a concrete tunnel has been constructed. Openings are provided in the roof of the tunnel at frequent intervals so that the coal may be chuted into a breaker that is driven by a small electric motor and mounted upon a car that can be moved along the tunnel upon tracks provided for the purpose. The bottom of the car is elevated and is arranged to straddle a smaller track; upon this is run a small dumping car, which is filled by the coal that passes through the crusher. The car is then pushed to the power house end of the tunnel upon a platform of a Morse-Williams elevator operated by belt from the main system of shafting. The elevator raises the car outside of the building opposite an opening in the wall of the boiler house, and from that point the car is pushed upon an elevated track to hoppers over the boilers in the boiler room and also to hoppers over the furnaces in the forge shop.

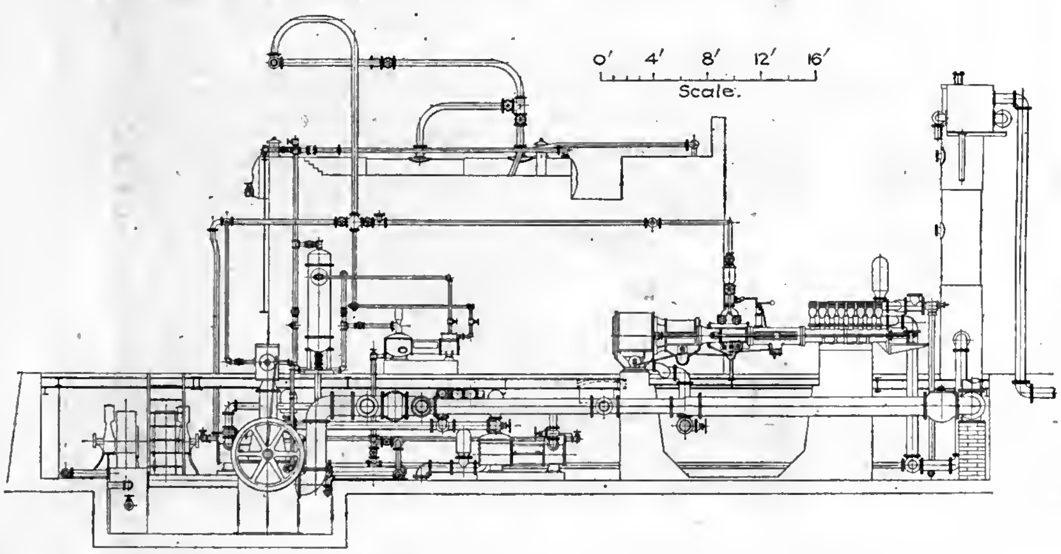
The engine room contains the main engine, the auxiliaries, two high-pressure pumps connected with an hydraulic system and also an electric generating plant. The engine is of the Reynolds-Corliss cross-compound type built by the Allis-Chalmers Company. The cylinders are 16 and 32 inches in diameter with a 42-inch stroke. The rotative speed is 75 revolutions per minute and the steam pressure 140 pounds. The engine is provided with a reheating receiver, and both the high and low-pressure cylinders may be by-passed if desired. The engine may be operated condensing or non-condensing as desired, a 28x16-inch air pump and condenser of the crank and fly-wheel type, provided with Corliss valves, having been furnished by the Allis-Chalmers Company. The pumps, two in number, are of the Worthington triple-expansion type with steam cylinders 13, 21 and 41 inches in diameter with a water cylinder 6½ inches in diameter, all with a stroke of 24 inches. The pumps work against a pressure of 1,000 pounds per square inch. There are also



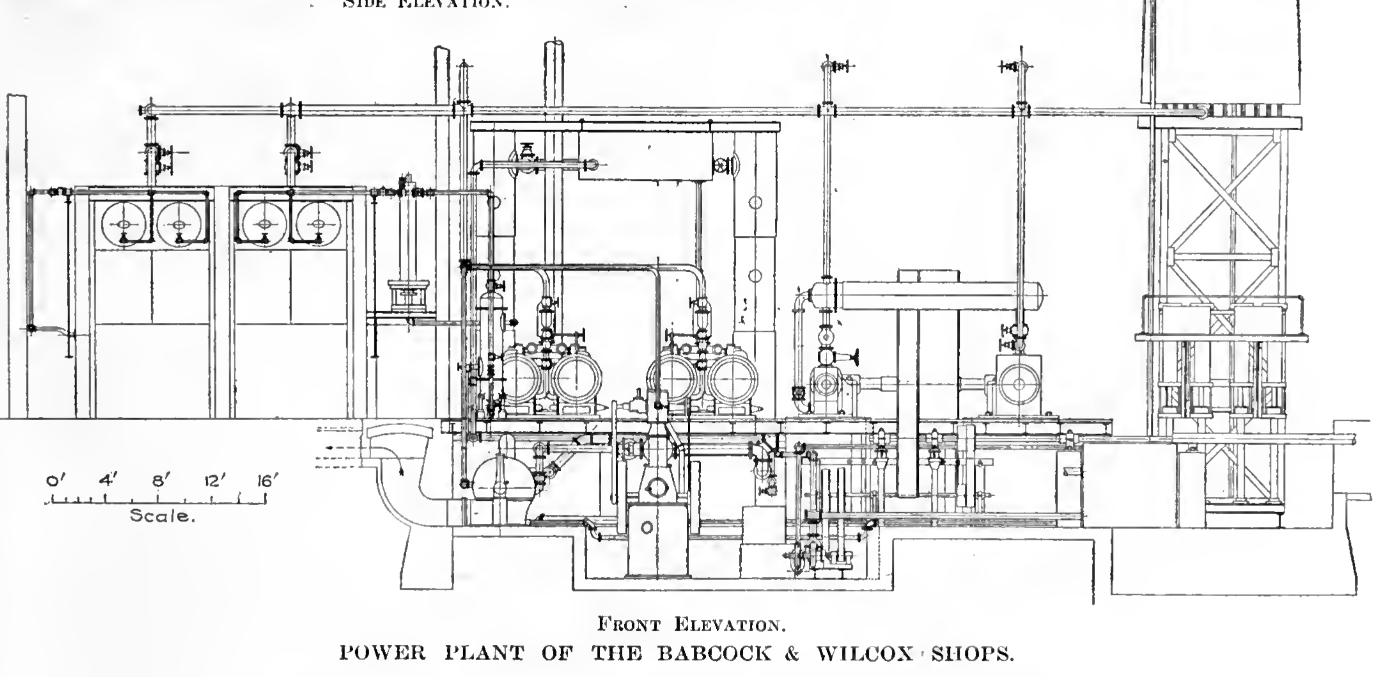
COAL TRESTLE AND TUNNEL.



PLAN.



SIDE ELEVATION.



FRONT ELEVATION.

POWER PLANT OF THE BABCOCK & WILCOX SHOPS.

two Worthington Underwriter fire pumps with 14 and 7¼x12-inch cylinders. These are placed in the basement of the engine room. Ordinarily the main engine and the Worthington high-pressure pumps are operated condensing. The pipe leading to the condensers is provided with an atmospheric exhaust containing a relief valve, as is the usual custom. The exhaust steam from the air pump is also turned into the condenser, while the exhaust steam from the boiler-feed pump is utilized in a feed-water heater made by the Goubert Manufacturing Company.

The fly-wheel of the main engine is 17 feet in diameter and 4 feet 8 inches in width of face. It is turned for a 34-inch belt leading to the main shaft in the drum shop and for a 16-inch belt leading backward to a shaft in the engine room basement. The latter serves to drive two Ingersoll-Sergeant two-stage, Class J, air compressors used to supply pneumatic tools throughout the shop. One of these has cylinders 14 and 7¼x12 inches and one, 24¼x 16¼x16 inches. The electrical equipment was supplied by the Diehl Manufacturing Company and consists of two 125-kilowatt belt-driven generators running 125 revolutions per minute

Each line is belted to a 100-horse-power motor located on the floor at the middle of the bay. There is also a 30-horse-power motor to drive machinery in the carpenter shop, a 10-horse-power motor for job work in the pipe department, and various motors connected to the traveling cranes and to several blowers for the supply of air to the heating furnaces. Means are provided for driving the small blowers for the heating furnaces as fires in them have to be started early in the morning before the main plant is in operation.

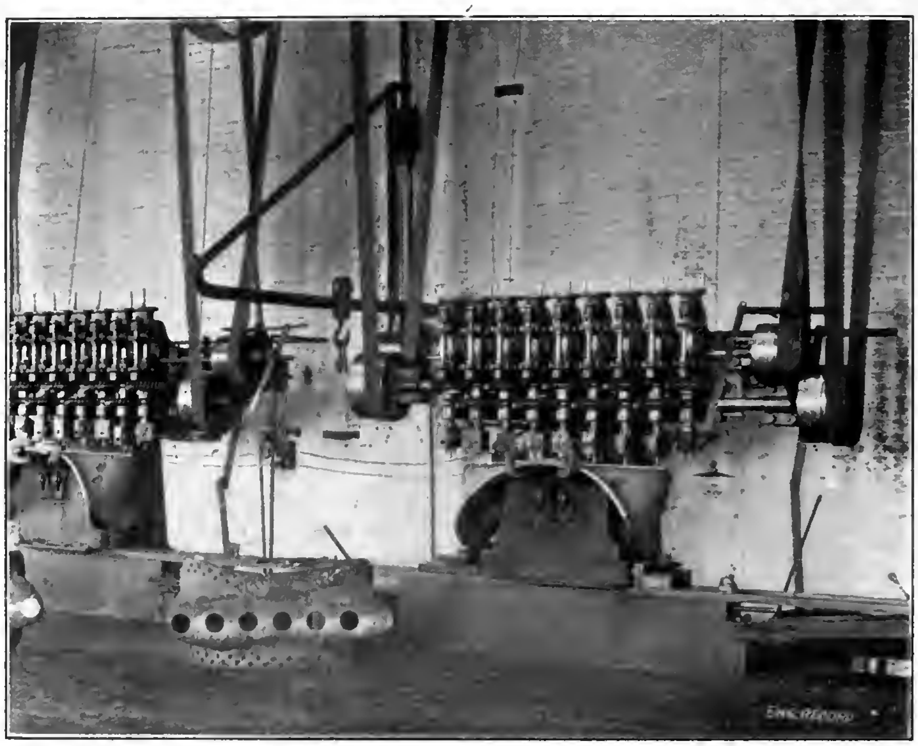
There are five systems of pipes distributed through the shops: four of them hydraulic under 80 pounds, 600 pounds, 1,000 pounds and 5,000 pounds pressure, and an air line of 100 pounds per square inch. Power lines are run to each interior column in the machine, forge and drum shops, so that electric, hydraulic or pneumatic tools may be supplied.

The 80-pound line is salt water obtained from the condenser discharge, and it is connected to an elevated tank supplying the fire protection system, the water closets in the toilet rooms and the testing departments, the drums and sections being filled with this water before the water under higher pressure is turned on.

elevated somewhat to give a pressure on the pump suction and insure smooth operation. The tank is connected to two vertical drums or stand pipes and the pump suctions connect with these at a point about three feet from the bottom, so that mud can settle there, whence it is blown off. The drums are cross-connected at the bottom. The water used for the hydraulic presses is returned to a tank in the engine-room basement and a centrifugal pump elevates it to the suction tank mentioned. This system is connected to an accumulator, which, as it rises or falls, governs the speed of the pumps by means of a cord connected to a pump governor.

The 5,000-pound line receives water from the 1,000-pound system, the pressure being increased by an intensifier which is an hydraulically operated pump receiving water at both ends from the 1,000-pound line, the difference in areas of the two cylinders enabling the intensifier to increase the pressure on the discharge by the amount stated. The discharge from the motor end of the pump returns to the lower tank. The system is also provided with an accumulator governing the action of the intensifier.

Multiple Tool for Boring Headers.



Multiple Tool for Drilling Cross Boxes.

and one 75-kilowatt belt-driven machine running at 550 revolutions per minute. The latter is driven by a Westinghouse compound engine, and is used for lighting when the main engine is not running. The voltage used throughout is 220 volts, and all machines connect with both the light and power service. The lights are controlled by nine circuits connected with the switchboard, one each to the drum shop, forge shop, machine shop, office building, shed, power house and toilet room and two circuits controlling the yard lights. There are five power circuits, two to the machine shop, one to the traveling cranes and drum shop and two to the machine shop in the forge department. There are three lines of shafting in the machine shop. One is in the eastern bay, supported over the interior columns and divided into three sections, each driven by a 30-horse-power motor mounted upon an elevated platform against the east wall. The remaining lines of shafting, two in number, are located in the western bay, one supported over the interior row of columns and the other from the lower chord of the roof trusses close to the west wall.

Salt water runs from the river to a well outside of the power house through an 18-inch brick conduit. The discharge from the air pumps empties into a hot well from which a centrifugal pump elevates water to the elevated tank for the 80-pound system. The remainder of the condenser discharge goes to waste in the sewer. While the fire protection lines are connected to this system, they are also connected to the fire pumps which can draw water from the city mains, and by means of the closure of a check valve in the connection to the tanks the pumps can increase the pressure on the fire-protection system.

The 600-pound line is supplied by a double-plunger pump located in the forge shop and belted to the shafting. This pump draws salt water from the elevated tank and the system is used to test headers, drums and boilers. An accumulator is connected to this system, and as the pump is belt-driven, the pump is arranged to by-pass when the accumulator is filled.

The 1,000-pound line contains fresh water that is drawn from a tank in the engine room,

The 80-pound line is composed of standard wrought-iron pipe and screwed fittings; the 600-pound line of extra heavy pipe and extra heavy screwed fittings; the 1,000-pound line of extra heavy pipe and extra heavy screwed fittings; and the 5,000-pound line with double extra heavy pipe and double extra heavy malleable fittings. The 1,000-pound line is used for hydraulic riveting and operating hoists, etc., and the 5,000-pound line for the heavy bending, flanging and forming processes in the forge and drum shops.

The boiler feed-water can be drawn from the city mains, from the fresh water tank for the 1,000-pound hydraulic system, from the heating system, and, in cases of emergency, from the salt-water supply. The boilers are operated under a pressure of 200 pounds per square inch, but the elevated position of the boilers over the heating furnaces in the forge shops requires that a slightly greater pressure be exerted or about 210 pounds over the feed pump discharge. To control the speed of the pumps and insure quiet running to meet this unusual condition an accumulator is placed in the boiler feed line and the position of the accumulator is utilized to control the speed of the pump which works against a constant head of about 210 pounds. The boiler-feed pump forces water through the Goubert heater, the Green economizer and thence to the boilers. The heater and economizer may be by-passed if desired. The returns from the heating system are carried back to an automatic pump and receiver and are delivered to the feed line inside of the feed pump.

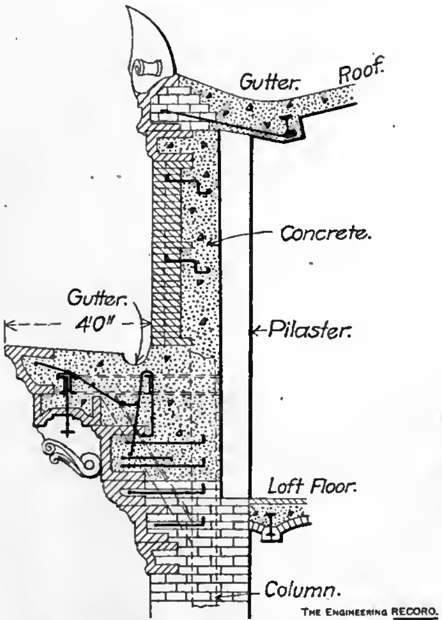
The heating system of the buildings comprises direct radiation. It was designed by the Paul System Company and installed by Baker, Smith & Co., of New York. Wall coils are used to counteract the cooling effect of the windows and ceiling coils are run along the interior row of columns in the machine and drum shops to offset the heat loss from the windows in the sides of the monitors. Exhaust steam from the main engines, pumps and auxiliaries is used for heating, although live steam at reduced pressure may be used if desired. The Paul system of relieving the heating apparatus of air is employed.

Excellent sanitary arrangements are provided for the workmen; a special building containing lavatories, closets and shower baths. A Merritt expanded metal locker is provided for each employe, and these are placed around the buildings convenient to where the men are working. A separate locker room is provided for the employes of the forge shop.

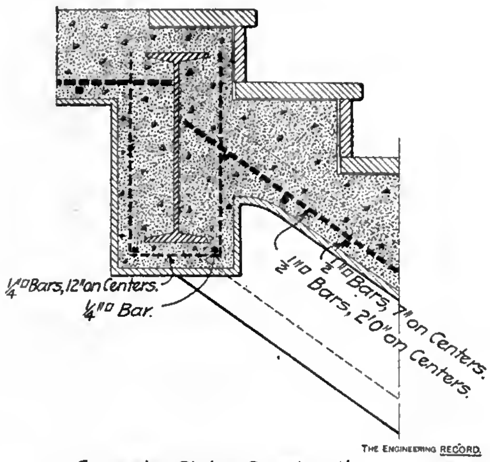
The contractor for the steel work of the buildings was the Riter-Conley Manufacturing Company, of Pittsburg, Pa. Mr. John W. Ferguson, of Paterson, N. J., was the contractor for the masonry and carpenter work. The shops were designed by the engineers of the Babcock & Wilcox Company, and the supervision of the contract work was in charge of Mr. S. J. Harwi assisted by Mr. M. M. Price, both of that company.

The Public Bath at the Fourteenth Street pumping station, Chicago, gave 58,603 baths during 1901.

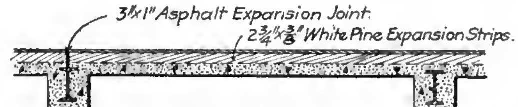
Transit Dues on the Suez Canal are to be reduced 50 centimes (9.6 cents) a ton on and after January 15, 1903.



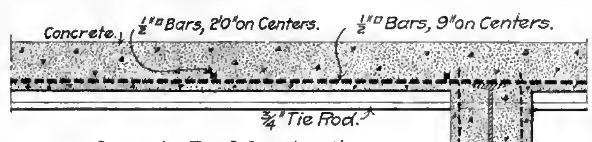
Concrete-Steel Backing for Cornice and Loft Walls.



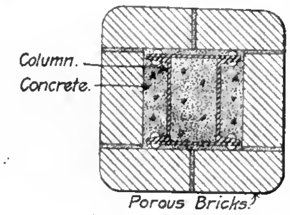
Concrete Stairs Construction.



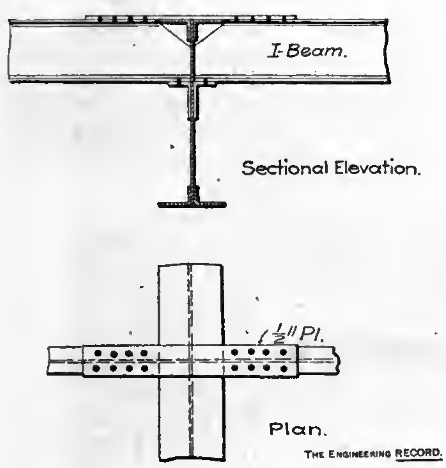
Expansion Joints in Roof.



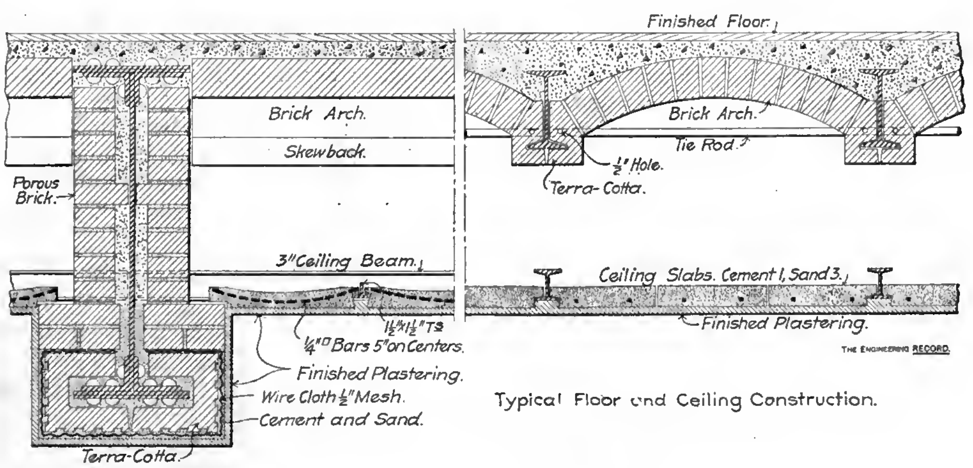
Concrete Roof Construction.



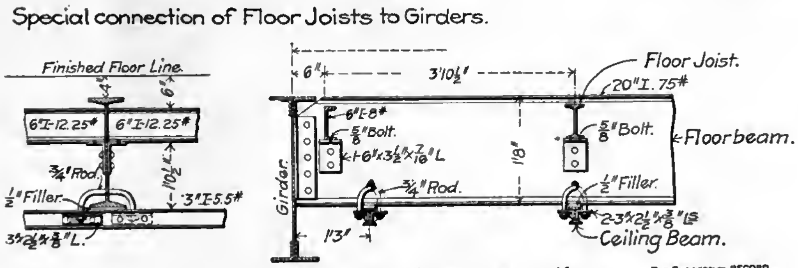
Column Protection.



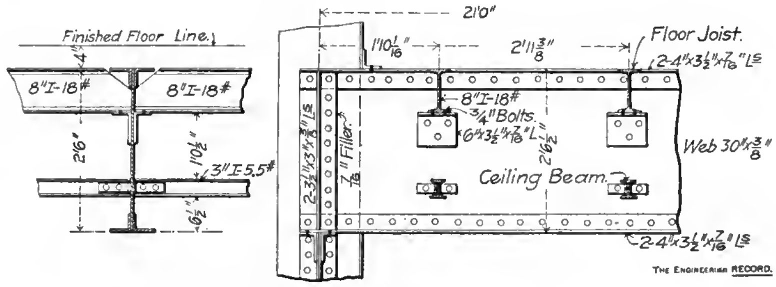
Special connection of Floor Joists to Girders.



Typical Floor and Ceiling Construction.



Typical Floorbeam and Girder connections.



Connection of Floor Girder to Column.

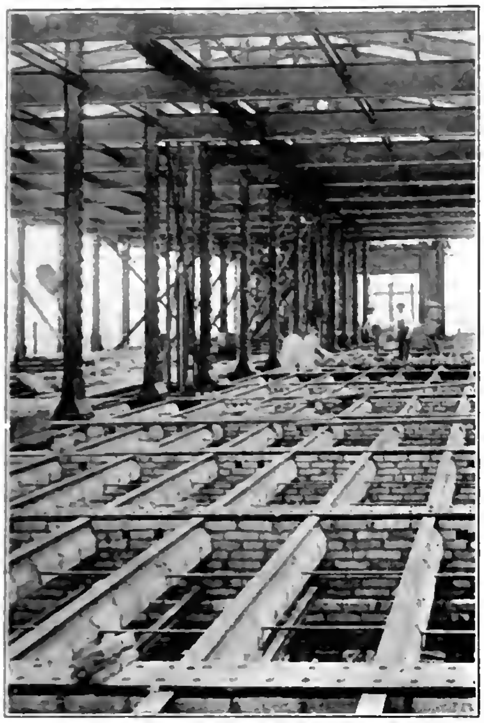
DETAILS OF FLOORS, ROOF AND FIREPROOFING.

Floor Construction and Fireproofing in the Government Printing Office, Washington, D. C.

The new building for the Government Printing Office is U-shaped in plan and has fronts of 408 feet on G Street and 175 feet on North Capitol Street, with a 30x165-foot light court between the two main wings. It has a basement, seven stories and a loft, rising to a height of about 132 feet above the sidewalk. It has steel columns and girders and principally brick masonry and is being built under an appropriation of $2,429,000.00 for its construction and equipment. Captain John Stephen Sewell, engineer corps, U. S. A., is in charge of construction, and under his direction the structural work has been completed.

Every floor is proportioned for a maximum dead load of 125 pounds per square foot and a quiescent live load of 300 pounds per square foot. Where the live load is a vibrating one it will not exceed 125 pounds per square foot. It was thought justifiable to use an unusually high unit stress in the steel work and to require a high quality of materials and workmanship. A unit stress of 18,000 pounds per square inch was therefore adopted for I-beams and girders, and it was required that all rivet holes should be punched small and reamed after the pieces were assembled. Open hearth steel with an ultimate strength of 63,000 to 70,000 pounds and an elastic limit of at least 55 per cent. of the ultimate was specified and the amount of steel required was thus reduced 800 tons below what would have been required if the work had been proportioned for ordinary unit stresses.

The main columns are about 12 feet apart in six longitudinal rows with one center space of about 31½ feet and four side spaces of about 35 feet between the rows. All the floors above the first have 30-inch transverse plate girders about 12 feet apart, which support longitudinal



Fireproofing for Floor.

floorbeams about 3 feet apart, but do not carry the wall masonry. The girders are made without web stiffeners except over the end bearings, where they rest on shelf connections riveted centrally to the column webs, and are not web riveted to the columns. The ends of the girders project between the webs of the wall columns, and are seated on horizontal angles riveted to vertical diaphragms which connect both column webs as shown in the elevation of one end of the girder. The opposite end is supported in the usual manner by a shelf angle having its flange reinforced by vertical angles riveted to the face of the interior column. At both ends of the girder horizontal angles are riveted across the top flange and to the face of the column. In some cases 20-inch 70-pound I-beams are used instead of the girders, and are supported by substantially the same column connections.

On account of their long spans the floor girders are so deep that there is a considerable distance between the floor and ceiling which together enclose all the steel construction, and the ceiling is supported on separate longitudinal I-beams, independently of the floor. The floorbeams have their top flanges flush with those of the girders and are beveled to clear the latter. In order to carry the tension stresses of horizontal forces in the planes of the floors those beams near the walls have their top flanges spliced together by horizontal plates field-riveted across the girder flanges. The regular connections of the beams to the girder webs were considered almost strong enough to transmit the maximum tension from wind stresses, but the tie plates were added as a precaution and to make the building much stronger horizontally.

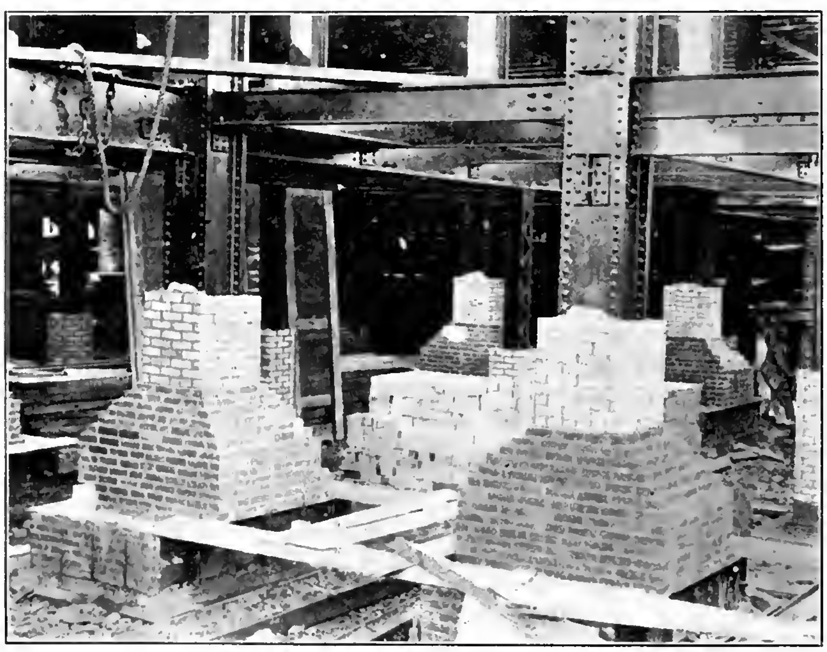
In the regular panels the ceiling beams are web connected to the girders, but in some special panels the floorbeams are transverse and are connected to 20-inch longitudinal I-beams about 2½ feet long and 7 feet apart which are web connected to the main girders. Here the ceiling beams clear the bottom flanges of the longitudinal beams, and are suspended from them with U-bolts as shown in the detail. In the first floor the main transverse girders are 20-inch I-beams, spaced like the plate girders in the upper stories and supporting 10-inch longitudinal beams about 5 feet apart. Each

Fireproofing for Ceiling.

of them is supported in the center by a single story basement column over the top of which the beam is continuous. At one side of the building there is under the sidewalk a storage vault about 20 feet wide and 230 feet long, which is covered with a solid floor having 10-inch transverse beams, 6 feet apart. These are supported at both ends on the vault walls and in the middle by a line of 15-inch longitudinal beams carried on cast iron columns about 12 feet apart. The double pitched roof has, in the planes of the floor girders, 20-inch I-beam rafters, supported on the center and wall columns, and carrying 7 longitudinal lines of 7-inch I-beams about 7 feet apart.

The machines in the building are driven by a large number of individual electric motors, and as it is necessary from time to time to change the arrangement of the machines and the electric lights the floor system was designed with especial reference to the convenience of relocating the motors and wiring system and so that holes could be easily cut through or be filled up in any place without injury to the strength of the construction. Lights suspended from the handsomely finished ceilings must also be moved without disfiguring the ceiling, and it was decided to take advantage of the space afforded by the depth of the long span girders to make the floors and ceilings separate with sufficient space between them for a man to pass through all places between girders, and to run all wires and cables in this space where they are protected from fire and are always accessible through manholes. To this end the floors have been built and the girders fireproofed, as shown in the view of the underside, and then the wiring has been done before the ceilings were built. Subsequent changes will be made by men crawling between the floor and ceiling.

In bidding for the fireproof floor construction contractors were requested to submit plans of special construction to conform to the conditions and requirements, but most of them failed to modify their usual types, and all bids were rejected. Specifications were then prepared and contracts awarded on them for segmental brick arches for all the main floors and for reinforced concrete flat slabs for roof, ceilings and stairways. The segmental floor arches 4 inches thick are made as shown in the detail sections, with solid porous terra cotta bricks set on very heavy skewbacks of the same material which have projecting lips 1½ inches thick to protect the lower flanges of the floorbeams. These lips, which are usually the weakest point of a beam protection, meet with a very thin mortar joint and are believed to be strong enough to resist any ordinary fire stream unless accompanied by prolonged and very intense heat. Where it would have been difficult to build the brick arches on account of irregular beam framing or where it was desired to have a sloping floor on level beams, the arches were replaced by steel-concrete slabs with the beams entirely enclosed in the concrete, as shown in the sections of the roof. The arches are leveled up with concrete above the tops of the steel beams, and in the working rooms the floors are finished with hard maple blocks, laid herring bone pattern in Neuchatel asphalt.



Fireproofing for Columns.

Originally the floorbeams were designed to be 12-inch I-beams 6 feet apart, thus affording space for a man to crawl only in the middle between each pair of beams under the crown of the 4-inch floor arch, but not allowing him to cross over the ceiling beams from one panel to another of the floorbeams. It was afterwards thought better to make the floorbeams only 8 inches deep and 3 feet apart, thus enabling a man to crawl under them on the ceiling and saving about 60 per cent. of the manholes and their expensive framing, an economy that offset to a considerable extent the extra cost of the several hundred tons of additional steel in the floorbeams.

The ceiling beams are 3 inches deep, about 3 feet apart, and support on their lower flanges transverse T-bars 2 feet apart. The T-bars carry 2-inch slabs of cement and sand reinforced with steel roofs. These slabs have drop ends which bring the lower sides below the I-beams and T's and leave the top flanges of the I-beams exposed, ready to carry insulators. The wires can be strung from the tie rods between the webs of the main floorbeams which were not considered necessary as tension members. Holes were punched through the girder webs and enameled iron pipe conduits are put through them to carry the main electric cables and protect them, while leaving them accessible.

The lower flanges of the main girders are protected by shoes of solid porous terra cotta, 2½ inches thick, filled with mortar and squeezed on. They are then wrapped with wire lath, plastered with cement mortar, and the 4-inch walls of solid porous terra cotta are built up each side of the girder web, and the spaces between the terra cotta and the girder are filled solid with cement mortar. Where the columns are not enclosed in the walls of red bricks made of unusually refractory clay, they are fireproofed by a 4-inch thickness of porous terra cotta enclosing them, and the spaces inside the columns and between them and the terra cotta are filled solid with Portland cement concrete.

The roof is made, as shown in the detail, with flat slabs of concrete about 5 inches thick reinforced with steel bars and extended to enclose and protect the purlin beams. It is divided into panels about 12 feet wide which reach from the eaves to the ridge, and are bounded on all sides by expansion joints. The longitudinal joints at the ridge and at the eaves are filled with asphalt, 1 inch wide and 3 inches deep. The transverse joints ⅜ inch wide are filled with thin pine strips bedded edgewise in the concrete. The stairs have steel girders and strings which are enclosed in the solid concrete moulding for the steps, as shown in the detail.

The brick walls terminate at the loft floor, where the lower courses of the terra cotta cornice are bonded into them. The cornice blocks are supported partly from a pair of 6-inch channels and a single line of 6-inch channels carried on horizontal brackets riveted to the columns. They are also anchored into the solid concrete backing which fills their concavities and locks them together while forming a massive gutter, on the inner edge of which there is a thin brick face wall built up to the eaves and backed with concrete, to which the brickwork and cresting is anchored. All terra cotta is made of very refractory, tough clay and is set, without grouting, in 1:3 American Portland cement mortar. The terra cotta and concrete used were, 4-inch brick arches, 311,000 square feet; ceilings, 227,900 square feet; roof, sidewalks and stairways, 101,100 square feet; rolled and riveted girders, 35,100 linear feet; columns, 4,438 linear feet. The terra cotta was furnished by the Fawcett Ventilated Fireproof Building Company, Limited. The concrete floors and roof were built by the Brennan Construction Company. The common bricks and red face bricks were furnished by the Frederick Brick Works, the enameled brick by Andrew Ramsay, and the white face bricks by E. R. Diggs & Co. The Phoenix Iron Company is the contractor for the structural steel work.

The Practical Operation of Sewage Purification Plants.

Paper prepared for the Annual Convention of the American Society of Municipal Improvements, at Rochester, Oct. 10, 1902, by John W. Alvord. Slightly condensed.

The revolution in sewage purification processes which has taken place in the last six or eight years has brought to the front a good deal of intelligent discussion on the proper design of sewage purification plants based on the new biolytic methods, and there has been a large amount of investigation into the chemical and biological processes involved, both by experiments in the laboratory and by means of miniature installations. All of this has been extremely necessary, interesting and valuable, but it must always be realized that much more valuable information as to the real nature of the problem has been already secured and will be secured from the study of the actual operation of full-sized working plants than will be obtained from any other source of information.

Financial Disadvantages.—The purification of sewage is not generally a popular municipal project. It is often undertaken as the result of long litigation, and by reason of some adverse court decision compelling action. A sewage purification plant produces no revenue, and it cannot be said to be a paying investment financially, except when viewed in the most indirect manner. Unlike water works, sewage plants cannot grow in value with added years, through the increase of municipal business, but must rather become year after year an added burden to the city officials, not only for proper maintenance but for important and necessary extensions as well. It therefore generally happens that officers charged with the care of such plants are desirous of economizing in various ways, in the endeavor to show that they may save their city useless expenditures, which predecessors in office had not found possible. Often the curtailment of necessary appropriations results in practical abandonment. Certain plants may be pointed out to-day in which official mismanagement, and not poor design, is responsible for apparent failure. Scarcely ever may the plant be found which is properly financed after the first year or two.

Physical Unattractiveness.—The subject of sewage purification is not an attractive one to the average citizen. A plant has usually to be located out of sight so that it may be out of mind. The idea is prevalent that it is a municipal eyesore, to be hidden if possible, which may be a necessary evil, but never a source of interest. Common imagination credits it as being a place of bad odor and revolting conditions, which must be avoided when one walks or drives. The idea that it can be a place of interest and source of information is only acquired after it has proved its inoffensiveness, and the slightest relaxation from a good record creates a prejudice which weeks of good conduct cannot overcome.

Termination of Expert Supervision.—The termination of the expert supervision of a sewage purification plant usually takes place a few weeks after its completion. The engineer who had charge of its design and construction, studied every phase of its environment, knows the kind, quantity and variations of the sewage to be dealt with, understands how such variations are to be met, and who will be equal to any emergencies, is dismissed and the plant is turned over to a place hunter, perhaps, or is forced on some unwilling city officer with other duties which already fill his time. This is wrong, and to this condition can be traced many cases of dissatisfaction on all sides. The engineer who has carefully designed and constructed a sewage disposal plant should be retained to supervise its operation for at least a year after it is started.

Tendency to Over-confidence.—One does not have to be long interested in sewage purification to observe the tendency to undue optimism among those engaged in planning or promoting sewage works. Not only is this the case with those connected with patented or proprietary processes, but even engineers designing or constructing plants are rather prone to enthusiasm over prospective performances. This is noticeable particularly in the many descriptions of new plants which are published. It is of course interesting and valuable to have these published accounts and know how each designer proposes to meet the problem he has to face, but new plants do not add to our information as to how sewage purification should be operated. A plant should be six months old before it is interesting and a year old before it is valuable from the standpoint of operation. Two years' operation ought to enable one to form an opinion of it, and three years ought to decide its merits if carefully worked all of that time. Too often the plant is pronounced a success by its originator in the first few weeks, and if a few good analyses, not difficult to obtain in new plant, can be added to the statement, so much the better.

Proprietary Claims.—The endeavor to obtain a monopoly of the field of sewage purification by the owners of proprietary processes and patented claims has for some time past made it difficult for the sanitary engineer to hold his field of activity in this line of work without some embarrassments. It is not easy to convince city officials that sewage purification is a matter in which study and constant care in operation will tell, in the long run, better than the guarantee of a strongly financed company. There is no patent now in the field that is particularly useful or valuable, as has been well shown by Mr. Leonard Metcalf, in his paper before the American Society of Civil Engineers. It is coming to be seen that in large plants skilled operation is as necessary as intelligent design and construction.

The Septic Tank.—It is frequently assumed that the septic tank once installed needs no particular supervision, that it operates wholly without attention, save, perhaps, a yearly cleaning. Now it has been well demonstrated that this is not true; that the septic process is, like all sewage processes, subject to natural variations which must be watched and governed if the best results are to be expected. The particular function of the septic tank is to break down the suspended matter into a manageable state. That this result can be attained by properly designed tanks, carefully operated, has already been fully demonstrated. The compartment system of control, original with the writer, allows the operator of a plant to adjust the fermentation period of the sewage to its quality, the temperature of the weather, and the volume of flow, regardless of the total capacity of the tank. This is accomplished by dividing the tank into a number of compartments of unequal size, opening into each other by troughs and gates, so that one, two, three or more may be combined as may be desired. Thus, if a tank has been constructed for large future requirements, and the early sewage reaching the plant is small in quantity and weak in quality, indicating the desirability of a brief rest period in the tank, enough compartments may be cut out to produce the desired result. The colder temperature of winter invariably lengthens the fermentation period, and in such cases an added compartment may be thrown into use. A thick and concentrated sewage requires a longer fermentation period than a thin and dilute one. An increasing flow of sewage, due to growth of the city or increased number of connections, may be provided for by the use of an increased number of compartments.

Evidence of Proper Regulation.—To one who has watched the effect of this method of regulation on the character of the effluent of the septic tank, no question could arise as to its importance and necessity. The addition or deduction of one compartment in a five-compartment tank will ordinarily produce an effect on the effluent easily determined by the unaided eye of anyone who has had experience in judging sewage effluents. An effluent producing a marked odor of sulphuretted hydrogen has usually been too long within the septic tank and is difficult to treat in the second, or anaerobic stages. It has been clearly shown that the nitrification of such effluents is exceedingly difficult or impossible, and the theory is advanced that the anaerobic bacteria have created toxins inimical to their own life and activity. A septic tank whose effluent shows advanced decomposition is plainly too large for the quantity then flowing, and the best results cannot be expected nor obtained in the secondary treatment of the impurities. On the other hand, an effluent containing large quantities of suspended matter suggests that there is not a proper length of fermentation period to break down the suspended particles. The writer has frequently observed the addition or deduction of a compartment to show a distinct and marked influence on the suspended matter coming over from the septic tank. The sewage enters some septic tanks in such a way that it evidently traces a path through the center, and its stay is not well averaged. This difficulty can only be obviated by modifications in design which will more evenly distribute the incoming sewage. By the experimental use of coloring matter it has been observed that great improvements may be made in evening the flow by multiplying the number of inlets and carefully arranging them so that the liquid shall be as evenly divided between them as possible.

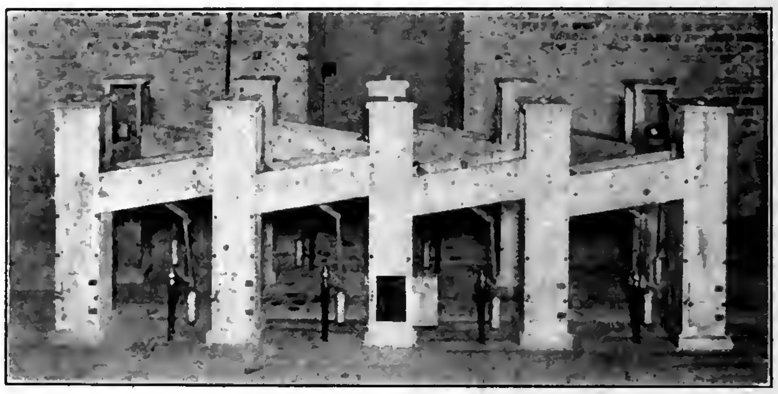
Effects of Proper Regulation.—The proper regulation of the septic tank is of great importance not only because it produces high efficiency for the tank itself, but because it also enables the secondary stages to be operated with equally high efficiency. A septic tank effluent which is in advanced stages of decomposition is not easily reducible in the secondary application, and an effluent containing much suspended matter will check and clog the secondary filters in a short time. The ideal septic tank effluent is one in which the organic matters in suspension have been resolved into the constituent gases or dissolved in solution, and in which no suspended matter is present or no serious decomposition observable. This result is usually obtained with average domestic sewage in this country with from four to eight hours' fermentation. Some particles of suspended matter may from various causes be detained in the tank many days while others are hurried on to the outlet.

Where septic tanks are followed by intermittent filtration, proper regulation insures a minimum of labor in caring for the beds; and it is also observable from actual experience that tanks properly run do not accumulate sludge to any considerable extent on their bottom or an undue thickness of scum at the top. Of the 17 tanks which the writer has so far installed and watched, in some cases over four years, only one has had to be cleaned so far, and in this case the occurrence was due to an only partial familiarity with this principle since satisfactorily demonstrated.

Fallacies of Analysis.—Contrary to the usually accepted opinion, the proper operation of sewage purification plants does not at all require that analyses be taken in order to understand and govern operation. There are many signs by which one may judge of the efficiency of a plant without resorting to the tedious and delicate work of the chemist or bacteriologist. For instance, flaky black matter in the effluent is evidence of more or less completed decomposition, and quantities of white humus are likewise indications of insufficient anaerobic action. Ordinarily in plants which are not imperiling a neighboring water supply it is thought sufficient if secondary decomposition be prevented. This is easily determined by sealing a small quantity of effluent in a bottle and letting it stand for two or three days. The appearance of black flakes by this time denotes that the impurities were not wholly removed, while the non-appearance of such black ash, and the absence of any odor of ammonia when the bottle is uncorked would ordinarily denote results entirely sufficient in all ordinary practice. Analyses are so often misleading in sewage purification work, especially when published for advertising purposes, that one may well grow wary of them. The enthusiasm which leads the designing engineer to look with hopeful assurance upon his newly created work seems to infect with the same optimism the judgment of those who publish analyses showing the work of purification. Too often is it the fact that very large inferences are drawn from exceedingly slender data and among those whose knowledge of the subject is slight or superficial, widespread misrepresentation often results. About four years ago, while studying sewage purification for a city of considerable size, attention was attracted to some exceptionally good results produced by a novel plant, analyses of the effluent from which were reported in the engineering press. A journey followed as the result of the article, and when the Mecca was reached the odor from the plant could be detected perhaps a half-mile away. It was a severe lesson, but an efficient one, and since that time analyses, unless frequently made, long continued and well certified, have lost their weight and influence with the writer.

Percentages.—Another of the fallacies which often deceive the student of sewage purification work is the determination of the results from any given plant in percentages of organic matter removed. A plant is reported as removing 99.99 per cent. of the organic matter in the original sewage. This naturally seems to be excellent work. Another plant is reported as removing but 80 per cent. of the organic matter, which according to the point of view may or may not be supposedly poor. As a matter of fact, the 80 per cent. plant may actually be doing a great deal better work than the 99.99 per cent. plant. The fallacy lies in this: it is comparatively an easy matter to obtain large percentages of removal from a strongly concentrated sewage, while it is an exceedingly difficult matter to obtain such a large percentage from a very dilute sewage. It may be possible that the removal of 80 per cent. of organic matter from a very slightly polluted water may produce an effluent which is relatively much purer than the effluent from the plant removing the 99.99 per cent. of organic matter from a very thick concentrated sewage. It is, therefore, always necessary to know the relative strength of the original sewage before deciding from percentage figures that a plant is doing very high-class service.

Contact Beds.—A great deal has been written on the proper management of contact beds, especially from English sources. Presumably we are in possession of many of the facts necessary to successfully operate contact beds, and it must be admitted that so far a good deal of the information is derived from the working of full-sized plants, and is well demonstrated. There are, however, many things about the working of such plants which may be profitably investigated. It may, first of all, be pointed out that arbitrary lengths of time for the sewage to remain in contact with the grain of the contact filter is not in accordance with what we know of the fluctuations in the character of the sewage. The fineness of the grain of the filter, the character of the liquid to be treated, the amount and fineness of the suspended matter which it carries, the temperature of the air and of the sewage all must reasonably be expected to have some bearing on the length of time which the sewage is kept in contact, and yet almost every automatic device now available fixes the time of contact by the quantity of inflow. The rate of inflow may and usually does vary within wide limits and in a way which may be quite different from the operator's ideas of the correct contact period required. Indeed, as usually operated, there is no chance at all for experiment as to what the correct contact period should be in any particular case. It is as evident here as it is with the septic tank that if the proper and most efficient contact period for any given strength of sewage, temperature of air or



Automatic Controlling Device, Sewage Purification Plant, Lake Forest, Ill.

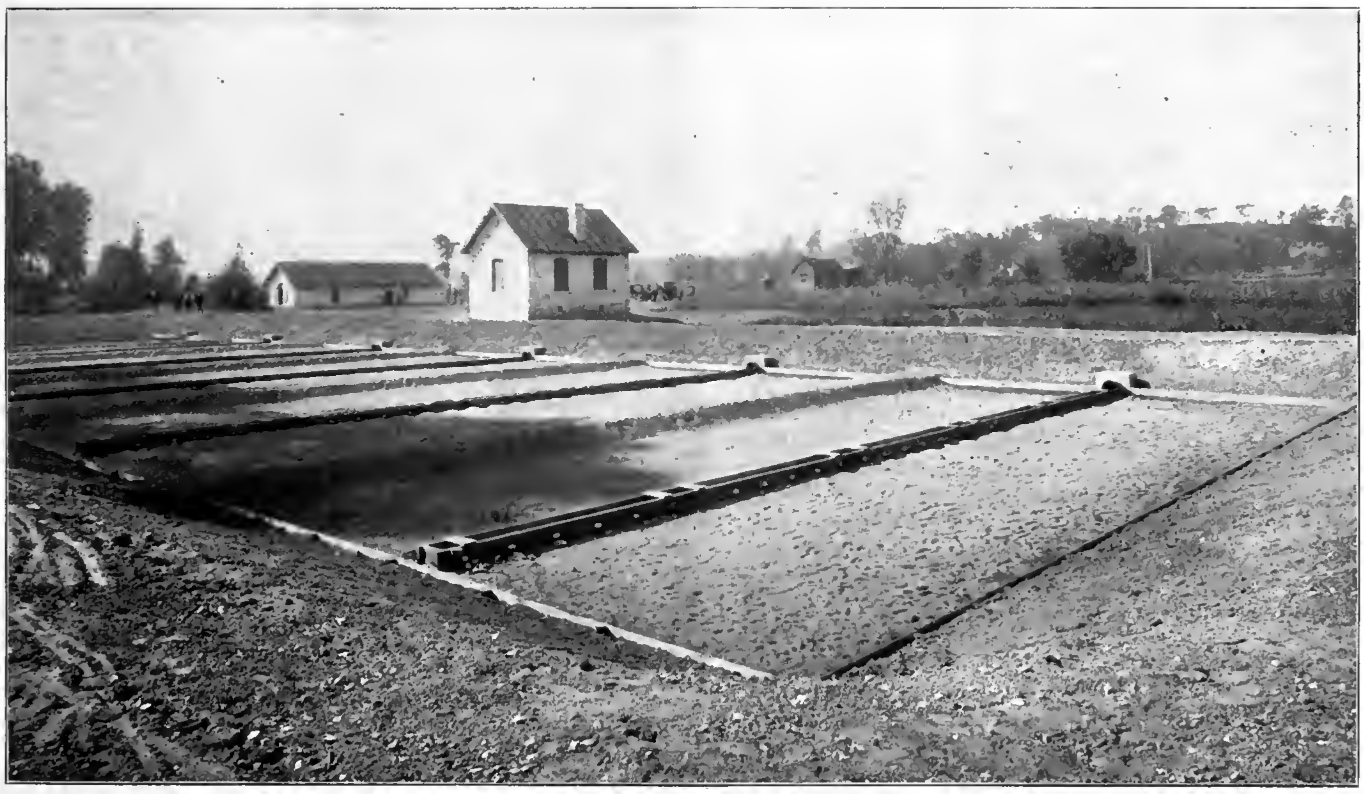
liquid, and fineness of grain could be experimentally determined, the efficiency of the plant might be largely increased. There is room for great improvement over present methods of control.

Leakage.—One of the minor difficulties in the operation of contact beds in the smaller plants is the question of leakage. A slight leakage of the valves of the automatic device, or of the contact bed itself, is generally sufficient to greatly retard the contact period, and even altogether defeat the operation of the beds. An engineer cannot be too careful in superintending the construction to be certain that the contact bed is thoroughly water-tight before putting in the contact material. The best form of automatic device for preventing leakage seems to be that which relies upon an air cushion for opening and shutting off flow. Ordinary valves will often either work very stiffly after a while and finally stop the automatic device from working at all, or else will be so loose and leaky as to allow a large portion of the incoming flow to escape before the bed is filled.

Supervision.—In installing automatic devices of any kind, and making recommendations for their management, it is a great mistake to assume that they do not need some supervision. Much has been expected in the practical operation of sewage purification plants from the many automatic features which have recently been introduced. It has been thought that with the newer biolytic processes supplemented by automatic devices for intermittent filtration or double contact work little or no annual operating expense would result. That this is true must not be denied, and that it does and will result in a larger adoption of sewage purification processes in the near future is certain; but it must be pointed out that there is a great danger in going from one extreme to the other, and for the designing engineer to intimate to the city authorities that he is about to give them an automatic plant which will require no renewals and which will practically run itself year in and year out, is at once to create the impression that no expense at all will be necessary, and that the city is purchasing something which can be put off in the most remote ravine adapted to the purpose and there left to be forgotten by everyone connected with municipal responsibilities. No plant, however automatic it may be, however perfect its appliances for preventing manual labor can be left alone, unless possibly one might except the small plants for household service.

Intermittent Filtration.—In the operation of plants consisting of septic tanks followed by intermittent filtration as a second stage, great gains have been made by the introduction of automatic devices by which the effluent from the septic tank may be rotated on to the intermittent filtration beds. Such devices are operated by the falling sewage. This not only dispenses with the services of a man who must divert the flow day by day, but makes the action of the beds much more regular and systematic, eliminating the contingencies of night, Sundays and holidays, which would naturally prevent uniformity in operation by hand. Then, too, the greatly lessened area of filter bed required for septic tank effluent means that there is the necessity for much more rapid diversion of the sewage from one bed to another than was formerly the case in intermittent filtration practice, and this almost puts it out of the question to employ manual labor for this purpose. Nowhere is the necessity for careful regulation of the septic tank more evident than it is in a plant of this character. If the septic tank effluent is filled with suspended matter, even finely divided, and the sand of the bed is of fine grain, very careful management is necessary.

Lake Forest, Ill.—The Lake Forest plant, which has been under the writer's supervision during the past year, consists of a septic tank of about 50,000 gallons capacity divided into five compartments. The tank is neither light- nor air-tight. It has no patent arrangements for inlet or outlet, and is an open tank housed over with a light structure giving ample ventilation and opportunity for inspection, while preventing the hot sun of summer or the cold winds of winter from varying the temperature of the sewage to any unusual degree. After leaving the septic tank the sewage passes into a dosing chamber holding 7,000 gallons of liquid, and by means of an automatic device operated by the falling liquid, it is delivered in rotation on to ten intermittent sand filters consisting of the natural sand of the beach of Lake Michigan as found in place. The beds are of 3,200 square feet area each. At present these beds are working at the rate of 300,000 gallons per acre per day, their total area being ¾ acre. This sand is quite fine; 85 per cent. passing a sieve of 40 mesh, 42 per cent. passing 60 mesh to the inch. In practical operation it has been found that unless the septic tank was working at a maximum of efficiency, finely divided suspended matter coming over from the tank, would, in the course of time, seal the surface of the filters and render it necessary to hand-harrow them after the application of five or six doses. As each bed receives about two doses a day, this meant that the total area would have to be raked over twice a week. In the early operation of the plant the man in charge, failing to rake the beds at all, reported that there must be something the matter with the under drains as the sewage would not go through the beds. A visit to the plant at once revealed that the difficulty was due to negligence, and a little application of the rake soon broke up the surface skin and put the beds in normal shape again. Later, after the septic tank was better regulated, much less suspended matter came over on to the filters, and a great improvement was seen in the amount of care which the beds had to receive. With fine sand used at this plant, it is probable that there will always be from ten to twelve hours of labor per week necessary to keep the beds in good condition. The septic tank is now operating with 6½ hours rest period, the longest of any of the plants under notice, the sewage being thick and concentrated. The tank has not been cleaned during the year and no perceptible deposit has occurred.



Septic Tank. Controlling Chamber. Filter Beds.

SEWAGE PURIFICATION PLANT, WAUWATOSA, WIS.

Wauwatosa, Wis.—The Wauwatosa plant is constructed on the same lines as the Lake Forest plant. A septic tank holding 40,000 gallons of sewage, operated on the five compartment system, was constructed of concrete and covered with a plain brick house. The effluent is delivered to a dosing chamber in a separate structure containing about 6,000 gallons, which by an automatic device is delivered in rotation on to six filtration beds about $3\frac{1}{2}$ feet in depth. The sand of which these beds are composed is much coarser than that used in the Lake Forest plant, consequently it has not needed so much attention. One hand harrowing each week for each bed has kept the plant up to its maximum efficiency, and the effluent is clear and odorless after being kept in close stoppered bottles for several days. The automatic device has been satisfactory and has operated without stoppage for over a year. The tank is operated with about four hours' rest period, and with the exception of removal of surface scum once or twice has not needed cleaning. The filter beds are operating at the rate of 300,000 gallons per acre per day, but when high water prevails in the river they are discontinued. The sewage is growing stronger. The plant has been in competent hands from the very beginning, and is excellently managed.

Holland, Mich.—Two septic tanks at Holland, Mich., have been in operation over one year. The effluent is emptied into Black Lake. The sewage is not strong as the sewer system is not yet extensive, but the tanks are exercising a marked improvement on the impurities, and so far have kept free from deposit. The main tank is constructed with three compartments, and has a rest period at present of about two hours. The plant is not closely watched.

Glen View, Ill.—This plant originally constructed in 1898 has not been under the writer's observation for two years. One year it was entirely neglected. The last season it has had some attention. The septic tank is only a single compartment and the secondary stage consists of contact beds of coke. The writer is informed that during the past season these contact beds have been successfully operated as continuous filters. About 10,000 gallons of very concentrated sewage a day is cared for. When the plant is supervised the effluent is good. The tank has had to be cleaned at least once every year, and one year (1899) it was cleaned four times.

Princeton, Ill.—A 60,000 gallon septic tank has been in operation about one year. It is built on the five compartment system and housed over. It does not receive special attention, but good results are reported. If so, they are probably accidental. It has never been cleaned, but some deposit on the bottom is reported. The rest period is not known. The plant was designed with intermittent filtration as a secondary stage, but the city is now hoping that the first stage will be sufficient to avoid nuisance.

Danville, Ky.—Three septic tanks have been in operation here over one year. The largest is of 40,000 gallons capacity, and is followed by intermittent subsoil filtration. It is reported to be working well, but receives no special attention. It is perhaps too early to draw conclusions concerning it. It has not required cleaning as yet.

Highland Park, Ill.—A small septic tank has been in operation on the West district for two years. It has received no attention whatever and has caused no complaint as yet; it has never been cleaned. It is said not to be unduly filled with deposit. The effluent is reported as good, but the sewage it receives is not strong. It is noticed as a matter of experience that weak or thin sewage is not generally exacting in its treatment.

An Analysis of the Commercial Value of a Water-Power.

Slightly condensed from a paper by A. F. Nagle before the American Society of Mechanical Engineers.

The writer recently testified in court as to the value of water-power per horse-power per annum in a manner that may be of interest to our membership. The subject-matter has been discussed heretofore in our society, but I am not aware that precisely the same analysis has been given before. The problem is quite a familiar one to New England engineers. The river-flow is assured to certain abutting parties by old legislative grants, and is usually used for power purposes. Any town or city taking water from this stream is liable for damages incurred by reducing the available power of said stream of water. The amount of power existing in the stream at each mill, expressed in horse-power per second, as well as the amount taken, or diverted, by the city, and affecting the particular mills, is a problem for hydraulic engineers which I do not take up; but the value of the water-power at each mill is a problem which I have attempted to solve. I have formulated my studies under three theorems, which I believe express the true principles under which the problem can be solved with as much certainty as the cost of a steam-power.

any analysis that may be applied to the problem under consideration.

The annual cost of steam-power per horse-power, including every item except land, can be calculated by an experienced engineer for any particular locality with reasonable accuracy. In Tables I. and II. I have given my estimates of engine plants ranging from 50 horse-power to 500 horse-power, single-condensing engines; and from 400 horse-power to 1,500 horse-power compound-condensing engines located along the Blackstone River, New England. These estimates are generally large, but as the items appear both in the minuend and subtrahend of the calculation, the remainder, resulting in the value of the water-power, is not so seriously affected thereby. The result, however, of these larger figures for steam-power is to increase the value of the water-power. The items comprising the tables are all so well known to engineers that it is needless for me to comment upon them. Nor is it so much my purpose to establish the accuracy of these particular items, or their results, as it is to establish a principle, or method, of calculating the value of a water-power for power purposes, and thereby take the problem out of the domain of prejudiced guesswork.

Table I.—Annual Cost of Steam-power per Indicated Horse-power.—Compound Condensing Engine.

Horse-power.	400	500	600	700	800	900	1,000	1,200	1,500
Cost of plant per I.H.P.	$64.00	$60.00	$57.50	$56.00	$55.50	$55.00	$54.60	$54.00	$53.00
Annual interest, etc., at 10 p. c. per I.H.P.	6.40	6.00	5.75	5.60	5.55	5.50	5.46	5.40	5.30
Cost of banking (no heating) repairs, supplies, engineer, etc., per I.H.P.	7.30	7.60	7.75	7.80	7.95	7.70	7.55	7.50	7.50
Annual (3,060 hrs.) cost of coal at $4.50 per long ton per I.H.P.	12.30	11.40	10.50	9.85	9.50	9.30	9.25	9.25	9.20
Total annual cost per I.H.P.	26.00	25.00	24.00	23.25	23.00	22.50	22.26	22.15	22.00

Table II.—Annual Cost of Steam-power per Indicated Horse-power.—Simple Condensing Engine.

Horse-power.	50	75	100	150	200	250	300	400	500
Cost of plant per I.H.P.	$90.00	$75.00	$65.00	$57.00	$51.00	$47.00	$45.00	$43.00	$42.00
Annual interest, etc., at 10 p. c. per I.H.P.	9.00	7.50	6.50	5.70	5.10	4.70	4.50	4.30	4.20
Cost of banking (no heating) repairs, supplies, engineer, etc., per I.H.P.	9.00	8.50	8.20	8.30	8.60	8.30	7.90	7.85	7.80
Annual (3,060 hrs.) cost of coal at $4.50 per long ton per I.H.P.	25.00	22.00	20.00	17.00	15.30	15.00	14.60	13.85	13.00
Total annual cost per I.H.P.	43.00	38.00	34.70	31.00	29.00	28 00	27.00	26.00	25.00

Theorem 1. The value of water-power, when of ample capacity for a specific purpose, does not exceed the cost of what a competing power, steam or gas engine, can be installed and operated for at the same locality.

Theorem 2. When a water-power is insufficient for a specific purpose, due to the varying flow at different seasons of the year, and its limited amount, then its value is reduced from that established by Theorem 1, by the cost of installing and operating a steam plant to make good this insufficiency.

Theorem 3. The damages to be paid annually, or capitalized at — per cent. if made in one payment, for a given amount of diverted water-power is the value of the water-power as found by Theorem 2, plus the depreciation in the value of the remaining water-power.

The cost of power is an element in all productive industries, and whether it be a large or small element, the mill (we will call it) demands a certain amount of power, the cost of which, if a steam plant, can be calculated quite closely, probably within 10 per cent. It is the interest of the mill owner to obtain his power at the least possible cost to himself, and he stands in the position of a buyer of power before the power-producing public. Two sellers may offer him power—a steam-power producer, or a water-power producer. Because the mill owner in New England is generally also a water-power owner, does not change the relation of the power consumer to the power producer, a buyer and a seller, and for a clear understanding of this complex problem, it is absolutely necessary to separate the two parties in

Theorem 1 is almost a self-evident proposition. No mill owner as a buyer of power will pay more for water-power than he can install and operate a steam plant for. He would not even give as much as that, because if he had water-power only, he would have to install a boiler plant for heating and other auxiliary uses; while if he had a steam plant, he could supply himself with this additional steam at a comparatively small cost. For present purposes, however, I shall neglect this fact.

Theorem 2 is not quite so obvious. Very few water-powers are of sufficient power to supply the large mills they drive with ample power every day in the year. At times there is an excess, and at other times it is quite insufficient. It is at this point that a clear understanding must be had of the relation of the mill owner to the water-power owner. It is not the business of the mill owner to meddle with the problem of this varying and insufficient water supply. That difficulty belongs entirely to the water-power owner. In order to make the water-power commercially available, in order to give it any value at all to the purchaser of power, in order to give it what it has been pleased to call "a market value," "a commercial value," he must supplement the fluctuating water-power with steam-power. The maximum possible price obtainable for the combined steam and water-power has been fixed by the cost of a single steam plant. Hence the less the steam-power costs him the more he will get for his water-power. This will be more fully illustrated by detailed calculations hereafter.

Theorem 3. This theorem is perhaps more theoretical than practical, for in few cases is the quantity of water diverted from a stream sufficiently large to affect perceptibly the quantity remaining. It is, however, a fact that repeated diversions constantly diminish the value of the remaining power; and it is proper that this depreciation of the remaining power should be paid for at each diversion. This would seem to be a principle of equity, and I have investigated the application to a particular case upon a rather extravagant hypothesis.

To illustrate the practical application of the theorems here advanced, one mill and its power diagram has been selected from the testimony in the suit. The river flow in horse-power per minute for every month in the year is established at the mill by the hydraulic engineers employed in the suit. The amount of the diverted power at the mill is also given by said engineers, but is too small to appear in the diagram, Fig. 1. The amount of power required to operate the mill, and the wheel capacity, are given by the mill owner. Referring to Fig. 1, the power of the river flow is seen to vary greatly. This mill requires an average of 900 horse-power per annum. The water wheel is of only 743 horse-power, and the mean annual

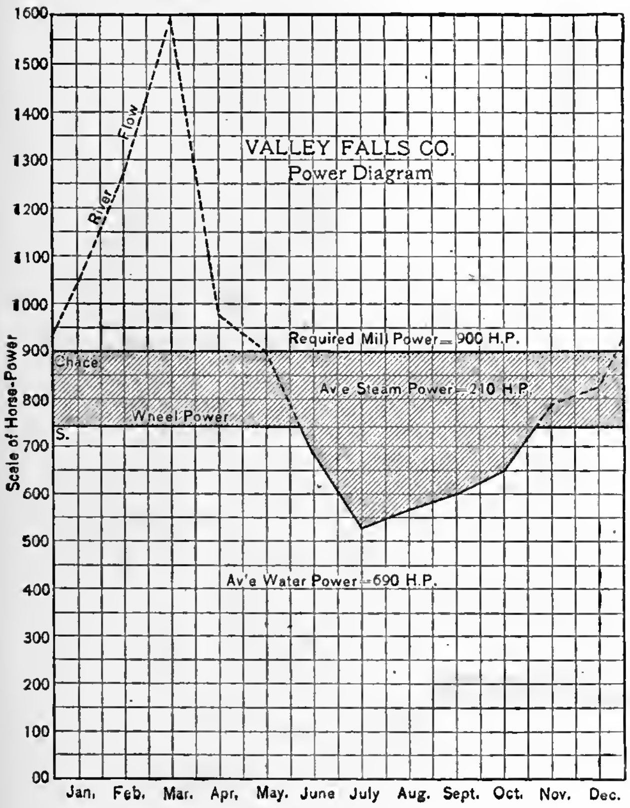


FIGURE 1.

water-power is 690 horse-power, requiring a steam-power of 210 horse-power to give the 900 horse-power to the mill. The low stage of the river is such that a 370 horse-power steam plant will be required at times.

Table III.—Valley Falls Company.

Required mill-power	900 H.-P.	
Average water-power	690 "	
Average steam-power	210 "	
Maximum steam-power	370 "	
Time engine runs	12 months	
Full annual cost of 900 H.-P.C.C. plant at $22.50		$20,250
Annual interest, etc., 370 H.-P.S.C. at $4.40	$1,628	
Annual supplies, etc., 370 H.-P.S.C. at $7.85	2,904	
Annual coal, 210 H.-P.S.C. at $14.00	2,940	
Total cost of 210 H.-P. steam	$7,472	7,472
Cost per H.-P.	35.60	
Value of 690 H.-P. water		$12,778
Value of 1 H.-P. water	$18.52	

Maximum Efficiency of a Water-power Plant.—Referring again to Fig. 1, it is quite evident that a larger wheel-power would have been conducive to a greater value of the water-power. For the purpose of ascertaining the greatest value of a water-power by the rules laid down in this paper, let us assume that the minimum flow is as shown in the figure. In that case water of 530 horse-power would be supplied every day in the year, and if it could be brought about that a mill required just that amount of power, the water-power would be worth $25 per horse-power (see Table I.), and the water owner would receive a revenue of $13,250 per annum. On the other hand, if the mill still required 900 horse-power, and only 530 horse-power wheel-power were available, then the calculation would stand as in Table IV.

Table IV.

Required mill-power	900 H.-P.	
Average water-power	530 "	
Average steam-power and maximum	370 "	
Full annual cost of 900 H.-P.C.C. plant at $22.50		$20,250
Annual interest, etc., 370 H.-P.S.C. at $4.40	$1,628	
Annual supplies, etc., 370 H.-P.S.C. at $7.85	2,904	
Annual coal, 370 H.-P.S.C. at $14.00	5,180	
Total cost of 370 H.-P. steam	$9,612	9,612
Cost per H.-P.	26.00	
Value of 530 H.-P. water		10,538
Value of 1 H.-P. water	$19.88	

Now let us go a step further, and under the same conditions and requirements put in a 900-horse-power-wheel. Then the calculations will stand as in Table V.

Table V.

Required mill-power	900 H.-P.	
Average water-power	764 "	
Average steam-power	136 "	
Maximum steam-power	370 "	
Time engine runs	7½ months	
Full annual cost of 900 H.-P.C.C. plant at $22.50		$20,250
Annual interest, etc., 370 H.-P.S.C. at $4.40	$1,628	
7½ mos.' supplies, etc., 370 H.-P.S.C. at $7.85	1,815	
Annual coal 136 H.-P.S.C. at $14.00	1,904	
Total cost of 136 H.-P. steam	$5,347	5,347
Cost per H.-P.	39.32	
Value of 764 H.-P. water		14,903
Value of 1 H.-P. water	$19.54	

Hence, we see that a mill requiring 900 horse-power with a river flow as indicated by Fig. 1, can be supplied with power by a water-power owner in one of two extreme ways. If he puts in only 530 horse-power wheels running every day in the year at this power, he will receive $10,538 net for his water, but he must spend $9,612 for steam-power in order to obtain this amount for his water. If, on the other hand, he would put in a 900-horse-power wheel and spend $5,347 for steam, albeit it costs at the rate of nearly $40 per horse-power, he will receive nearly $15,000 per annum, or $19.54 per horse-power.

Monthly versus Annual Averages.—There is some question as to the accuracy of determining the average annual value of the water-power by the annual average, or calculating it separately for each month in the year. I have made an estimate of said values as applied to Fig. 1, by monthly estimates, and compared it with the annual average which has been used throughout these calculations. I have also introduced a corrected value of coal due to underloading of the engine, and embodied the result in Table VI. Column 1, Table VI., is the average monthly steam-power, column 2 is the cost of this steam-power as found by preceding methods, column 3 is the corrected cost of coal per annum for an underloaded engine, column 4 is the annual cost of steam-power based upon coal value in column 3, and column 5 is the final value of water-power based upon steam cost in column 4.

Table VI.

Power required at mill....................900 H.-P.
Cost of steam, H.-P. per annum.......... $22.50
Cost of coal per H.-P. per annum.......... 9.30

Monthly H.-P.	Cost of steam per H.-P. uncorrected.	Cost of coal per H.-P. corrected for underload.	Cost of steam per H.-P. corrected.	Value of water per H.-P. based upon Col. 4.
160	$42.32	$17.50	$45.82	$17.47
160	42.32	17.50	45.82	17.47
160	42.32	17.50	45.82	17.47
160	42.32	17.50	45.82	17.47
160	42.32	17.50	45.82	17.47
220	34.60	16.00	36.62	17.94
350	27.00	14.00	27.00	19.67
330	27.73	14.00	27.73	19.47
300	29.11	14.50	29.61	18.95
240	32.89	15.50	34.38	18.18
160	42.32	17.50	45.82	17.47
160	42.32	17.50	45.82	17.47
210	37.30	16.38	39.67	*18.04
210	35.60	14.00	....	†18.52

*Annual average by monthly estimate. †Annual average by yearly estimate.

It will be seen that while the cost of steam-power (210 horse-power) based upon a yearly average is $35.60 per horse-power, it is increased to $37.30 per horse-power if made upon a monthly basis; and if also corrected for coal, becomes $39.67 per horse-power; and the value of water-power is reduced from $18.52 to $18.04, which is less than one would have supposed it to have been, and yet it is the correct way to pursue.

Successive Diversions.—The amount of water diverted is usually very small in proportion to the total quantity in the river. To illustrate in detail the manner of calculating the value of the water-power per horse-power per annum when large quantities of water are taken at several intervals instead of all at one time, I have applied the calculation to a water privilege substantially like that of the Valley Falls Company, Fig. 1, where, say, 100 horse-power is taken at each interval, until it is all taken. The results are given in Table VII.

Table VII.—First Case, Original Condition.

Required mill-power	900 H.-P.	
Average water-power	700 "	
Average steam-power	200 "	
Maximum steam-power	400 "	
Time engine runs	12 mos. always	
Full annual cost of 900 H.-P.C.C. at $22.50		$20,250
Annual interest, etc., 400 H.-P.C.C. at $6.40	$2,560	
Annual supplies, etc., 400 H.-P.C.C. at $7.30	2,920	
Annual coal, 200 H.-P.C.C. at $12.30	2,460	
Total cost of 200 H.-P. steam	$7,940	7,940
Cost per H.-P.	39.70	
Value of 700 H.-P. water		12,310
Value of 1 H.-P. water	$17.60	

Second Case.

Required mill-power	900 H.-P.	
Average water-power	600 "	
Average steam-power	300 "	
Maximum steam-power	500 "	
Full annual cost of 900 H.-P. as before		$20,250
Annual interest, etc., 500 H.-P.C.C. at $6.00	$3,000	
Annual supplies, etc., 500 H.-P.C.C. at $7.60	3,800	
Annual coal, 300 H.-P.C.C. at $11.40	3,420	
Total cost of 300 H.-P. steam	$10,220	10,220
Cost per H.-P.	34.07	
Value of 600 H.-P. water		10,030
Value of 1 H.-P. water	$16.72	

Third Case.

Required mill-power	900 H.-P.	
Average water-power	500 "	
Average steam-power	400 "	
Maximum steam-power	600 "	
Full annual cost of 900 H.-P. as before		$20,250
Annual interest, etc., 600 H.-P.C.C. at $5.75	$3,450	
Annual supplies, etc., 600 H.-P.C.C. at $7.75	4,650	
Annual coal, 400 H.-P.C.C. at $10.50	4,200	
Total cost of 400 H.-P. steam	$12,300	12,300
Cost per H.-P.	30.75	
Value of 500 H.-P. water		7,950
Value of 1 H.-P. water	$15.90	

A summary of cost of steam-power and value of water-power at seven successive diversions, the required mill-power remaining at 900 horse-power, is given in Table VIII.

Table VIII.

Cost of Steam-power.			Value of Water-power.		
Amount.	Per H.-P. annual.	Total cost.	Amount.	Per H.-P. annual.	Total value.
1	2	3	4	5	6
200 H.-P.	$39.70	$7,940	700 H.-P.	$17.60	$12,310
300 "	34.07	10,220	600 "	16.72	10,030
400 "	30.75	12,300	500 "	15.90	7,950
500 "	28.61	14,305	400 "	14.86	5,945
600 "	27.50	16,500	300 "	12.50	3,750
700 "	26.27	18,390	200 "	9.30	1,860
800 "	24.10	19,320	100 "	9.30	930
900 "	22.50	20,250	0 "	...	...

In addition to the value of the diverted water-power, there is also a depreciated value to the remaining water-power. This is easily found by finding the value of the water-power before and after diversion, and the difference between the two, multiplied by the amount remaining, is the amount to be paid for depreciation. Table IX. gives these amounts, as well as the direct damages for 100 horse-power diverted at seven intervals.

Table IX.—Annual Cost of 100 H.-P. Diverted Successively, and Depreciation of Remaining power for Seven Periods. Required Mill-power Always 900 H.-P. Cost Thereof at \$22.50 = \$20,250 per Annum.

Amount of water-power. 1	Value of water per H.-P. 2	Difference. 3	Cost of 100 H.-P. 4	Water-power remaining. 5	Amount of depreciation. 6	Total Cols. 4 and 6. 7	Cumulative amount. 8
700 H.-P.	\$17.60	0.88	\$1,760	600 H.-P.	\$528	\$2,288	\$2,288
600 "	16.72	0.82	1,672	500 "	410	2,082	4,370
500 "	15.90	1.04	1,590	400 "	416	2,006	6,376
400 "	14.86	2.36	1,486	300 "	708	2,194	8,570
300 "	12.50	3.20	1,250	200 "	640	1,890	10,460
200 "	9.30	0.	930	100 "	...	930	11,390
100 "	9.30	...	930	...	...	930	12,320
Total.......	...	...	\$9,618	...	\$2,702	\$12,320	...

The accounts of the water-power owner will, therefore, stand as in Table X.

Table X.

Receives annually from the mill owner for 900 H.-P.	\$20,250
Before any water is taken, expends annually for steam-power (Table VIII, Column 3)..	7,940
Leaving a net income of	\$12,310
1st—When 100 H.-P. are taken at \$17.60 plus depreciation, receives from mill owner....	\$20,250
100 H.-P.—From city (Table IX, Column 8)	2,288
A total income of	\$22,538
Expends for steam-power (Table VIII, Col. 3)	10,220
Net income	\$12,318
2d—Second diversion at \$16.70 plus depreciation, receives from mill owner	\$20,250
100 H.-P.—From city (\$2,288 + \$2,082)...	4,370
A total income of	\$24,620
Expends for steam (Table VIII, Column 3)..	12,300
Net income of	\$12,320
3d—From mill owner	\$20,250
From city	6,376
100 H.-P.—Total income of	\$26,626
Cost of steam as above	14,305
Net income	\$12,321

It will be seen that the analysis proves itself correct in every instance. The water-power owner, whose income was \$12,320 per annum before any diversion of water took place always receives the same figure, whether much or little, or all be taken, at intervals, or all at one time.

It is sometimes admitted by engineers on the other side that my analysis for ascertaining the value of water-power may be correct, but that diverted water-power must be paid for at what it costs to take its place. Thus the value of the water-power is \$18.52, but the cost of its auxiliary steam-power is \$35.60 per horse-power, and they would thus maintain that that should be the amount to be paid for diverted power. This seems very plausible, and it is a fallacy not easily seen through by engineers, attorneys, or courts; but it is a fallacy nevertheless. It is a fallacy, in the first place, because if the theory were correct, it would lead to absurd conclusions. Thus, if the entire water-power of 690 horse-power were taken and paid for at the rate of the cost of its auxiliary steam-power, namely, \$35.60, the damages would be \$24,564, which exceeds the cost of an entire 900-horse-power steam plant.

It is fallacious, in the second place, because it makes the damages to an imperfect or insufficient water-power greater than is conceded to be the value of a perfect or complete one; that is, it is claimed that \$35.60 per horse-power should be paid for a defective water-power when \$22.50 per horse-power will pay for a perfect power.

It were perhaps better for a clearer understanding of this problem if the cost of furnishing the auxiliary steam-power were not reduced to its equivalent cost per horse-power at all, and simply to say that it costs the water-power owner so much money to supply the natural defects of his water-power, which expense he must go to in order to find a market for his water-power. The question of cost of steam-power is only entered into in order to ascertain the true value of the water-power, and it is the interest of the water-power owner to make it as little as possible. As a matter of fact, for the small diverted power, it costs him only the price of coal, say \$14 per horse-power per annum, while he is paid, under this analysis \$18.52 per horse-power. It is held, however, that if he is paid only for the coal consumed, he is paid nothing for his plant, etc., and that the defendant has no right to use that plant.

The maintenance of this auxiliary steam plant is a necessity and a burden entirely upon the shoulders of the water-power owner, in order to make his water-power worth its maximum to himself, and that maximum value of water-power the defendant is willing to pay.

Two causes are at work which make this auxiliary steam-power disproportionately expensive: First, the natural fluctuation of the river flow; and, second, its insufficiency for the uses of the mill. Neither of these causes are the fault of the defendant, except in the latter case, by the amount of diversion. It is not the fault of the defendant that the auxiliary power costs what it does, and he should, therefore, not be made to pay for it. When he has paid the market or commercial value of the water-power, plus the damage inflicted upon the balance of remaining power, he has met the requirements of equity.

En passant I may allude to the favorite illustration of eminent counsel, that if a man brings into the city horses which he is selling for \$100 apiece, and the city takes for its own use one or more of his horses, the city must pay \$100 for the horses taken, and not \$50 or so, or whatever they may cost him. I agree to the correctness of the claim of the plaintiff. On the other hand, the plaintiff attempts to establish the market value of steam-power by asking a tenant at some city factory what he pays for power. The case of a tenant at a distance from the source of power, and in small amounts, is not an analogous case with the one with water-power at a mill. Here the entire water-power is absorbed by one purchaser, and in order to give the entire water-power its maximum commercial value, an incidental expense is necessary, with which the defendant really has no concern.

Theorem 3 expresses the true basis upon which damages should be paid. Under the analysis here laid down the water-power owner is not injured one dollar whether much or little water be taken, for he is assured precisely the same annual income he received before the city trespassed upon his rights as after. In the suit referred to, however, the amount of power diverted is so small compared with the river flow or total mill power that I neglected to compute this item.

The Elevated and Subway street railways of New York have been brought under one control by the combination of the Manhattan Elevated Railway Company with the Interborough Rapid Transit Company.

The Engine Builders Association of the United States held its annual meeting in New York City, at Sherry's, December 1 and 2. Professional papers were presented by Mr. Ernest Foster on "Superheated Steam," by Mr. William Andrews on "High Pressure Steam Piping," by Mr. George R. Phillips upon "The Early History of the Corliss Engine" and by Prof. John E. Sweet upon "The History of the High Speed Engine." On the second day in executive session for members only reports of committees and various business matters were taken up. In the evening the annual dinner was held.

Letter to the Editor.

Rockwood Compound Engines.

Sir: In the issue of The Engineering Record for Nov. 22 may be found some data of a triple expansion engine test made by Prof. Hollis. The conditions under which this engine is working are not fully stated, but enough is said to invite comparison between its performance and that of the Atlantic Mills compound engine tested by Mr. Barrus. (Eng. Rec. Nov. 8.)

The boiler pressure and load were in each case nearly the same. A slight superheat to the steam of the compound was offset by the increase of the pressure of the steam supplied to the triple expansion engine. The best performance of the compound was 2 per cent. better than that of the triple. The actual figures were as follows:

Triple expansion engine...11.47 lbs. per I.H.P. per hr.
Compound engine.........11.22 lbs. per I.H.P. per hr.

If these facts had been placed before the engineering public even ten years ago what a sensation would have been created, not to mention doubts of the validity of both tests which would have been freely expressed. It is ten years since the first test of a Rockwood compound engine was published, and at that time it was freely doubted. But at that time no such engine had the advantage of an adequate boiler pressure. The best result obtainable was 12.8 pounds of steam per I. H. P. per hour. The saving of 14 per cent. is due to the higher pressure and slight superheat of the steam in the present instance. It should be noted, however, that this engine is the first one to have Corliss valves. All the others were Wheelock engines. It may be noted that the Wheelock valve gives very much less clearance for the same port areas than the Corliss valve. On the other hand, the Wheelock valve has much more superficial area upon which condensation may take place. The practical question probably is: Which form of valve remains tight without scraping for the longest period of time? Prof. Hollis thinks it is the gridiron, while many others will doubtless hold the contrary view.

The two cylinder engine for stationary purposes has so many practical advantages over the triple expansion engine that its great economy when working under high boiler pressure and a large ratio of expansion and considerable "drop" in the receiver should be more generally realized.

Yours truly,

George I. Rockwood.

Worcester, Mass., Nov. 25.

Systematic Water-Waste Detection was begun at King's Lynn, England, a town of about 20,000 inhabitants, in 1899, under the direction of the engineer, Mr. H. J. Weaver. Thirteen 6-inch Deacon waste-detection meters were set and the town divided into districts, each governed by a meter. Stopcocks were fixed on every service, and valves were so arranged on the mains as to command each street and section of district. Two night and two day inspectors were appointed, the duty of the former being to make the night inspections with a stethoscope, and report to the day inspectors, who visited the houses. The number of inspectors has now been reduced to one, who acts as night inspector, the foreman of the water-works department taking care of the rest of the work. As a result of this plan, the consumption has been reduced from 69 U. S. gallons per head per day to 44.4. The minimum limit of proper consumption for this town, where a large amount is required for sewer flushing and for other than domestic purposes, is considered by Mr. Weaver to be in the neighborhood of 35 U. S. gallons per head per day.

Water Supply for the Ansonia Swimming Bath.

The Ansonia Apartment hotel is a very large 17-story building at Broadway and 73rd Street, New York, which has been fitted with extensive and elaborate sanitary, mechanical and hydraulic installations. The general system and details for the supply and distribution of over 80,000,000 gallons of water a year, and the steam, heating and mechanical plants were illustrated in The Engineering Record of November 1st and 15th respectively. These articles describe both the general conditions of operating the elaborate plant, and its special relations to the delivery, removal and economical use of the large quantity of water required for the swimming bath, the details of which are here described.

The Ansonia has an estimated tenancy of about 1,300 persons, and besides the water supplies to its public and private restaurants and dining rooms, its general hot and cold water distribution systems, refrigerated water circulation and private bath rooms, there is planned a complete system of Turkish and Russian baths and an immense swimming tank in the sub-basement. The latter is to be abundantly supplied with hot and cold water by a system which will not only keep up a constant circulation and insure clean bathing water but which is arranged so that the water will be successively used for several purposes and so designed as to make a liberal demand for water in the swimming baths promote the efficiency of the mechanical installations and reduce, rather than increase, the operating expenses of the establishment.

The swimming bath is about 86 feet long, 33 feet wide and 11 feet deep, in maximum dimensions, and has reinforced concrete walls and floor built in an excavation in solid rock below the sub-basement floor. It has, as shown in the general diagram, rounded ends and straight sides with inside projections made to enclose columns which are located at one end. The concrete has an average thickness of about 2 feet and is reinforced by overlapping sheets of expanded metal embedded in all parts of it parallel with the surface. Close to the outer surfaces of the concrete there is also embedded a waterproof course of several thicknesses of tar paper and hot asphalt, continuous over the whole exterior of the bath, and its upper edges have a white marble coping. The bath is lined with white glazed bricks. It is accessible by three flights of stairs with white marble tread and riser slabs bedded in the solid concrete. Twelve of the square cast-iron columns supporting the building are located in the walls of the bath, which are widened to receive them, and are carried down through the concrete to footings on the rock below, as shown in the detail section of the wall.

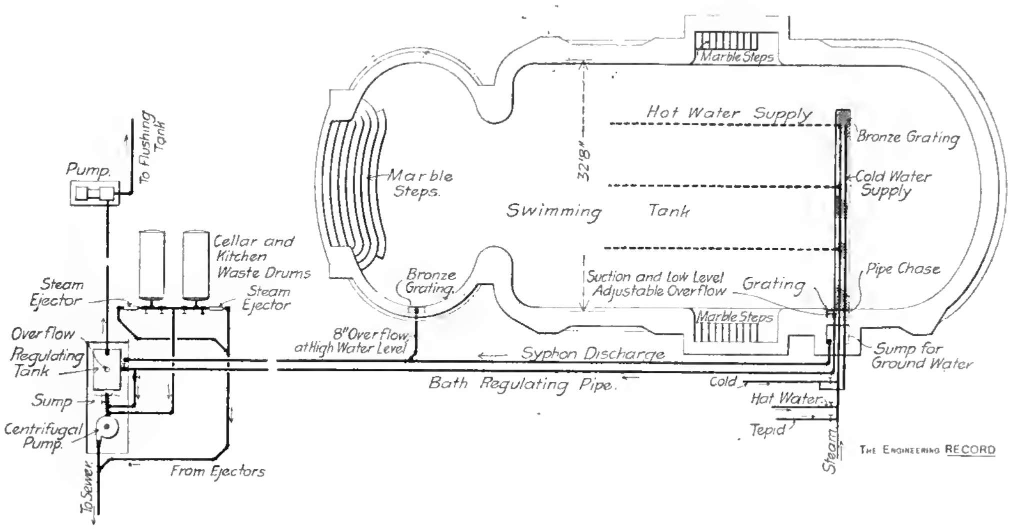
The bottom of the bath is curved, to make, in cross section, a flat arch fitting the concave excavation in the rock and intended to give additional strength to resist possible upward pressure from ground water. It is unlikely, however, that there will ever be any unbalanced upward pressure there for a sump has been excavated close to one end of the bath, to a depth below the bottom of the bath, in which the ground water freely collects and from which it is automatically ejected to the sewer. Adjacent to this sump well, but separated from it by a solid wall, is a vertical recess in the side wall of the bath through which the principal inlet and outlet pipes are carried to the bottom of the bath behind a removable bronze grill. The grill plate is made of ½-inch metal, countersunk screwed to the rebated face of two vertical bronze jamb plates. These are Z-shaped in cross section with horizontal inside ribs through which hook rods anchor them back to the concrete. The bath is enclosed by a railing, not shown in the drawings, with 2½-inch vertical posts extending through the coping and 18 inches into the concrete walls.

The bath has a depth to high water line of 9 feet 9 inches maximum, and a capacity of 23,000 cubic feet, or about 172,000 gallons. It requires about 3½ hours to fill the bath. It can be supplied with cold water directly from the street mains, with cold water heated by injection of live steam, with tepid water, with hot water, with hot water superheated by steam or with steam alone, injected into the water in the bottom of the bath. Normally the supply will be of hot or tepid water which has already been used in the refrigerating plant. All water supplied to the bath is filtered and that which is used first for refrigerating purposes is circulated around coils without being in any way exposed to contamination so that the whole supply is perfectly clean and fresh. Tepid water at a temperature of about 90 degrees is delivered through a 3-inch pipe from the closed absorber of the ice plant. Hot water at 110 to 120 degrees is delivered through a 3-inch pipe from the ammonia condenser, cold water is delivered through a 4-inch pipe and live or exhaust steam is delivered through a 1½-inch pipe.

All these pipes are connected to a header which may receive a single supply or be supplied from two or more sources at once. The header, as shown in the detail sketches and indicated in the general plan and section at C C, delivers into the 4-inch horizontal hot water pipe which is carried nearly across the bath in a floor trench covered with a removable bronze grill. This pipe is closed at the farther end and has three 2-inch horizontal branches, about 20 feet long, open at their extremities. Each branch passes through a stuffing box into a 4-inch brass jacket pipe which is closed at both ends and is bedded in the concrete floor of the bath about 5 inches below the finished surface. This pipe serves as a shell from which the 2-inch pipe can be easily removed if required, without disturbing the floor of the bath, and is also a distributing chamber which is filled from the inside pipe and discharges into the bath at several places. The outlets are small vertical brass nozzles, ½ inch in diameter, which are screwed in T's set about 24 inches apart on the 4-inch pipe, and having their tips just flush with the finished floor surface. By this arrangement water of any desired temperature between about 50 degrees and 120 degrees is injected into the bath through 30 nozzles distributed over the middle third of its area.

The 4-inch cold water supply pipe to the hot water header is valved and continued down the wall chase and across the bath floor in the trench beside the hot water pipe. It is perforated with ¼-inch holes 3 inches apart on the upper surface and is closed at the farther end. Ordinarily, warm or tepid water only will be supplied to the tank and its temperature will be maintained at about 66 degrees. The estimated daily supply is about 60,000 gallons all filtered. At the regular city rate of $1 per 1,000 cubic feet this would cost about $2,800 a year, and this sum, plus what it would cost to heat the water, is saved by using the water which has passed through the condenser and absorber. Besides this the cost of the water is doubly saved for the same water after being used in the swimming bath is refiltered and used for the flushing system in toilet rooms.

A fixed high water overflow is built in one wall of the bath and limits the height to which the water can rise, no matter how much water may carelessly be delivered through the hot and cold inlets after the bath is full. It has a brass box with a vertical bronze grating in the face of the wall just below the coping. The bottom of the box has a removable convex strainer covering the outlet to an 8-inch waste pipe which discharges to a sump, whence the water is periodically pumped into the sewer. Ordinarily this outlet is not used but the water overflows through a regulating pipe by which it is maintained at an adjustable lower level.



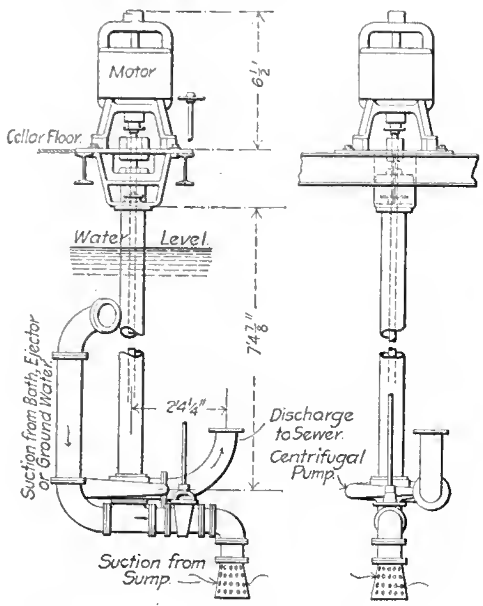
System of Pipes for Filling and Emptying Swimming Bath.

This is a 6-inch iron pipe, with its highest point about 24 inches below the high water overflow level, which rises from the bottom of the bath and runs alongside the inlet pipes in the wall chase and thence in a floor trench to the pump sump. This pipe is shown in the detail of the wall chase and supply pipes, but the location of the horizontal upper part of it is incorrectly shown too high.

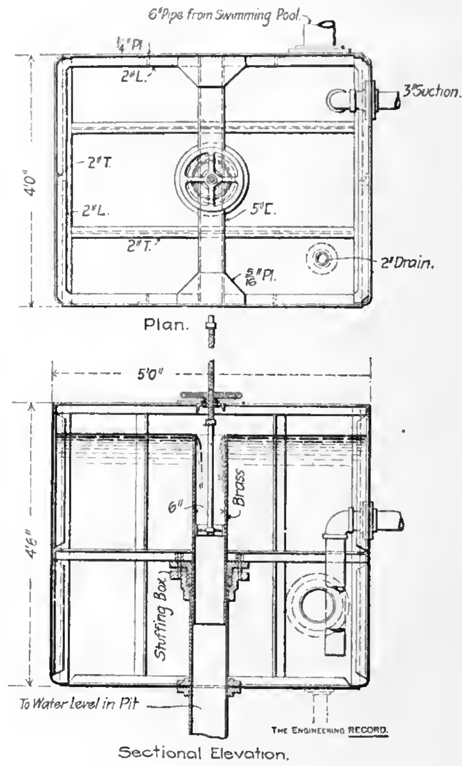
This pipe, as long as the bath is filled within 2 feet of its maximum depth, is always full of water, and connects into a steel plate regulating tank set in the upper part of the pump sump with its upper edge a little above high water level in the bath. The tank overflows into the sump through a vertical center stand pipe which is made telescopic, with the upper part commanded by a hand wheel and regulating screw and sliding in a stuffing box, as shown in the detail section. The position of the upper edge of the stand pipe thus determines the level of the water in the bath, and may even be high enough to cause the water to escape first through the fixed overflow. From the lower part of the regulating tank, a suction pipe is run to the pump which supplies the flushing system of the toilet rooms, and the tank does not overflow to waste into the sump until this demand has been satisfied.

All water in excess of this requirement which overflows from the swimming bath reaches the sump and is thence pumped to the sewer by a submerged centrifugal pump driven by a vertical shaft enclosed in a steel tube with the upper bearing above water level. The pump suction has two inlets, one with a strainer to receive water from the sump, and the other connected to the regulating pipe from the bath and to the discharge from the ejectors which deliver the kitchen and cellar drainage to the sewer. All of them are controlled by valves so that the pump can serve either of the three, but it is normally used only for discharging the overflow water which is not required for the flushing system, and that which is delivered to the sump, from the ground water sump at the bath inlet by the steam syphon installed there. When the valve to the regulating tank is closed and that to the pump suction is opened the bath can be emptied by the centrifugal pump in two hours, and the water can be either delivered direct to the sewer or can be circulated through a closed condenser on the exhaust connection of the elevator pumps and thus render additional service before it escapes. Ordinarily the kitchen and cellar wastes and ground water are discharged to the sewer by their own separate automatic apparatus, but connections are made to the centrifugal pump to provide an additional safeguard in case of their disability.

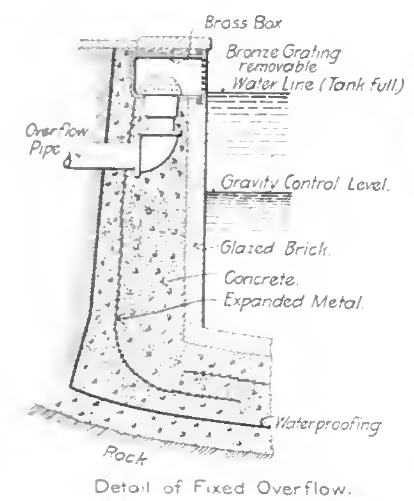
The bath system was designed by Mr. Reginald Pelham Bolton, M. E., consulting engineer for the entire mechanical equipment and sanitation of the building, of which Mr. Paul Duboy is the architect. Milton Schnaier & Company are the contractors for the sanitary work and piping, and the construction of the building and the bath has been carried out by the owner and builder, Mr. W. E. D. Stokes.



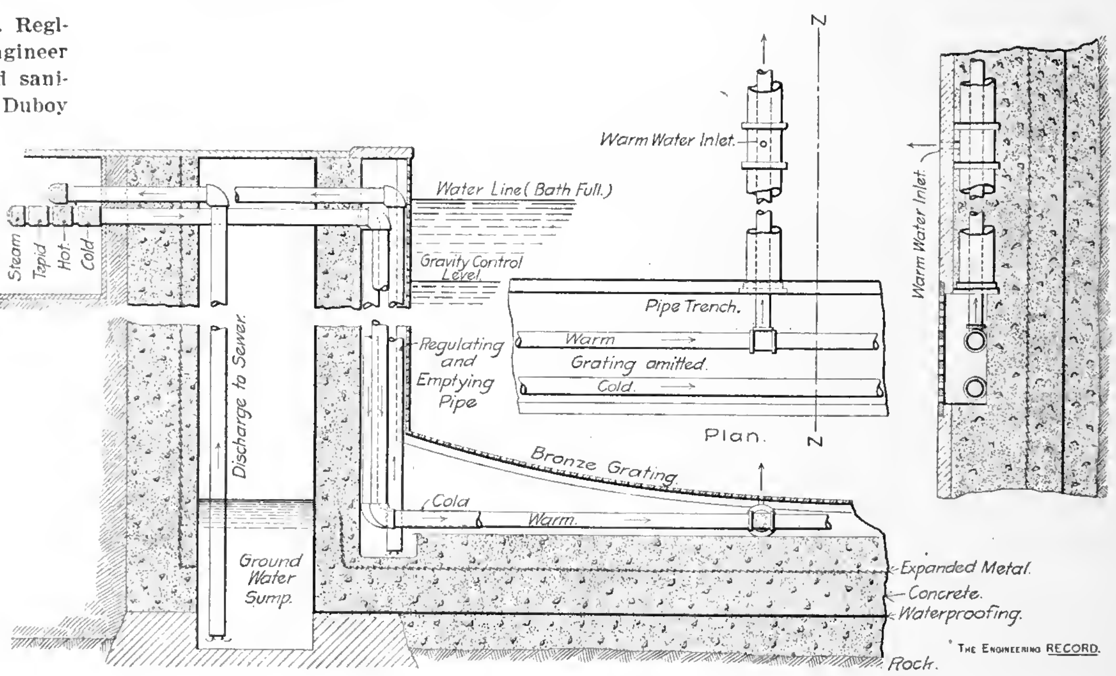
Submerged Centrifugal Pump for Swimming Bath.



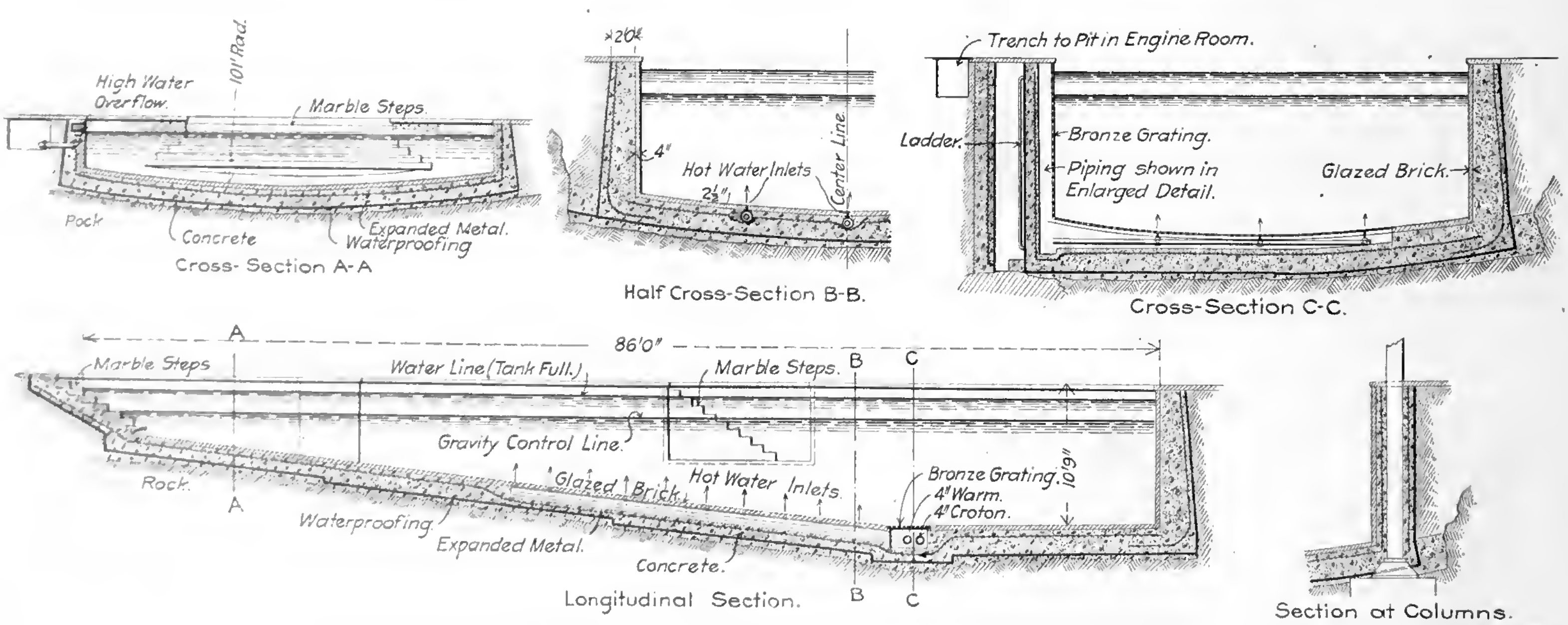
OVERFLOW REGULATING TANK.



Detail of Fixed Overflow.



Details of Pipe Chases.



Details of Swimming Tank Construction.

DETAILS OF THE SWIMMING TANK OF THE ANSONIA APARTMENT HOTEL.

The Meeting of the American Society of Mechanical Engineers.

The forty-sixth meeting of the American Society of Mechanical Engineers was held in New York, December 2 to 5. Owing to the illness of the president, Mr. Edwin H. Reynolds, the first session on the evening of December 2, in the Society's house, was called to order by Vice-President Arthur M. Waitt. One paper was presented by Prof. Sidney A. Reeve, entitled, "A Rational Solution of the Problem of Weights and Measures," and after the discussion the meeting resolved itself into a smoker. The system the author advocated is one which subdivides by halves, thirds and quarters.

The second session of the meeting was held on Wednesday morning in the Sturtevant House. The first business of the morning was the presentation of the report of the Council. This document announced the appointment of the following committees: To act with delegates from the American Institute of Architects to plan and arrange for tests on Steel I-beams of Large Size, Mr. H. deB. Parsons and Prof. Palmer C. Ricketts. As a Committee on the Standardization of Screw Threads: Mr. Wilfred Lewis, Mr. George R. Stetson, Mr. George M. Bond, Mr. Charles C. Tyler and Mr. John Riddell. As representatives of the Society on the committee to fix the next award of the John Fritz Medal, Prof. Lanza, Prof. John E. Sweet, Mr. Samuel T. Wellman and Mr. Robert W. Hunt. The Council also reported favorably with respect to the New York monthly reunions. Ninety-three additions to membership were announced, comprising 50 members, 10 associates and 33 juniors, not including promotions.

The meeting next considered the report of the committee on the revision of rules, Mr. Chas. W. Hunt, chairman, devoting the rest of the morning to the subject and voting in favor of the resolution offered a year ago by Mr. C. W. Baker. With the exception of the matter of passing that resolution the topic which occupied the entire period of the meeting was the status of the junior membership in the Society, notwithstanding that in addition to an inquiry in this regard, the committee had asked for an expression of the meeting's attitude as to whether life memberships should be increased, and if so, as to whether the fee should be increased or should be dependent on age, and as to the number of votes which should be necessary to defeat a candidate for election to membership, both on the first and second balloting, besides questions relating to the size of the Council, of a quorum and other matters. With regard to junior membership, Mr. Jesse M. Smith had found that out of 531 juniors in good standing, 177 were of 7 to 20½ years' connection with the Society, 10.13 years on the average, and he thought a likely solution of the problem of rectifying that membership status and of increasing the Society's income at the same time could be secured by some regulation of the junior membership dues. The meeting finally narrowed the discussion to three possible recommendations, of which the last was chosen by vote as indicating the choice of the Society. These proposed rules were: 1.—That the dues of junior members should be progressively increased (for example, after two years' affiliation, the dues should be increased $1 per year for five years); 2.—That after arriving at the period when the dues became equal in amount to those of associate members, the junior should then, ipso facto, become an associate member; 3.—That after reaching the age of 31 years, all juniors should cease to be members of the Society, unless they affiliated with the grades in which they were eligible, except those elected juniors prior to this rule. The resolution of Mr. C. W. Baker provides that a proposed amendment to the rules must be submitted to the Council at least ten days before the opening of a meeting; that it may be rejected by that meeting, after discussion, by a majority vote of members present; and, if accepted by that meeting, that it shall be submitted by letter ballot to the entire voting membership and be passed by a majority vote.

At the beginning of the afternoon session on December 3, the result of the election for officers was announced, as given in this issue among the personal notes. It was then voted to refer the matter of the revision of rules back to the committee and that this committee be increased to five members. The final report of the committee on a standard system of steam-engine testing was presented, together with the discussion on the preliminary forms of the report. Some changes have been made, in the withdrawal of some of the matter pertaining to diagram factors and in the provision that tests may be conducted both of the engine alone and of the plant, the latter in order to include the performance of the engine and auxiliaries together.

The second paper of the convention was then presented, "The Metric System," by Mr. F. A. Halsey. It proved such an interesting subject that the rest of this session and all of the evening session was spent in discussing it and the bill before the House of Representatives providing for the adoption of the metric system for the business of all departments of the Government.

Judging from this and the evening session it appeared that the majority of those present were opposed to the adoption of the metric system, although a very large number of arguments were presented to prove that there was much to be said in favor of the system and of the feasibility of its adoption by American manufacturers. It was felt that a supremacy or invasion of American manufactures in foreign lands would lead to an adoption of the American system of measurements. It was shown in a number of cases that where a particular country is prominent in some one branch of industry, the units of that country are always associated with the products of that industry.

The first item of business of the Thursday morning session was the presentation of the report of the committee on metric measurements by Mr. Charles T. Porter. Its tenor was that the Society should determine for itself what system of units it desired and expressed the opinion that by the end of the century the English system would be the universal one. The Council, by motion of Mr. F. J. Miller, was requested to appoint a number of representatives to confer with other engineering and scientific societies to make an investigation of the subject of the metric system. In this connection a resolution, presented by Mr. Henry R. Towne, was adopted to the effect that notwithstanding some statements that have been printed to the contrary the Society has never officially withdrawn its opposition to the metric system.

A paper was then read by Prof. Reeve, entitled: "Entropy Analysis of the Otto Cycle." On account of the comparatively little time remaining, the rest of the papers were read by title, and were in general not discussed very much, due, however, in part to the absence of a number of the members who had evidently expected to participate at the session in which the papers were scheduled. The first of these papers was that of Mr. J. C. Riley describing an apparatus for obtaining a continuous record of the position of an engine governor. This was followed by a paper on flywheel capacity of engine-driven alternators, presented by Mr. W. I. Slichter, and one entitled: "Heat Resistance the Reciprocal of Heat Conductivity," by Mr. William Kent. Mr. Kent advocates the use of reciprocals of the usual values of heat conductivity of substances, analogous to conductivity and resistance in electricity, in order, for example, that the conductivity of a combination may be obtained in the same manner that it is in electrical work. The coefficient of heat resistance he makes equal to unity divided by the number of British thermal units transmitted in one hour, by a slab of one square foot in area and one inch thick per degree Fahrenheit of difference of temperature between the two faces of said slab, both surfaces being exposed to the still air.

The remainder of the papers discussed at this session were as follows: Mr. J. M. Barnay, on a 44-foot pit lathe; Mr. Chas. T. Porter, on finer screw threads; Mr. C. C. Tyler, on the use of a surveying instrument in the machine shop; Mr. Frank Richards, on gift propositions for paying workmen; and Mr. W. Trinks, on the deflections of beams by graphics.

Thursday evening occurred the main social function of the convention at Sherry's. There was a reception by the acting president, and the president-elect, followed by dancing and a supper.

The Friday morning and last session was held in the Society's house. The following papers were there presented, a number of interesting topics were discussed and the president-elect was formally installed into office. Mr. J. T. Wilkin presented a paper on rotary pumps, Mr. H. M. Lane, on a filing system for office use, Mr. A. F. Nagle, on the analysis of the commercial value of water power, per horse-power per annum, Mr. B. Viola, on centrifugal machines, and Prof. A. Kingsbury, on an oil-testing machine and its results.

Messrs. R. H. Soule and G. M. Basford were announced as additional members of the committee on Rules and By-Laws. Before concluding this report mention should be made of the admirable plan of holding the greater number of the sessions at the Sturtevant House where the large number present were easily accommodated.

Trade Publications.

The Jeffrey Mfg. Co., Columbus, O., has published a profusely illustrated catalogue of 372 pages, devoted largely to elevating and conveying machinery. The book will prove a valuable one. It gives photographs from actual installations of labor-saving and power-transmission machinery of this class applied to all sorts of industries. The various types of conveyors and elevators are so numerous that a detailed reference cannot be made to them. Other apparatus, such as crushers and screens, are described. Price lists are scattered throughout and there is an index at the end.

The Watertown, N. Y., Engine Co. has prepared a booklet describing its line of engines, which comprises simple and compound, vertical and horizontal and four-valve and slide-valve machines. The various details of the machines are described by the aid of a large number of clear engravings.

The P. H. & F. M. Roots Co., 109 Liberty St., New York, is distributing a circular relating to its high-duty positive pressure rotary pumps for suction lifts of 20 to 25 feet, and heads to 400 feet. Some of the pumps are designed to handle 50,000 gallons per minute.

The Automatic Electric Co., Chicago, Ill., has published a catalogue devoted to its automatic telephone system, without switchboard operators, which appears to have an indefinite capacity for handling the business of any exchange. Owing to the extended description and numerous illustrations, a very good idea of the system can be obtained.

The Dodge Manufacturing Co., 128 West Third St., Cincinnati, O., has prepared a brochure descriptive of the Dodge American system of rope transmission, illustrated with a number of views of notable installations.

The Pullman Automatic Ventilator Co., 903 Arcade Building, Philadelphia, has published a 32-page pamphlet illustrating the application of its ventilator to all kinds of buildings and street and railway cars. It consists of a hood and a diffusion box placed in the lower sash rail of a window or in a board below the sash, the hood projecting into the open air and provided with a valve to produce alternately the admitting and exhausting of air.

The December issue of "Graphite," a paper printed for free distribution by the Joseph Dixon Crucible Co., Jersey City, N. J., contains leading articles on graphite brushes for commutators, force feed lubrication, experiments in the use of Dixon's graphite in air-brake equipment, by Prof. W. F. M. Goss, and brass melting. All the matter is not prosaic, however, as a poem, claimed to be an unpublished one of Robert Burns, is also given. Another circular from the Dixon Co. gives the different grades of graphite which it manufactures for use in foundries for the facing of molds.

The Herendeen Mfg. Co., Geneva, N. Y., has lately issued a catalogue describing the Furman boilers for steam and hot-water heating, giving particular details of its new sectional boiler. It is made in widths of from 12 to 40 inches, supplying from 2,450 to 5,700 square feet of steam radiation, or from 4,000 to 9,400 square feet of water radiation. The same catalogue illustrates the Furman portable and brick-set water-tube boilers, the tubes of which are vertical and contain internal diaphragms extending nearly to the bottoms of the tubes to provide circulation.

The November issue of "Ryerson's Monthly Journal and Stock List," published by Joseph T. Ryerson & Son, Chicago, takes the form of an anniversary number commemorating the close of their sixtieth year in business. Through six generations the Ryerson family has been associated with the iron and steel industry. Under "Letters from Old-Timers" a number of choice reminiscences have been collected from veterans in the trade. Another publication from the same firm is No. 6 of Ryerson's New Technical Library and deals with pneumatic tools. In addition to purely catalogue matter this book embodies considerable theoretical and practical information of a general character.

An illustrated article entitled "Underground Wire Rope Haulage" has been published by the Broderick & Bascom Rope Co., and is being distributed free of charge from its St. Louis office, 809 North Main St., and from its New York branch, Frank Baldwin, 33 South St. It is printed in pamphlet form on heavy paper, and is an excellent example of artistic typography. Its illustrations are reproductions from photographs of practical applications of the system and its text has the merit of being concise.

The Reliance Machine & Tool Works have recently issued a booklet, No. 2, containing cuts and brief descriptive matter concerning the Hooke steam pumps and air compressors for all kinds of service. Appended to each cut is a table of sizes and capacities that will be appreciated by the engineer.

In Bulletin No. 2 the De Laval Steam Turbine Co., 74 Cortlandt St., New York, describes a new line of direct-connected direct-current turbine-dynamos in sizes of from 1½ to 300 horsepower. It gives a detailed account of the construction of all parts of the dynamo with numerous illustrations and contains the usual price list and tables of dimensions and capacities.

The United States Naval coaling station at Frenchman's Bay, Me., is described in an illustrated brochure issued by the John A. Mead Manufacturing Co., 11 Broadway, New York. The pier is 400 feet long, the approach pier 305 feet long and the building, which holds 10,000 tons, has a length of 380 feet. Considerable machinery was required for unloading, storing and rehandling the coal.

The Mechanical Cashier is a machine which receives money, places it beyond the reach of the operator, records the transaction and the number of the operator who makes it, makes a record of the total of all transactions and makes change. It is described in a beautifully printed publication by the American Mechanical Cashier Co., 40 Wall St., New York.

Two catalogues have been received from the Atlas Car & Mfg. Co., Cleveland, O. No. 1,008, illustrates a line of cars for use in brick yards and cement plants, and No. 1,012 shows its cars for use in rolling mills, foundries, etc. Both catalogues contain information concerning tracks, turntables and other accessories for car conveying.

A flyer is being distributed by the Pittsburg Meter Co., East Pittsburg, Pa., containing some interesting facts about the Frick Building of Pittsburg. For example, it is 21 stories high, measuring 360 feet from basement level to roof and contains 532 offices. Its ten passenger elevators travel 250 miles daily and carry 20,000 people. It is equipped with two 6-inch Keystone water meters with a combined daily capacity of 2,600,000 gallons.

Personal and Obituary Notes.

Mr. P. W. Gates has been elected general superintendent of the Allis-Chalmers Co., with headquarters at Chicago.

Mr. J. Beyers Holbrook has been admitted to the partnership of Charles Henry Davis & Partners, 25 Broad Street, New York, as the firm's heating and ventilating engineer.

John M. Walbrecht, deputy city engineer of Los Angeles, Cal., died at his home in that city on November 26. He was born in Chicago in 1846, and was graduated from the St. Louis School of Engineering.

The Engineers' Society of Western New York, elected the following officers at Buffalo: President, Samuel J. Fields; vice-president, George H. Norton; secretary, L. W. Eighmy; treasurer, George B. Bassett; librarian, William A. Haven; director, S. T. M. B. Kielland.

Mr. Bruce W. Duer has been appointed superintendent of the Pittsburg division of the Baltimore & Ohio Railroad, succeeding Mr. S. P. Hutchinson, who resigned a short time ago to become assistant general superintendent of the Michigan Central Railroad at Detroit.

Mr. Charles A. Van Keuren has been reappointed chief engineer of the Board of Street and Water Commissioners of Jersey City, N. J., for a term of two years. He entered the service of the city, as surveyor, in 1884 and received his first appointment as chief engineer in 1898.

Mr. Charles E. Dafoe has been appointed superintendent of the Northwest division of the Chicago Great Western Railway to succeed Mr. J. A. Kelly, who resigned, and Mr. Charles S. Weston has been appointed superintendent of the Wisconsin, Minnesota & Pacific division, filling the vacancy caused by Mr. Dafoe's transfer.

Prof. C. L. Crandall has been appointed professor in charge of the College of Civil Engineering, Cornell University, for the remainder of the current year, succeeding Prof. Estevan A. Fuertes; and Prof. L. M. Dennis has been made professor in charge of the Department of Chemistry to take the place vacated by the resignation of Prof. Caldwell.

Mr. Desmond FitzGerald, past president Am. Soc. C. E., has resigned his position as engineer of the Sudbury Department of the Metropolitan Water and Sewerage Board of Boston, on account of ill health. He has been in the service of that city since 1873, when he became superintendent of the Western division of the Boston water-works.

George Leach, M. Am. Soc. M. E., died after six weeks' illness at his home in Providence, November 27. He was born in 1843, and began his engineering career working in industrial shops. Since 1891 he has been largely engaged in plant design and erection, for the Brown & Sharpe Manufacturing Co., the Oakdale Manufacturing Co., and others.

Prof. W. Kendrick Hatt, professor of Applied Mechanics at Purdue University, has been granted leave of absence for the remainder of the academic year, and will resume his duties September 1, 1903. During this interval he will be connected with the Road Material Laboratory, Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C.

Mr. Edward S. Larned has been appointed New England representative of the United Building Material Co., with an office at 101 Milk Street, Boston. For the past six years he has been with the Metropolitan Water Board, lately as principal assistant engineer in direct charge of masonry construction and of the cement testing laboratory of the Weston aqueduct.

Prof. Henry Mitchell died of heart disease in Boston, December 1, aged 72 years. He was a member of the Mississippi River Commission for many years, a member of the American Society of Civil Engineers since 1880 and a member of the National Academy of Arts and Sciences. Without the advantages of a college education, he achieved a position of prominence.

At its meeting in New York this week the American Society of Mechanical Engineers elected the following officers: President, James M. Dodge, Philadelphia; vice-presidents, F. H. Daniels, Worcester; James Christie, Philadelphia; John R. Freeman, Providence; managers, R. C. McKinney, New York; S. S. Webber, Trenton; Newell Sanders, Chattanooga; treasurer, William H. Wiley.

Salem Howe Wales, a prominent figure in both the municipal and business life of New York City, and for nearly 24 years managing editor of "The Scientific American," died at his home in that city December 2, of apoplexy. He was born in Wales, Mass., in 1825, and came to New York in 1846, where two years later he became associated with "The Scientific American." In 1855 he was appointed New York State commissioner at the Paris Exhibition. In 1873 he was made Park Commissioner of New York, and later became president of the commission, and besides a number of years in this service was also for a time president of the Dock Department. He was one of the early commissioners of the New East River Bridge, was one of the founders of the Metropolitan Museum of Art and a director and member of a large number of institutions of business, art, science and charity.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xvii, xix and xx.

WATER.

Norwalk, Conn.—At a recent citizens' meeting a vote was taken in favor of extending the 16-in. water main from its present terminal at Daniels' mill to the distributing reservoir on Spring Hill, a distance of 23,700 ft. Estimated cost, $70,000 to $80,000.

Hartford, Conn.—The Water Bd. has secured the option on considerable property in the meadows north of the New England R. R. for the new system of filtration of Connecticut River water, which the Commissioners have under consideration.

Long Island City, N. Y.—Bids are wanted Dec. 18 for furnishing, delivering and laying water mains in several streets in the Boro. of Queens. Robt. Grier Monroe, Water Comr., N. Y. City.

Erie, Pa.—Geo. C. Gensheimer, Secy. and Treas. of City Water Works Comrs., writes that preliminaries have just been started for the proposed extension of the present intake from the crib in Erie Bay through Presque Isle and into Lake Erie. The engineer's work will probably not be finished before next spring. Estimated cost, about $200,000. Geo. H. Fenkell, Engr. in Charge.

Great Notch, N. J.—Bids are wanted at once by Stewart & Abbot, Ltd., Times Bldg., N. Y. City, for doing about 30,000 cu. yds. of earth stripping at Cedar Grove Reservoir, Great Notch, N. J.

Rochester, N. Y.—Mayor Rodenbeck has disapproved the ordinance providing for the purchase or condemnation of Cobbs Hill as a site for a reservoir.

Buffalo, N. Y.—Comr. of Pub. Wks. Ward recommends the expenditure of $70,000 for 10 new boilers with fittings at the water works plant.

Baltimore, Md.—The Bd. of Awards is reported to have awarded the contract for building a storehouse on Gay St., to be used by the Water Dept., to Jas. W. Arthur, at his bid of $29,952.

Long Branch, N. J.—The Bd. of Comrs. has granted a 10-year contract to the Tintern Manor Water Co. to supply the city with water for municipal and other purposes. Rufus Blodgett is Pres. of the Co.

Ocean City, N. J.—At the annual meeting of the Ocean City Water and Sewer companies held recently it was decided to spend $10,000 in improvements before next season.

Newark, N. Y.—The contract with the Newark Water Works Co. expires in Oct., 1904, and local press reports state that there is a growing sentiment in the village in favor of the purchase of the present plant or the construction of a new plant to be owned by the village.

Coatesville, Pa.—The Boro. Council has under advisement the question of asking the voters to authorize a loan of $50,000 for the purpose of improving the water and sewer systems of the Boro.

Scotia, N. Y.—Local press reports state that the survey has been completed for the village water works to be constructed next summer. The new reservoir is to be located on Horstmann farm, and have a capacity sufficient for a population of 20,000.

Nassau, N. Y.—Local press reports state that R. H. Strong, of Albany, has the contract for constructing a system of water works for $10,500.

Jersey City, N. J.—The Consolidated Water Co., principal office, Corporation Trust Co., 15 Exchange Place, Jersey City, has been incorporated, with a capital of $2,000. Incorporators, John D. Stocker, Wm. Walker and Chas. H. Wellea.

Allegheny, Pa.—The Councils Water Com. has approved ordinances authorizing the City Recorder and the Dir. of Pub. Wks. to ask for bids for a pumping station on B'way, 2 electric pumping engines for the same and 2 iron water tanks to be located on Greentree Hill.

Penngrove, N. J.—The Council has under consideration the proposition of Geo. Pfeiffer, of Camden, to seek artesian water at his own expense if the Council will give him the contract to erect the water plant.

Parkside, Pa.—The Parkside Water Supply Co. has been incorporated with a capital of $5,000.

McKees Rocks, Pa.—Local press reports state that the Pittsburg & Lake Erie R. R. Co. has awarded to the Kennecott Water Softening Co., of Chicago, Ill., the contract for a plant at McKees Rocks, having a capacity of 1,500,000 gal. per day. Cost, $20,000.

Danielsville, Pa.—A charter has been granted to the Lehigh Acme Water Co., of Danielsville. Capital stock, $1,000. Incorporators: F. M. Hower and H. H. Hower, Danielsville; W. E. Beck, of Nazareth, and others.

Atlantic City, N. J.—The Water Comrs. have asked the City Council to issue $150,000 bonds to cover the cost of increasing the capacity of the water plant and making numerous improvements.

Griffin, Ga.—See "Sewerage and Sewage Disposal."

Lexington, Va.—The Town Council is said to be taking steps for the general installation of water meters in the town.

Richmond, Va.—The Common Council on Dec. 1 adopted the recommendation of the Water and Finance Com. in reference to the issue of $405,000 bonds for the erection of settling and coagulating basins and the construction of a stand-pipe in the western part of the city.

Chicago, Ill.—Bids are wanted Dec. 11 for furnishing and delivering the following approximate quantities of cast iron water pipe: 400 pcs. of 4-in., 4,000 pcs. of 6-in., 3,000 pcs. of 8-in., and 500 pcs. of 12-in. internal diameter; also for furnishing and delivering during the term ending Dec. 31, 1903, the following: Special castings for water pipe; cast iron rings and covers for hydrant chambers; necessary patterns and from these patterns to construct and deliver complete cast iron valve basin covers, and for furnishing and delivering at the water works shops, 22d St. and Ashland Ave., all hydrants and stop-valve castings. F. W. Blockl, Comr. of Pub. Wks.

Wellsville, O.—Bids will be received by the Bd. of Water Wks. Trus. until Dec. 16 for 2 triple single-acting pumps of 2,000,000 gals. per 24 hours capacity, 2 gas engines of 175 H.-P. and 1 hand-power traveling crane of 20 tons capacity. For specifications address Robt. W. Hunt & Co., Monongahela Bank Bldg., Pittsburg, Pa. Wm. Perkins, Supt.

Findlay, O.—City Engr. John W. S. Riegle writes that the time for receiving bids, for laying 10.6 miles of 24-in. vitrified pipe or 10.6 miles of 20-in. cast iron pipe, has been postponed to make tests for a water supply at a point nearer to the city.

Minneapolis, Minn.—City Engr. G. W. Sublette writes that the contract for placing steam mains and feed pipes in the new northeast pumping station has been awarded to Robinson & Cary Co., of St. Paul, for $3,298.

Cincinnati, O.—See "Power Plants, Gas and Electricity."

Reinbeck, Ia.—According to press reports, W. P. Walsh, of Grundy Center, Ia., seeks a franchise for an electric light and water plant.

Alexandria, Ind.—Press reports state that the Council proposes to establish the meter system.

Henderson, Minn.—A water works system is said to be under consideration.

Moline, Ill.—The Council is said to be considering the purchase of additional meters.

Buffalo, Minn.—The proposition to install a water and light plant at a cost of $15,000 is being agitated.

Barnesville, O.—John P. Force, of Columbus, is reported to have been engaged by the Council to prepare an estimate of the cost of water works and a sanitary sewerage system. Mr. Force is said to be in favor of a municipal water system, using drilled wells as the source of supply, with a pumping station and a stand-pipe or elevated tank having a capacity of 100,000 gal.

Duluth, Minn.—The Common Council has approved the bid of N. J. Upham & Co. for the purchase of $140,000 bonds; said bonds to be used for the purchase of the West Duluth water plant, to incorporate it in the general municipal plant.

Dubois, Ill.—The Illinois Central R. R. Co. is reported to have purchased a tract of land in Dubois on which to construct a reservoir by building a dam 600 ft. long and 20 ft. wide. W. J. Harahan, Ch. Engr. of R. R., Chicago.

Marinette, Wis.—Local press reports state that the Marinette Water Co. has asked for bids for lowering the intake pipe of said Co., which crosses the Menominee River. Estimated cost about $30,000.

Cincinnati, O.—The Bd. of Water Works Trus. has decided to sell to the sinking fund trustees $75,000 worth of manuscript bonds.

Two Harbors, Minn.—At a recent special election the Council was authorized to issue water and light improvement bonds to the amount of $24,000.

Clinton, Ind.—The Council has been petitioned for a franchise to establish a water system.

Ottumwa, Ia.—City Engr. J. T. Brady writes that bids were received Dec. 1 as follows for furnishing and laying C. I. water pipe, in all 470 net tons of pipe, and 19,000 lbs. of specials: The U. S. Cast Iron Pipe & Fdy. Co., Chicago, for furnishing pipe delivered by Feb. 1, 1903, bid $35.25 per ton for 6-in., $34.25 for 8-in., $33.25 for 12-in., 14-in. and 16-in.; $60 per ton for specials. The Des Moines Bridge & Iron Wks., Des Moines, for laying pipe, work to be finished by April 1, 1903, bid 46 cts., 48 cts., 54 cts., 68 cts. and 65 cts. for 6, 8, 12, 14 and 16-in. pipe and specials per ft.

Clarion, Ia.—The Council is reported to be considering the question of building a water works plant.

Oshkosh, Wis.—The Oshkosh Water Works Co. has filed an amendment to its articles of incorporation, increasing its capital stock from $200,000 to $300,000.

Austin, Minn.—The State Bd. of Investment has authorized a loan of $25,000 to this city for the purchase of a water works plant.

Searcy, Ark.—Bids will be received by Emmet Snipes, Secy. of Comn. until Dec. 26 for constructing a water works and electric light plant. Owen Ford, Consulting Engr., 710 Security Bldg., St. Louis, Mo.

Springfield, Tenn.—See "Power Plants, Gas and Electricity."

Memphis, Tenn.—The Council has adopted the report of the Water Com. recommending that the city purchase the plant of the Artesian Water Co. E. B. LeMaster, Chmn. of Water Com.

Kansas City, Mo.—The Council is reported to have appropriated $4,000 for about 100 additional fire hydrants to be erected in the business part of the city.

Marshall, Tex.—Bonds to the amount of $25,000 are reported to have been sold for the betterment of the water works.

Sheffield, Tex.—The City Council has granted to Parsons Sons & McIntyre a 30-year franchise for a water works.

Cameron, Mo.—The subject of water works is being agitated by the business men of this place.

Vicksburg, Miss.—Gov. Longino has approved an amendment to the charter of Vicksburg which gives this city additional rights to issue $300,000 municipal bonds for the purpose of building water works, sewerage, a city hall, etc.

La Follette, Tenn.—Press reports state that Pennsylvania capitalists propose to spend $250,000 in a water works system for this city.

Kingman, Kan.—Citizens of this place are said to be considering the bonding of the city to the amount of $35,000 for the construction of water works.

Wilbur, Wash.—Bids will be received by the Town Council until Dec. 17 for furnishing material and constructing a water works system and pumping plant, work to include 7,200 ft. of 4 to 8-in. pipe, the construction of a cement and concrete reservoir, a brick pump-house, installation of a gasoline engine and pump. Bids will be received on steel lap welded pipe and wood stave galvanized wound asphalted pipe. Geo. N. Matzger, Town Clk.

Havre, Mont.—The City Council will receive bids until Dec. 20 for the construction of water works, estimated to cost $20,000; also for electric lights.

Denver, Colo.—A. L. Fellows, Hydrographer, U. S. Geological Survey, writes from Denver that the construction of the Gunnison tunnel will depend upon the decision of the Secy. of the Interior. The work as planned provides for 1 tunnel 4 miles long and 1 tunnel of 2 miles, with perhaps 50 miles of canal. Estimated cost, $1,500,000.

Warner, S. D.—A company is being formed to sink an artesian well.

Egan, S. D.—A water works system is said to be projected by the village. Estimated cost, $6,000.

Souris, N. D.—Press reports state that bids are being taken by this village for boring a well. A. C. O. Lomen, Clk.

Wenatchee, Wash.—Local press reports state that this city will probably construct a new system of water works next summer the source of supply to be Wenatchee River.

Santa Barbara, Cal.—Steps have been taken by the city to acquire by condemnation sites for a reservoir and retaining dam in the Mono flats, involving an area of 2,000 acres; the object being to increase the water supply of this city. In order to connect with the lands specified it will be necessary to run a tunnel through the Santa Ynez mountains, a distance of about three miles. Estimated cost, $500,000.

Los Angeles, Cal.—Supt. of Water Works Wm. Mulholland writes that the following bids were opened Nov. 24 for 2 250-H.-P. water-tube boilers for the pumping plant at Buena Vista: John Wigmore & Sons, Los Angeles, Cal., $9,499; Fulton Engine Wks., Los Angeles, $8,342; Baker Iron Wks., Los Angeles, $10,645; Western Electric Co., Los Angeles, $11,100; Stirling Co., Chicago, Ill., $8,525 (awarded). The time for receiving bids for a pump has been deferred; time not yet set.

Suisun City, Cal.—The question of establishing a water plant is said to be under consideration.

Hinsdale, Mont.—Articles of incorporation of the Rock Creek Canal Co. have been filed with Secretary of State. The Co. proposes to build ditches, canals and flumes for purposes of irrigation, and has a capital stock of $9,600. The principal place of business will be at Hinsdale. The incorporators are: Wm. M. Wooldridge, Fred Hellesten, Jerome Hutchens, and others, of Hinsdale.

Los Angeles, Cal.—Imperial Water Co., No. 8, has been incorporated, with a capital of $1,000,000. Directors: F. C. Paulin, W. J. Boden-Hamer, R. T. Perry, J. C. Coy, J. W. Oakley.

Colorado Springs, Colo.—The special water committee appointed to arrange some plan of unwatering the Cripple Creek district is reported to have adopted a plan known as the El Paso tunnel, and estimated to cost between $80,000 and $100,000. Sherwood Aldrich is Chmn. of Com.

The Trus. of the North Side Water Works are reported to have let a contract to the Iron City Mfg. Co. for a standpipe to be erected at Fairmount Park for $6,900, and the contract for 3 miles of pipe, leading to the tower, to the Holme & Allen Pipe Co. for $35,000.

Aguascalientes, Mex.—See "Sewerage and Sewage Disposal."

North Toronto, Ont.—Local press reports state that further extensions of the town's water works system are contemplated.

Hamilton, Ont.—See "Sewerage and Sewage Disposal."

Durango, Mex.—Julian Bermudez, representing Eusebio Rodriguez, Nicolas Lopez and Manuel Soto Martinez, is reported to be soliciting permission to construct an irrigation dam at San Juan del Rio with the object of irrigating the ranches of La Galera and La Boca di Cachila.

SEWERAGE AND SEWAGE DISPOSAL.

Boston, Mass.—Bids will be received by the Metropolitan Water and Sewerage Bd. until Dec. 15 for building Section 48 of the high-level sewer in Quincy. Length, 5,880 ft.; average cut in embankment, 12 ft.; inside diameter of sewer, 135x150 inches. Wm. M. Engr.

Stamford, Conn.—Surveys are being made under the direction of City Engr. Paul Nash for the East Side sewer.

New York, N. Y.—Bids are wanted Dec. 15 for constructing sewers and appurtenances in portions of Vyse St. Louis Haffen, Pres. Bronx Boro.

Washington, D. C.—The time for receiving bids for the construction of a sewerage pumping station has been changed from Dec. 20 to Jan. 3, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids are wanted Dec. 17 for furnishing material and constructing a 36-in. brick and 12, 15, 18 and 24-in. vitrified stoneware pipe sewers in portions of several streets. J. Edw. Swanstrom, Boro. Pres.

Camden, N. J.—City Engr. Farnham has completed the survey made with a view to ascertaining what changes will be necessary in the sewer system along Bridge Ave., on account of the proposed elevation of the tracks of the Pennsylvania R. R. Co., on said street.

Coatesville, Pa.—See "Water."

Harrisburg, Pa.—Highway Comr. McConkey is reported to have received the following bids for the construction of State St. sewer: J. S. Bayard, $9,950; Bradley & Caldwell, $10,080; Fisher & Lynch, $9,975.

New Brunswick, N. J.—Property owners of Highland Park, at a recent meeting, considered plans for a sewerage system as prepared by Augustus N. Whitlock, and plans for the Raritan Ave. branch of the system, estimated to cost $6,000, were adopted.

Erie, Pa.—The Mayor has approved an ordinance for a sewer in McCarter and Pennsylvania Aves.

Rockaway Beach, L. I., N. Y.—The Property Owners' Association has appointed a committee to call upon Boro. Pres. Cassidy, the Bd. of Health and Mayor Low to urge the necessity of a sewer system at the beach. Surveys and plans prepared a year ago by the Topographical Bureau of the City of New York call for a sewerage system and disposal plant, estimated to cost $350,000.

Brooklyn, N. Y.—The contract for constructing a sewer in 92d St., from 11th Ave. to N. Y. Bay (bids opened Oct. 29), has been awarded to Jas. Malloy & Co., of Bridgeport, Conn., at $656,233.

Griffin, Ga.—An election will soon be held here to vote on the issue of $100,000 bonds for the purpose of putting in a sanitary sewerage system, improving the light and water plants, and for other improvements.

Pensacola, Fla.—Waring, Chapman & Farquhar, 874 Bway., New York City, have just finished surveys and are preparing plans for sewerage, street grading, paving and surface drainage for this city.

Richmond, Va.—Maynard & Ford are reported to have received an $8,000 contract for the construction of a sewer on Broad and 30th Sts.

Miami, Fla.—Local press reports state that the City Fathers are receiving bids for constructing a sewer in a portion of 8th St.

Chillicothe, O.—Bids are wanted Dec. 22 for furnishing material and constructing an 8-in. sewer in a portion of Second St.

Cincinnati, O.—The Bd. of Pub. Service has approved specifications for a sewer in Eastern Ave., to cost $10,618, and for one in Morris Place, to cost $2,010.

Columbus, O.—The contract for constructing the west side main trunk sewer is stated to have been awarded to J. B. Shetts & Co., of Pittsburg, Pa., for $51,840. For bids received for this work, on Oct. 30, see The Engineering Record of Nov. 8.

The Bd. of Pub. Wks. has adopted a resolution declaring the construction of that part of the west side main trunk sewer system which will be west of Central Ave., to be necessary. Estimated cost, $33,255.

Crookston, Minn.—Local papers quote Geo. A Ralph, Engr. of the State Drainage Bd., as having stated that as a result of the decision of the Supreme Court upholding the State drainage law, work will be undertaken in the spring which will call for the expenditure of over $500,000 for drainage ditches.

Charlotte, Mich.—A petition has been circulated in the townships of Brookfield, Eaton, Carmel, Walton and Bellevue, and presented to the County Drain Comr., asking that Battle Creek be dredged from its source at Narrow lake in Brookfield township to the Bellevue dam. The ditch will be about 30 miles in length and will cost about $75,000 to complete.

St. Joseph, Mich.—The City Council has ordered the Bd. of Pub. Wks. to proceed with the work of constructing a sewer 5,086 ft. long on Wisconsin, Michigan, Morton and Harrison Aves. Estimated cost, $5,203.

Chicago, Ill.—Plans for draining the Calumet region have been presented to the Sanitary Trus. by Ch. Engr. Randolph. He suggested that a canal 70 ft. in width be constructed to connect the Calumet River with the main channel of the sanitary canal, thereby reversing the flow of the Calumet River and diverting large quantities of sewage from the lake. He estimates the cost as follows: Excavation, $8,863,820; right of way, $472,534; bridges, $1,943,500; guard locks, $600,000. Total, $11,879,854.

Milwaukee, Wis.—The Council Com. on Finance has recommended the passage of a bond ordinance for $50,000 for the west sewerage district.

Findlay, O.—The construction of pipe sewers, in E. Lincoln, W. Lincoln, W. Front, 3d and other streets is contemplated. John W. S. Riegle, City Engr.

Gibson City, Ill.—This city is said to be planning to put in a sewer system.

Wichita, Kan.—City Clk. J. L. Leland writes that estimates have not yet been made for the proposed storm water sewer system. H. J. Harding, Engr. in Charge.

Osceola, Ark.—County Clk. W. D. Howard writes that the contract for constructing 27½ miles of drainage canal was let Nov. 28 to C. H. Moore, of Memphis, Tenn., at 12.95 cts. per cu. yd.; estimated contents, 550,000 cu. yds.

Big Spring, Tex.—Acting in conjunction with the Comrs.' Court of Howard County, the Texas & Pacific R. R. Co. will construct a drainage canal through Big Springs as a precaution against floods. Estimated cost, $15,000.

Vicksburg, Miss.—See "Water."

Marysville, Cal.—Marsden Manson, of San Francisco, is reported to have completed an inspection of this city and its surroundings in relation to the proposed installation of sewerage and drainage systems. Plans for said improvements will be adopted by the Council and a bond issue of $50,000 submitted to the people.

Oakland, Cal.—Bids will be received by the City Council until Dec. 20 for constructing a concrete and steel sewer across the right of way of the Southern Pacific R. R. Co. R. W. Church, City Clk.

Aguascalientes, Mex.—Texas papers state that plans are being prepared for a sewer system and addition to the water works.

Montreal, Que.—See "Paving and Roadmaking."

Hamilton, Ont.—The City Council is considering the proposition to submit to the people a by-law for the raising of $100,000 to be expended as follows: West-end sewage disposal works, $50,000; water mains, $5,000; Home for Incurables, $7,000; Ferrie St. opening, $12,500; East-end fire station, $5,000. The balance to be expended on macadam roads.

BRIDGES.

Charleroi, Pa.—A charter is stated to have been granted to the Charleroi & Monessen St. R. R. Bridge Co. to construct a bridge across the Monongahela between Charleroi and Monessen; it will be 1,700 ft. in length, and cost about $175,000.

Beaver Falls, Pa.—A press report states that John Warren, of Beaver Falls; W. A. Park, of Freedom; Richard Holt, of Beaver, and others will on Dec. 12 apply for a charter to build a bridge over Beaver River between this place and New Brighton. The plans are already drawn, and it is said the contract for the stone work has been let.

Steelton, Pa.—Dr. W. R. Powell is reported interested in the construction of an iron bridge, about 50 ft. in width, between Steelton and New Cumberland.

Erie, Pa.—An ordinance has been approved authorizing the construction of an overhead crossing over the P. R. R. tracks on Buffalo Road, at an estimated cost of $45,000 (exclusive of damages). The P. R. R. assumes $20,000, the Erie Electric Motor Co., which will have a track crossing the structure, assumes $15,000, and the city assumes the balance. This crossing, which will be a steel structure on masonry abutments with filled approaches and paved top, will eliminate two grade crossings.

Buffalo, N. Y.—Bids will be received by the Dept. of Pub. Wks. until Dec. 9 for constructing retaining walls, wing walls, piers and roadway on Sprenger Ave. at Scajaquada Creek; also for taking down, moving and resetting bridge now at Perry St., over Ohio Basin Slip at Sprenger Ave. and Scajaquada Creek. Bids will also be received until Dec. 12 for constructing substructure for a bridge on South Park Ave. over Cazenovia Creek. Francis G. Ward, Comr.

Seneca Falls, N. Y.—The proposition to borrow $15,000 with which to purchase land and construct the Ramsey St. bridge is reported to have carried at the recent election.

Warsaw, N. Y.—The Wyoming Co. Superv. are reported to have granted the following towns permission to issue bonds to repair bridges destroyed by the July floods. Benningtin, $12,500; Eagle, $3,250; Java, $8,600, and Sheldon, $9,000.

Allegheny, Pa.—Separate bids will be received until Dec. 11 for doing the following work: Constructing and erecting superstructure; constructing piers and abutments; and for paving the roadway and sidewalks of a bridge across Woods Run Valley in Shady Ave. D. L. Fulton, Dir. Dept. of Pub. Wks.

Tonawanda, N. Y.—A correspondent writes that the Town Bd. has awarded the contract for constructing the superstructure and steel work for a bridge across Two Mile Creek, to the Rochester Bridge & Construction Co. for $9,350.

New York, N. Y.—Mayor Low has approved the bond issue of $350,000 for the construction of a bridge across East Chester Bay, in Pelham Bay Park, Bronx Boro.

McKees Rocks, Pa.—Local press reports state that the business men of this city have taken up the matter of building a bridge across Chartiers Creek at Furnace St., to connect with Sheridan.

Doylestown, Pa.—The Jury appointed to view the site for a bridge across Park Creek, on the Kansas Road, reports in favor of constructing a structure, to cost not more than $9,000.

Wrightsville, Pa.—It is stated that the Pennsylvania R. R. Co. intends constructing an elevated span over the top of the bridge connecting Wrightsville and Columbia, to be used by vehicles and pedestrians.

Scranton, Pa.—It is reported that bids will soon be asked by Dir. of Pub. Wks. Roche for constructing the W. Lackawanna Ave. viaduct.

Columbia, S. C.—See "Electric Railways."

Hammond, Ind.—The Michigan Central Ry. Co. is reported to be preparing to place a new bridge over Calumet River, west of this city. The structure will be a 500-ton draw bridge. W. S. Kinnear, Ch. Engr., Detroit, Mich.

Kokomo, Ind.—The Co. Comrs. are reported to be figuring on 2 new bridges, one over Charley Creek, to be built as soon as the City Council and Co. Comrs. agree as to the kind of structure needed, and the other over Wabash River, to cost about $30,000.

Racine, Wis.—Engineers are reported to be in the city looking over the ground and laying out stakes for the proposed new bridges for the Northwestern Ry. Co. The 6th St. viaduct will be made into a double structure and a new double swinging bridge will be constructed over the river. Edw. C. Carter, Ch. Engr., Chicago, Ill.

Boscobel, Wis.—It is reported that the wooden bridge over Sanders Creek, at Oak and Bell Sts. in the 1st Ward, has been condemned, and the city will at once commence the erection of an iron structure.

Montezuma, Ia.—Press reports state that bids will be received by the Co. Aud. until Jan. 5 for constructing county bridges during the year 1903.

Dayton, O.—The officials of the Cincinnati, Hamilton & Dayton R. R. are reported to have submitted to the Bd. of City Affairs, plans for the construction of overhead bridges for pedestrians at Albany St., Edgemont and Kiefer Sts., North Dayton.

Portland, Ind.—Bids will be received by the Co. Aud. until Dec. 18 for constructing an iron bridge across Salamonia River in Green Township, to be 120 ft. long, 16-ft. roadway and 16-ft. truss.

Columbia City, Ind.—Bids will be received by the Bd. of Co. Comrs. until Dec. 19 for constructing several small steel truss bridges, ranging in size from 14 to 56 ft. long. W. H. Carter, Co. Aud.

Decatur, Ill.—The cost of the proposed viaduct at the West Main St. crossing of the Wabash Ry. has been estimated at $45,000.

Chicago, Ill.—Local press reports state that Lydon & Drews Co. have secured the contract for the substructure of both Loomis St. and 18th St. bridges at $62,728 and $63,854, respectively. The contract for the superstructures is reported to have been secured by Jackson & Corbett Co., at $121,620 for Loomis St., and $115,870 for 18th St.

Saginaw, Mich.—Local press reports state that the American Bridge Co., Lafayette, Ind., submitted the lowest bid Nov. 26 for constructing a 2-span bridge across Cass River, at $8,990 for the 120-ft. span, and $10,400 for the 150-ft. span; total, $19,800. The cost had been estimated at $15,000 and it is reported that these bids will likely be rejected and new bids asked.

Hot Springs, Ark.—Deputy Circuit Clerk J. M. Anderson, ex-Mayor W. W. Waters and Jas. Richards are stated to have been appointed as a commission by County Judge O. H. Sumpter to build a steel bridge across Ouachita River, on Central Ave., to cost about $80,000.

Phoenix, Ariz.—It is stated that a bridge will be built over Salt River by the Phoenix & Eastern R. R. Co. F. M. Murphy, Pres., Prescott.

Stockton, Cal.—Carl Salbach, Deputy Co. Clk., writes that it is proposed to construct a bridge at Millers Ferry, between San Joaquin and Sacramento Counties. For further information address F. E. Quail, Co. Surveyor, Stockton.

Spokane, Wash.—Local press reports state that the City Engr. has been instructed to prepare plans for a steel and wood high bridge to be built across Hangman Creek.

San Bernardino, Cal.—Superv. Glover has received permission from the Bd. of Superv. to purchase 2 80-ft. steel spans for a bridge to cross Warm Creek at East Colton Ave.

Redding, Cal.—The Co. Surv. has been directed to prepare plans and specifications for a steel bridge, of the Platt truss pattern, to cross Pit River at Elena, also for a steel bridge, of the same kind, to cross Pit River near Baird. It is reported that the plans are to be presented at the January meeting of the Bd. of Superv. when bids for construction will be called for.

New Westminster, B. C.—City Clk. W. A. Duncan writes that contracts have been let as follows for the construction of an $800,000 bridge across Fraser River at New Westminster: Substructure, to Armstrong, Morrison & Balfour; superstructure, to Dominion Bridge Co.

Joliette, Que.—See "Railroads."

PAVING AND ROADMAKING.

Boston, Mass.—The Street Comrs. have reported the estimated cost of widening Albany St., from Troy to Lehigh Sts., at $90,000, of which $75,000 is for land and building damages and $15,000 is for construction.

Quincy, Mass.—The City Council has authorized Mayor Bryant to petition the Legislature to appropriate $200,000 for building a State boulevard along the shores of Quincy Bay to the Blue Hills.

Pittsfield, Mass.—City Clk. Jos. Ward Lewis writes that on Dec. 2 it was voted to issue $100,000 bonds for street paving.

New York, N. Y.—Bids are wanted Dec. 12 for furnishing material and paving with asphalt the new-made land between 18th and 21st Sts., East River, and with granite between piers old 20 and new 16, East River. McDougall Hawkes, Comr. of Docks, Dept. of Docks and Ferries.

Butler, Pa.—This Boro. will issue $30,000 bonds for street improvements.

Allegheny, Pa.—See "Bridges."

Salisbury, Md.—Property owners are said to be interested in a movement to pave the business streets of this city.

Jersey City, N. J.—The Street and Water Bd. has adopted a resolution declaring that the only pavements which should be put down in this city, in the future, are Belgian, granite and asphalt.

New York, N. Y.—Bids are wanted Dec. 15 for regulating and laying macadam pavement on a telford foundation on a portion of Arthur Ave., Engrs.' estimate, 22,700 sq. yds. pavement, 8,700 lin. ft. of curbstone rejoined and reset; for regulating and grading, setting curbstones, flagging sidewalks, laying macadam pavement on a portion of Morris Ave., estimated quantities, 3,400 sq. yds. of macadam, 7,780 sq. ft. new flagging, 1,010 sq. ft. new bridgestone for crosswalks, etc.; for regulating, grading, setting curbstones, flagging sidewalks, etc., on portions of several streets requiring in all 101,210 sq. ft. of new flagging; for paving with granite block the roadway of E. 133d St., requiring 7,060 sq. yds. of granite block pavement laid on a sand foundation with sand joints, and for repaving with asphalt pavement on the present block pavement the roadway of 144th St., requiring 5,050 sq. yds. of asphalt pavement, including binder course, and 5,050 sq. yds. of old stone pavement, to be relaid as foundation or in approaches, etc. Louis F. Haffen, Pres. Bronx Boro.

Schenectady, N. Y.—Bids are wanted Dec. 9 for furnishing material and grading, curbing and paving portions of Lincoln Ave. and Seward Place. Address City Engineer.

Williamstown, N. J.—It is stated that bids will be received by the Monroe Township Com., H. B. Garwood, Chmn., until Dec. 20, for constructing about 9,350 ft. of Main St. Wm. C. Cottell, Township Engr., Wenonah, N. J.

Reading, Pa.—An ordinance is pending in the Council providing for an increase in the appropriation for paving Cherry St., to a total of $15,000; work to be done in the spring.

Erie, Pa.—The Mayor has approved an ordinance for curbing and paving German St., from 8th to 18th Sts.

McKeesport, Pa.—It is stated that bids are wanted Dec. 18 for grading, curbing and paving on portions of Fourth Ave. and Diamond St. R. A. Hitchins, City Compt.

Niagara Falls, N. Y.—The Common Council has rescinded all previous action in regard to the paving of Niagara Ave., and has adopted a new resolution declaring its intention to pave the avenue with waterproof bituminous macadam at a cost not to exceed $69,561.

Cumberland, Md.—The Council has authorized the paving with vitrified brick of Green St., at a cost of about $12,000.

Pensacola, Fla.—See "Sewerage and Sewage Disposal."

St. Augustine, Fla.—It is stated that bids are wanted Dec. 30 for paving with vitrified brick the north end of Washington St. John M. G. Carrera, City Clk.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Dec. 22 for furnishing material and improving a portion of Gilbert St. by paving and repaving the roadway with granite blocks redressing and resetting old curbs, furnishing and setting new granite curbs where necessary and relaying old and furnishing and laying new granite crossings. Bids will also be received at the same time for improving a portion of Rochelle St., by grading, setting curbs, and paving the roadway with brick and constructing the necessary drains. Geo. F. Holmes, Clk.

Chicago, Ill.—Bids will be received until Dec. 10 by the Lincoln Park Comrs. for furnishing 10,000 to 20,000 sq. yds. of blocks for paved beach work on the lake front near North Ave. Bids must be made for blocks delivered at work and also F. O. B. Chicago; delivery to begin not later than April 1, 1903. Sizes of block to be 4 to 5½ in. wide, 6, 7 and 8 in. deep and 9, 12 and 14 in. long. W. W. Tracy, Pres.

Glenville, O.—Bids are wanted Dec. 13 for grading, curbing, flagging and improving a portion of Lakeview Ave. B. F. Davis, Jr., Village Clk.

Keokuk, Ia.—City Engr. J. Ross Robertson writes that the following bids were opened Nov. 29 for brick paving to be done in the spring of 1903: *a*, 4,574 yds. of brick paving; *b*, 1,860 ft. curb; *c*, 1,344 yds. of excavation: Cameron & McManus, *a*, $1.51½; *b*, 62c.; *c*, 50c. Keokuk Const. Co., *a*, $1.33; *b*, 57c.; *c*, 39c. The contract will be awarded to the Keokuk Const. Co. Work is to be completed by June 1, 1903.

Lake Geneva, Wis.—The Geneva Lake Good Roads Asso. has been formed for the purpose of improving the parks and drives in the vicinity of Lake Geneva, Walworth Co. Incorporators: E. Davidson, Geo. W. Barr, C. S. Douglass, and others.

La Crosse, Wis.—The Common Council has passed ordinances providing for the paving of portions of 3d, Main, Jay and 5th Sts. with brick; also for curbing and macadamizing portions of numerous other streets.

Medford, Wis.—Taylor County Bd. has voted to construct a road 16 miles long from Medford to Aurora.

Holland, Mich.—The Common Council is considering the question of issuing $30,000 bonds for street paving purposes.

Marshalltown, Ia.—The City Council has ordered brick paving on 4th St. and on the east side of the square.

Indianapolis, Ind.—The City Park Bd. has instructed Park Supt. Power to make plans for the condemnation of land, for the Fall Creek Boulevard, under the Park Bd. law. It is hoped to build the driveway next year.

Wichita, Kan.—Bids will be received by the City Clk. for repairing approximately 70,000 sq. yds. of old asphalt pavement for a term of from 1 to 5 years; surface to be 2½ in. thick. Bids to state price per sq. yd. and whether sheet or rock asphalt. A 10-year guarantee is required.

Louisville, Ky.—Local press reports state that bids will be opened by the Bd. of Pub. Wks. Dec. 10 for paving with vitrified brick on a portion of Peterson Ave., cost about $5,000.

Albany, Ore.—It is stated that bids are wanted Dec. 9 for paving a portion of First St. J. S. Van Winkle, Recorder.

Portland, Ore.—Samuel Connell, Pres. of the Albina Improvement Asso., writes that it is proposed to pave the streets of Lower Albina with macadam or crushed stone.

Los Angeles, Cal.—Press reports state that ordinances for 8 miles of street improvements are now pending. Notices will be posted on 18 different streets, covering 39,642 ft. of street improvement.

Denver, Colo.—The Bd. of Pub. Wks. has acted favorably upon the petition to pave 6 blocks of Ogden St. with macadam.

Hamilton, Ont.—See "Sewerage and Sewage Disposal."

Montreal, Que.—In a report to the City Council City Engr. Barlow estimates the total cost of work required to be done by the Road Dept. in 1903 as $2,376,788. Of this amount $293,734 is asked for macadamizing old roads, $128,161 for macadamizing new roads, $197,000 for repairing permanent pavements, $199,042 for wooden sidewalks, $216,272 for paving between car tracks, $504,372 for new pavements, $325,000 for sewers and pump stations, $60,000 for snow removal and a number of smaller items.

POWER PLANTS, GAS AND ELECTRICITY.

Boston, Mass.—See "Public Buildings."

Kenmore, N. Y.—The Bd. of Village Trus. has awarded the contract for laying and installing a gas system to John B. Winter, 94 Amherst St., Buffalo, N. Y., who is lowest bidder at a price of 16c. per ft. for 4-in. pipe, $2.50 for setting lamp posts and $1 for setting syphons. Mr. Winter expects to begin work immediately and complete his contract by Dec. 20th, 1902.

Dansville, N. Y.—It is stated that plans are being prepared, and contracts will soon be let by the Mill Creek Electric Light & Power Co., for its proposed plant.

Cape May, N. J.—Saml. Shields and Chas. Fitzgerald, representing a syndicate, are stated to have purchased the local electric light plant for $95,000.

Philadelphia, Pa.—One bid for supplying naphtha lamps to the city was opened by Dir. of Pub. Wks. Haddock Nov. 26 and it was from the Pennsylvania Globe Gas Light Co., who at present have the contract. The prices offered are $29.50 a year for each Welsbach burner and $21 a year each for the old style Maloney burners. There are 12,537 naphtha lamps. The appropriation to maintain these lamps for the present year was $306,500. The Bureau of Lighting has asked $310,066 for next year.

York, Pa.—The Merchants' Electric Co. is reported incorporated with a capital of $300,000. Chas. H. Bear, Geo. W. Campbell and J. A. Walker, all of York, are among the directors.

Pittsburg, Pa.—The stockholders of the Manufacturers Light & Heat Co., at a special meeting, Nov. 25, voted to increase the authorized capital stock from $5,000,000 to $10,000,000. This means according to reports a vast extension of the company's operations and the taking over of contemporary interests. The Shadyside Electric Light Co. has been incorporated with a capital of $15,000, by John Eaton, W. L. Abbott and others, of the 20th Ward.

Lancaster, Pa.—The stockholders of the Lancaster Gas, Light & Fuel Co. have decided to recommend to the Bd. of Dirs. the betterment of the services, purchase of new equipment, etc.

Aberdeen, Md.—The Aberdeen Electric Light, Heat & Power Co. is reported organized, with D. B. Arthur, Pres., and Dorsey Rowe, Secy. The Town Comrs. are stated to have made a contract with a newly formed company to light the streets for the next 5 years.

Kenmore, N. Y.—Bids are wanted Dec. 15 for the purchase of $5,000 lighting bonds. Chas. V. Busch, Village Treas.

La Salle, N. Y.—The Village Bd. is stated to have granted the Ontario Power & Transmission Co. a franchise for the distribution of power. The company agrees to have 5,000 H.-P. ready for transmission by Sept. 1, and to erect a transformer house in the village.

Griffin, Ga.—See "Sewerage and Sewage Disposal."

Springfield, O.—The City Council is stated to have granted a franchise to the Citizens' Htg. & Power Co.

Akron, O.—The Bd. of City Comrs. is stated to have granted John Lamparter and Elsworth R. Bathrick a franchise to lay pipe through the city and construct a steam heating plant.

Findlay, O.—The City Council is stated to have granted Kirkbride, Taylor & Chapman a franchise for a gas plant.

Millersburg, O.—The City Council is stated to have granted Z. T. and Chas. E. Duer a natural gas franchise.

The Millersburg electric light plant is reported to have been purchased by O. P. and M. J. Van Sweringen, of Cleveland. The new firm will improve the plant and will add a heating plant.

North Amherst, O.—It is stated that bids will be received by F. E. Kasen, Village Clk., until Dec. 18 for a municipal lighting plant, estimated to cost $10,000, and to have a capacity of 50 arc and 1,000 incandescent lights. E. Y. Dow, Des. Engr., 1144 Fernwood Ave., Toledo, O.

Cincinnati, O.—Bids will be received by the Bd. of Trus. of the Cincinnati Hospital until Dec. 27 for the following repairs and improvements at the Cincinnati Hospital and Branch Hospital. One 300 16 c. p. dynamo and removal of present dynamo at Main Hospital to Branch Hospital, and furnishing switchboard; the whole to be set up ready for connections; electric light wiring of buildings and fixtures for Branch Hospital; storage battery with ample capacity for 250 16 c. p. lamps; new water mains and branch pipes, Main Hospital, repair and resetting 5 boilers, Main Hospital. John Fehrenbatch, Supt.

Reinbeck, Ia.—See "Water."

Medina, O.—Local press reports state that the Medina Electric Lighting, Power & Htg. Co. has secured a franchise. It is reported to be considering the purchase of the present electric plant. If purchased, the capacity will be doubled and a central heating plant will be constructed.

Buffalo, Minn.—See "Water."

Riverside, Ia.—The citizens are reported to have voted to issue $5,000 bonds for the construction of a gas plant.

Henderson, Ky.—The City Council is reported to have appointed a committee consisting of Judge C. C. Givens and Councilmen Hall and Young to investigate the cost of an electric light plant.

Springfield, Tenn.—It is stated that bids are wanted Dec. 15 for furnishing material and building water works and an electric light plant. Robt. L. Lund, Engr., Nashville, Tenn.

Moss Point, Miss.—L. S. Anderson, of Moss Point, writes that 5 per cent. bonds are about to be placed, to secure capital with which he proposes to electrify 6¼ miles of railway and construct 4½ miles of additional road, also to light 4 towns with an aggregate population of 12,000. Probable cost, $150,000 to $200,000.

St. Louis, Mo.—Bids will be received by the Bd. of Local Improv. until Dec. 9 for furnishing and setting in place, with all connections, the following: 3 engines of the horizontal, direct-connected, single cylinder, non-condensing type, for lighting plant, New City Hall; dynamos, switchboards, transformers, meters, etc., for lighting plant to be installed in the New City Hall; 2 horizontal, direct-connected, automatic, single cylinder type engines for lighting plant to be installed in the Insane Asylum; dynamos, switchboards, meters, transformers, etc., for lighting plant to be installed in the Insane Asylum; also for furnishing material and tools and labor necessary to construct conduits from New City Hall to 4 Courts, old City Hall, Court House, and Engine House No. 6; also to construct pole lines, etc., from Insane Asylum to Engine House No. 35, Female Hospital and Poor House. Hiram Phillips, Pres.

Louisville, Ky.—It is stated that the Louisville Htg. Co. will extend its lines and increase the capacity of its plant.

Searcy, Ark.—See "Water."

Douglas, Wyo.—John Morton and John T. Williams are stated to have secured a franchise for an electric light plant.

San Francisco, Cal.—The United Pacific Power Co., of San Francisco, has been incorporated, with a capital of $100,000. Incorporators: E. J. Martin, W. S. Burnett, and others.

Havre, Mont.—See "Water."

Nampa, Idaho.—The Com. on Sewers and Water of the City Council is reported to be negotiating with the Swan Falls Power Co. with a view of having electric power brought here from Snake River.

Niagara Falls, Ont.—A press report states that Wm. McKenzie, of Toronto, Pres. Toronto Ry. Co., and Fred Nichols, Pres. Canadian General Electric Co., are at the head of a syndicate applying to the Niagara Falls Park Comrs. for permission to construct a power plant at the Falls.

Toronto, Ont.—Certain persons, including E. W. Backus, of Chicago, Ill., are negotiating with the Dept. of Crown Lands for the control of the power on the Canadian side of the Falls on Rainy River, Ft. Francis, Ont. If they get it, it will be on condition that they proceed to develop the power at once.

ELECTRIC RAILWAYS.

Augusta, Me.—The Council is stated to have granted the Augusta & Waterville Ry. Co. a franchise along Bangor St., a distance of 4½ miles. The company is also reported to have secured a franchise in Vassalboro.

Caledonia, N. Y.—The Village Trus. are stated to have granted a franchise to the Buffalo & Depew Electric R. R. Co. E. Melvin, Ch. Engr., Depew.

Bridgeton, N. J.—It is stated that the Bridgeton & Millville Traction Co. is considering the extension of its line. B. F. Hires, Gen. Mgr., Bridgeton.

Pittsburg, Pa.—Local press reports state that the Pittsburg Ry. Co. is preparing ordinances to be introduced in Council providing for a system of elevated railroads in Pittsburg. F. Uhlenhaut, Ch. Engr., Pittsburg.

Meadville, Pa.—The Crawford County St. Ry. Co is stated to have filed in the office of the Register and Recorder of Deeds an application for right of way from Meadville to Titusville.

Elizabeth, N. J.—The Essex Cross Ry. Co. is stated to have secured a franchise for a line through Union Ave., from the city limits to Prince St.

Sheridan, N. Y.—The Dunkirk & Point Gratiot Electric Ry. Co. is stated to have secured a franchise to extend its line from Dunkirk to Buffalo through Sheridan. D. F. Toomey, Mgr., Dunkirk.

Richfield Springs, N. Y.—The Village Trus. are stated to have granted a franchise to the Oneonta, Cooperstown & Richfield Springs Ry. Co. W. D. McQueston, Mgr., Oneonta.

Greensboro, N. C.—The Bd. of Aldermen is stated to have granted a franchise to the High Point Electric Ry. Co.

Morgantown, W. Va.—Bids will be received until Dec. 13 by the Morgantown Electric & Traction Co. at Morgantown for constructing a steel and masonry power house and also for laying about 4 miles of street railway track. Power house to be fireproof, 88x94 ft. Material for tracking will be furnished. Geo. H. Switzer, Supt.; Walter Loring Webb, Consult. Engr.

Findlay, O.—The Western Ohio Ry. proposes to build 32 miles of track connecting Findlay with Lima, O.; work to begin in the early spring. F. D. Carpenter, Gen. Mgr., Lima.

Akron, O.—The Northern Ohio Traction & Light Co., of Akron, has been incorporated with a capital of $10,000 by J. R. Nutt, W. B. Whiting, and others, to construct an electric railway to connect Akron, Barberton, Cuyahoga Falls, Doylestown, Wadsworth, Ravenna, and Cleveland. This is a reorganization of the present Northern Ohio Traction Co.

Jackson, Mich.—The Jackson & Battle Creek Traction Co. is reported organized, with a capital of $1,500,000, to complete and operate an electric line between Jackson and Battle Creek. C. M. Spitzer, Pres., Toledo, O. W. A. Foots, Secy., Jackson.

Plymouth, Wis.—The Sheboygan Light, Power & Ry. Co. is reported to be considering the extension of its electric railway to Plymouth and Fond du Lac. E. J. Zufelt, Ch. Engr., Sheboygan.

Mankato, Minn.—The City Council is stated to have passed an ordinance granting a street railway franchise through the city to U. P. Hord, of Aurora, Ill., and F. G. Keator, of Chicago, Ill.

Aurora, Ind.—The City Council is stated to have granted a franchise to E. W. Swartsout and C. W. McMullan, both of Aurora. It is stated that the Indiana Southern Ry. will be incorporated to build a line from Rising Sun to Aurora, Versailles and Osgood.

Columbus, O.—The Toledo, Columbus, Springfield & Cincinnati Electric Ry. Co. is stated to have petitioned the Co. Comrs. for a franchise for a line from the limits of the city north through the county to the Union County line. W. R. Toy, Ch. Engr., Toledo.

Covington, Ky.—A. S. Berry, of Newport, and M. S. Barker, of Carrollton, are reported interested in the construction of an electric railway between Louisville and Covington.

Lexington, Ky.—The North Middletown, Winchester & Lexington Ry. Co. is reported incorporated, with a capital of $5,000, to construct an electric railway about 55 miles in length from Lexington to Winchester, North Middletown and Sharpsburg. Incorporators: C. H. Berryman, Stanley Milward and Rudolph Harting, all of Lexington.

Kansas City, Mo.—The Circle Belt Ry. Co., of Kansas City, has been incorporated; capital, $150,000. Incorporators: C. S. Jobes, A. C. Kennard, and others.

Montgomery, Ala.—The Montgomery County Bd. of Revenue is stated to have granted franchises to the Montgomery Traction Co. and the Montgomery St. Ry. Co.

Moss Point, Miss.—See "Power, Plants, Gas and Electricity."

South McAlester, Ind. Ter.—The Indian Territory Traction Co. is stated to have purchased a site here for its power house and car sheds. M. M. Lindly, Secy., South McAlester.

Florence, Colo.—The City Council is reported to have granted a franchise to Thos. Robinson.

Colorado Springs, Colo.—A press report states that the Colorado Springs & Cripple Creek District Ry. Co. has filed an additional mortgage of $1,600,000 for extensive improvements to the electric system in Cripple Creek District. T. L. Waggener, Ch. Engr., Cripple Creek.

Ogden, Utah.—The Co. Comrs. are stated to have granted the Consolidated Ry. & Power Co. a franchise to build several extensions. W. P. Reed, Supt., Salt Lake City.

Tacoma, Wash.—It is reported that the Tacoma Ry. & Power Co. will proceed with the erection of car shops and establish a power plant, developing power from White and Puyallup Rivers; the work complete will cost about $2,000,000. S. G. Ames, Ch. Engr., Tacoma.

Whatcom, Wash.—Messrs. Likins, Wyatt and Butters are stated to have recently secured a franchise to construct an electric railway from Whatcom to Lynden. Engineers are reported to have started surveying for the proposed line.

RAILROADS.

New Castle, Pa.—The Wabash Ry. has been granted an entrance into New Castle and has decided upon the location of its lines and station. W. S. Newhall, Ch. Engr., St. Louis, Mo.

Pittsburg, Pa.—The Bessemer & Lake Erie R. R. Co. is stated to have decided to complete a double track system from Pittsburg to the Lake. The improvement will cost about $2,000,000. H. T. Porter, Ch. Engr., Pittsburg.

Brownsville, Pa.—The Council is stated to have granted the Connellsville Central R. R. Co. a right of way through the borough.

Philadelphia, Pa.—It is stated that the Pennsylvania R. R. Co. will construct an elevated double-track freight line across West Philadelphia, from the 34th St. bridge at Aspen St. to the bridge over the Schuylkill, opposite the arsenal; it will cost about $500,000. W. H. Brown, Ch. Engr., Philadelphia.

Bedford, Pa.—The Bedford & Western R. R. Co. has been incorporated, to construct a railroad from Mt. Dallas to Geigers. Geo. H. Stein, Pres., Philadelphia.

A charter is stated to have been granted to the Monongahela Tunnel Co., of Pittsburg, to construct an underground passage from a point on the Pittsburg, Cincinnati, Chicago & St. Louis R. R. and extending under Mt. Washington from Sycamore St; capital, $1,000. Incorporators: O. J. W. Higbee, J. H. Mering, T. Chalmers Duff, and others.

Tallahassee, Fla.—The J. P. Williams Co., of Savannah, Ga., is reported to be preparing to construct a railroad from Tallahassee to Tampa.

Indianapolis, Ind.—The Indiana Harbor Co. has been incorporated, with a capital of $200,000, to build a railroad from East Chicago and Lake Michigan in a southerly direction through Benton, Newton, Warren, Vermilion and Vigo Counties to Sullivan County: total length, 200 miles. Directors: Oakley Thorne, John A. Spoor, Owen F. Aldis, and others.

Toledo, O.—The Toledo, Ft. Wayne & Southwestern R. R. Co. is reported organized, to build a steam road from Toledo to Indianapolis via Ft. Wayne.

Chicago, Ill.—Bids will be received by McArthur Bros. Co., Suite 810, Fisher Bldg., Chicago, for doing 1,000,000 cu. yds. of steam shovel and team work; also about 8,000 cu. yds. of masonry on the new line of the B. & O. R. R., between Ravenna and Newton Falls, O. Contractors to have outfit suitable for the work.

Winfield, Kan.—The Winfield & Southern R. R. Co. has been incorporated, with a capital of $100,000, to build a railroad through southeastern Cowley County to the coal fields of the Osage and Cherokee Nations. Directors: W. E. Otis, W. C. Robinson, and others, all of Winfield.

St. Louis, Mo.—Jas. D. Houseman, Mgr. St. Louis, St. Charles & Western Ry. Co., is reported interested in the construction of an elevated railroad, to run east and west through the city.

Huntsville, Ala.—R. E. Pettus and Capt. Humes are reported interested in the construction of a railroad between Huntsville and Birmingham.

Danville, Ky.—The Southern Ry. Co. is stated to have decided to extend its line from Harrodsburg to Danville. W. K. Morley, Div. Supt., Louisville.

Paragould, Ark.—The Paragould & Memphis R. R. Co. has been incorporated, with a capital of $525,000, to construct, equip and operate a railroad from Paragould, Ark., to Osceola, Ark., through the southeast corner of Missouri, a total distance of 52 miles. Incorporators: John W. Vail and Don Quinn, of Decatur, Ind.; J. B. Hale, of Cardwell, Mo., and others.

Cherryvale, Kan.—J. F. Porter and T. H. Stanford, of Cherryvale, Kan., are reported to be promoters of the plan to construct a railroad 900 miles in length. The line runs through Perry, Okla. Ter., from Cherryvale, Kan., and southwest into Mexico and southeast to a Gulf connection.

Coalgate, Ind. Ter.—It is reported that the Denver, Enid & Gulf line will be extended to Coalgate, a distance of 125 miles.

Enid, Okla. Ter.—A charter has been granted to the Enid, San Diego & Pacific R. R. Co., with a capital of $30,000,000, to build a line 1,000 miles long, from Enid to San Diego, Cal.

San Diego, Cal.—Geo. W. Marston is reported as being president of the San Diego & Eastern Ry. Co., which proposes constructing a railroad from San Diego to Yuma.

Salt Lake City, Utah.—Local press reports state that bids will be received until Dec. 15 by H. A. Sumner, Ch. Engr. of the Utah-Colorado Construction Co., for grading the second section of the Moffat road. The contract is to be made for 36 miles, in part or as a whole. The work is to include a tunnel, and the removal of earth and rock work of about 2,250,000 cu. yds.

Corinne, Utah.—The Malad Valley R. R. Co. has been incorporated with a capital of $4,000,000 to build and operate a railroad from a point near Corinne and through the valleys of the Bear and Malad Rivers into Oneida County, Idaho, to Malad City; length of road will be about 40 miles. Incorporators: W. H. Bancroft, E. E. Calvin, and others, all of Salt Lake City.

Monterey, Mexico.—The National R. R. Co. is reported to have decided to construct a line from the main line to Matamoras. E. N. Brown, Gen. Mgr., Mexico City.

Joliette, Que.—C. E. Loss, 8 Bridge St., New York, N. Y., has secured the contract for constructing the Chateauguay & Northern Ry., and for the substructure of the Bout de l'Ile bridge. This road runs from Joliette into Maisonneuve. The contract for bridge and railway is reported to amount to $1,000,000.

PUBLIC BUILDINGS.

Boston, Mass.—The Bd. of Aldermen on Dec. 1 passed the loan bill including $50,000 for a bath house and gymnasium at Charlestown, $40,000 for a bath house and gymnasium, Ward 17, $65,000 for an engine house and site in North End, $175,000 additional for sites and schools, and $10,000 additional for electric plant at the Parental School.

The Bath Trus. on Dec. 1 opened the following bids for erecting a bath house on Cabot St., Roxbury: The Wheaton Bldg. and Lumber Co., Putnam, Conn., $87,900; John W. Bruty, $87,773; Chas. H. Dodge Construction Co., $82,450; McNeil Bros., $79,990; Jas. Fagan, $78,692; John J. Flynn, 1011 Tremont Bldg., $69,400.

New York, N. Y.—Bids are wanted Dec. 11 for constructing a dormitory in the Medical College Building on Bellevue Hospital grounds. John W. Brannan, Pres. Bd. of Trus., Bellevue and Allied Hospitals.

Bids are wanted Dec. 16 for furnishing material and erecting a building for Engine Co. No. 41, in the Bronx Boro. Thos. Sturgis, Fire Comr.

Utica, N. Y.—Bids will be received by the State Comn. in Lunacy, Capitol, Albany, until Dec. 10 for plumbing improvements, Wards 1 to 12, Male Dept., main building, at the Utica State Hospital, Utica. T. E. McGarr, Secy.

Brooklyn, N. Y.—Bids are wanted Dec. 12 for furnishing material and making alterations to Cumberland St. Hospital and stable connected with same, Boro. of Brooklyn. Homer Folks, Comr. of Pub. Charities, N. Y. City.

Bids are wanted Dec. 17 for furnishing material and erecting 3 public comfort stations, underground, all in the Boro. of Brooklyn. J. Edw. Swanstrom, Boro. Pres.

Braddock, Pa.—The Congregation of St. Michael's Slavonic Catholic Church is reported to be preparing to erect a $50,000 edifice and a $25,000 school. Rev. Albert Kajlinski, Pastor.

Wilmington, Del.—The New Castle County Work House is reported to have been destroyed by fire Nov. 29. It will be rebuilt at once.

Atlanta, Ga.—Donaldson & Pearson, 33 Ivy St., are stated to have secured the contract for erecting an edifice on Peachtree St. and Porter Pl., for the First Methodist Church, to cost $75,000. Archt. Willis F. Denny, Prudential Bldg.

Richmond, Va.—The contract for erecting the $400,000 R. C. Cathedral, on Floyd Ave., is stated to have been awarded to J. E. & A. L. Pennock, 305 Walnut St., Philadelphia, Pa. Architect, Jos. H. Maguire, New York, N. Y.

Xenia, O.—Governor Nash is reported to have approved the plans for a new heating plant for the Soldiers' and Sailors' Orphans' Home at Xenia. The Legislature appropriated $32,000 for this purpose.

Clarksburg, W. Va.—Elliott & Winchell, of Zanesville, O., are stated to have secured the contract for erecting a jail and sheriff's residence for $33,000. The Champion Iron Works, of Kenton, are stated to have the contract for the cell work, at $30,000.

Centerville, Ia.—O. O. Smith, of Des Moines, is stated to have been selected to prepare plans for a $75,000 court house for Appanoose County.

Marion, Ind.—Local press reports state that bids will be received by the Bd. of Co. Comrs. until Dec. 29 for erecting a jail and sheriff's residence; cost not to exceed $100,000.

Waukesha, Wis.—Bids will be received by the Library Bd. until Dec. 20 for erecting a library. Bids to include plumbing, heating and wiring. C. C. Anderson, Archt., 214 Bethesda Ave.

Canton, O.—Bids will be received until Dec. 20 at the office of L. W. Thomas & Co., Archts., the Geo. D. Harter Bank Bldg., Canton, for furnishing material and erecting the Canton Auditorium and Market House. C. C. Loyd, City Clk.

Houston, Tex.—The plans of Geo. E. Dickey & Co. are stated to have been accepted for the proposed market house and city hall, to cost $80,900.

Vicksburg, Miss.—See "Water."

St. Louis, Mo.—The World's Fair Comrs. are stated to have decided to erect a Woman's Hall, to cost between $150,000 and $200,000.

Billings, Mont.—The citizens of Yellowstone County are stated to have voted to issue $75,000 bonds for a court house. Plans for same were to have been received Dec. 1 by the Co. Comrs.

Grand Island, Neb.—The Pub. Library Bd. is stated to have adopted plans for a $20,000 Carnegie Library.

Morristown, Tenn.—Bids are wanted Jan. 7 for remodeling the Hamblen Co. Jail. Address, R. S. Hale.

Santa Rosa, Cal.—It is stated that bids are wanted Dec. 13 for erecting a public library. L. D. Rathbone, Secy. Bd. Library Trus.

Toronto, Ont.—It is stated that bids are wanted by Mayor Howland until Dec. 9 for installing a cold storage plant in the St. Lawrence Market.

Hamilton, Ont.—See "Sewerage and Sewage Disposal."

Owen Sound, Ont.—It is stated that bids are wanted Dec. 9 for erecting a House of Refuge. Chas. Gordon, Chmn. Com.

BUSINESS BUILDINGS.

Holyoke, Mass.—G. P. B. Alderman & Co., 380 High St., are stated to have prepared plans for a $50,000 building for the Harmonie Society of Holyoke. It will be a tenement house block, with society rooms and two stores, and will be 4 stories high, of brick, and measure 107x108 ft.

South Sharon, Pa.—The Pennsylvania lines will erect a new station at South Sharon, Mercer Co. Thos. Rodd, Ch. Engr., Pittsburg.

Wilmerding, Pa.—The Westinghouse Air-Brake Co. is reported to have had plans prepared for a 4-story brick and stone Y. M. C. A. building.

Cape May, N. J.—The East Cape May Co. has been incorporated, for the improvement and development of Cape May. The improvement includes the erection of 2 hotels, one to cost about $1,000,000, the other $600,000. Anthony M. Zane, of Philadelphia, Pa., and Capt. Frank G. Edwards, of Bristol, Pa., are reported interested.

Oakland, Pa.—The Oakland Bd. of Trade is stated to have decided to erect a $25,000 building at 5th Ave. or Forbes St.

Atlanta, Ga.—A petition has been filed with the Secy. of State by J. S. B. Thompson, W. A. Vaughan, Otis M. Ezell, and others, of Atlanta, for a charter to construct the proposed $600,000 depot on the north side of Mitchell St. viaduct. Contracts for material will soon be let.

Columbus, O.—Chas. L. Henry, of Anderson, Ind., is reported to be preparing plans for a 12-story business building to be erected at Columbus.

Ft. Wayne, Ind.—It is reported that the Ft. Wayne Lodge of Elks proposes to erect a $40,000 club house.

Ames, Ia.—The Y. M. C. A. is reported to be preparing to erect a $25,000 building.

Lockland, O.—It is stated that the Miami & Erie Canal Transportation Co. will erect a 2-story brick warehouse at Canal and Lock Sts.

Peoria, Ill.—The members of the Creve Coeur Club are stated to have decided to erect a club house, to cost about $75,000.

Oklahoma City, Okla. Ter.—It is stated that the Santa Fe will erect a passenger station, to cost $100,000, and a freight station, to cost $50,000. Jas. Dun, Ch. Engr., Chicago, Ill.

Plans have been filed for a theater to be erected at 692 Washington St., 60x175 ft., to cost $200,000. Owner, R. B. Brigham Estate. Builder, Sylvester & Cooper, Paddock Bldg. Architect, Arthur H. Vinal, 19 Milk St.

Leavenworth, Kan.—Wm. P. Feth, of Leavenworth, is preparing plans for a $50,000 building for the Wm. Small Memorial Home for Aged Ladies.

Vicksburg, Miss.—Herbert L. Shirk, of Indiana, will erect, in this city, a 6 story office building of fireproof construction, with 2 elevators and all modern improvements. Rawson & Paunack, of Vicksburg, are the architects.

St. Louis, Mo.—Plans are reported to have been completed for the Hotel Epworth, to be erected on Melville and Washington Aves. It will contain 500 rooms. Architect, J. H. Lynch, 715 Locust St. Rev. Dr. C. R. Carlos, Pres. Hotel Co.

New Orleans, La.—Col. Jerome Hill, of Memphis, Tenn., is reported interested in the erection of 2 International warehouses to be erected on the Mississippi River, one on the east and the other on the west bank. It is reported to be the intention to incorporate the International Warehouse Co., with a capital of $3,000,000.

Mitchell, S. D.—A. B. Beal, of Sioux City, Ia., is reported interested in the erection of a theater at Mitchell.

Omaha, Neb.—Bids are wanted Dec. 11 for the brick work and cut stone or terra cotta work for the superstructure of the Omaha Auditorium. Jos. R. Lehmer, Secy.; John Latenser, Archt., Bee Bldg.

San Francisco, Cal.—The Southern Pacific Co. is reported to have under consideration plans for a new slip and depot at the Alameda mole, to take the place of the one recently burned, to cost about $60,000. Wm. Hood, Ch. Engr., San Francisco.

Pendleton, Ore.—The Pendleton Commercial Assoc. is stated to have adopted plans for a $20,000 club house.

Niagara Falls, Ont.—A press report states that W. M. Aiken, 18th St. and 4th Ave., N. Y. City, is preparing plans for a $750,000 hotel, to be erected at Niagara Falls.

DWELLINGS.

Philadelphia, Pa.—Doyle & Doak, 1509 Sansom St., are stated to have secured the contract for erecting an apartment house on Broad St. and Girard Ave., to cost about $300,000. Architect Jos. M. Huston, Witherspoon Bldg.

Pittsburg, Pa.—W. A. Thomas, Park Bldg., is stated to have prepared plans for a brick and stone apartment house to be erected on Frankstown and Brushton Aves., East End, for F. H. Trembly, to cost about $60,000.

Washington, D. C.—T. F. Schneider, Bond Bldg., is stated to be preparing plans for a 7-story apartment house to be erected on Columbia Road and Mintwood Pl. S. Walter Woodward and Phelan C. Hawn are reported interested.

Dubuque, Ia.—A correspondent writes that Jas. Burch will build a $25,000 residence, next spring.

Kansas City, Mo.—J. L. Bergner is about to erect a $10,000 brick dwelling at 3346 Lydia Ave.
Braecklein & Martling, of Kansas City, are the architects for a $25,000 brick apartment house, to be built by L. Rosinfield on Harrison Ave., between 15th and 16th Sts.

Mobile, Ala.—A $12,000 dwelling is to be built for Chas. W. Stanton. Geo. G. Johnson, 54 N. Royal St., Architect.

Cleveland, O.—S. R. Badgley, 1273 Euclid Ave., is stated to be preparing plans for 4-story apartment house, to be erected on Harkness and Hough Aves., for F. D. and C. M. Shock. It will be of brick and stone, 4 stories high, 50x70 ft.

SCHOOLS.

Boston, Mass.—The following are the lowest bids for school work received by the Schoolhouse Comn. Dec. 1: for erecting a school on Huntington Ave. and Kenwood Road, exclusive of plumbing and heating, G. W. Harvey, $123,500; for ventilating and heating school on Norman St., A. B. Franklin, 167 Ft. Hill Sq., $25,112; and for sanitary work in Freeman School on Charter St., Ganey & Burke, $4,470.

Boston, Mass.—See "Public Buildings."

New Haven, Conn.—Sperry & Treat, Hoadley Bldg., are stated to have secured the contract for erecting Lamson Hall at the Yale Univ. It will be 5 stories high, of brick, and measure 50x142 ft. Cady, Berg & See, of New York, N. Y., are the architects.
K. K. Cutler, of Spokane, Wash., is stated to have prepared plans for Kirtland Hall, for the Yale Univ. It will be of brick and stone, 65x100 ft.

Long Island City, N. Y.—The following bids were opened Dec. 1 by the Dept. of Educ., New York City, for the general construction of school 83, Ravenswood, Boro. of Queens: Chas. H. Peckworth, $150,732; Francis Sullivan, $152,000; Geo. Hildebrand, $156,900; Myron C. Rush, $149,794; P. J. Walsh, 503 5th Ave., N. Y. City, $145,000 (awarded); Thos. Cockerill & Son, $157,500; Tolmie & Kerr, $155,128; Wm. P. McGarry, $149,291.
Bids are wanted Dec. 15 for erecting School No. 81, Boro. of Queens. C. B. J. Snyder, Supt. of School Bldgs., N. Y. City.

Dickinson, N. Y.—Bids will be received by the Bldg. Com. of School Dist. No. 8, of Dickinson, until Feb. 1 for erecting an addition to the school in the village of Dickinson Center. B. L. Orcutt, Chmn.

Buffalo, N. Y.—Bids are wanted Dec. 12 for erecting an 8-room brick school on Hertel and Aldrich Aves., work to include ventilating, heating, plumbing, etc. Francis G. Ward, Comr. of Pub. Wks.

Philadelphia, Pa.—The Com. on Property of the Bd. of Educ. is stated to have directed Architect Cook to prepare plans for a manual training school at 7th St. and Lehigh Ave., to accommodate 600 students. $200,000 has been appropriated for the building and equipment.

Ligonier, Pa.—The plans of Milligan & Miller, of Wilkinsburg, are stated to have been accepted for a $25,000 school.

Braddock, Pa.—See "Public Buildings."

New Brighton, S. I., N. Y.—The following bids were opened Dec. 1 by the Dept. of Educ., New York City, for alterations in, and additions to, the heating and ventilating apparatus for school 16, Boro. of Richmond: The Baldwin Engineering Co., 107 W. 17th St., N. Y. City, $7,900; Frank Dobson, $9,990; E. Rutzler, $8,775; Williams & Gerstle, $9,368; John Neal's Sons, $8,866; United Htg. Co., $8,840.

Braddock, Pa.—Bids will be received by the Bd. of Educ. until Dec. 15 for erecting a school in Braddock. Plans and specifications may be seen at the office of E. J. Carlisle & Co., Archts., 901 Westinghouse Bldg., Pittsburg. Address, V. C. Knoor, Secy., c. o. E. J. Carlisle & Co., Pittsburg.

Meadville, Pa.—The Trus. of the Meadville Theological School are stated to have decided to erect a $26,000 building.

New York, N. Y.—Bids are wanted Dec. 15 for erecting School No. 183, Boro. of Manhattan, and for installing electric elevators in the Morris High School, Boro. of Bronx. C. B. J. Snyder, Supt. of School Bldgs.

Sterrett, Pa.—Separate bids will be received until Dec. 20 by W. J. Fleming, Secy. School Bd., care of Ellsworth Dean, Archt., 612 Fitzsimons Bldg., Pittsburg, for erecting 2 schools, 1 on Braddock Ave., the other on Linden Ave., 22d Ward, Sterrett.

Spartanburg, S. C.—It is stated that bids will be received until Dec. 15 for erecting a brick and stone Science Hall for the Wofford College at Spartanburg. Avery Carter, Archt., Cleveland Bldg.

Cincinnati, O.—Bids will be received until Dec. 15 by the Bd. of Directors of the University of Cincinnati for erecting a building for observatory purposes on the grounds of the University in Burnet Woods Park. Oscar W. Kuhn, Chmn.

Cleveland, O.—School bonds amounting to $600,000 have been sold.

Jackson, Mich.—Harry J. Rill, 54 Buhl Blk., Detroit, is reported to be preparing plans for an $18,000 school for the Polish Society. Rev. Joseph Heir, Pastor.

Chicago, Ill.—Bids will be received by the Bd. of Educ. until Dec. 12 for erecting a school at Washtenaw Ave. and 15th St., work to include heating, ventilating, plumbing, etc. Address Com. on Bldgs. and Grounds.
The City Council has granted the Bd. of Educ. permission to expend $140,000 for the erection of an English High and Manual Training School at Sedgwick and Division Sts.

Sac City, Ia.—The citizens are stated to have voted to issue $20,000 bonds for a new school.

Leavenworth, Kan.—Wm. P. Feth, of Leavenworth, is preparing plans for the proposed $60,000 high school.

St. Louis, Mo.—Hiram Lloyd, 816 Olive St., is stated to have secured the contract for erecting the Jas. E. Yeatman High School, for $307,766.

Dallas, Tex.—The Dirs. of the Patton Seminary are stated to have decided to erect a hall, with a seating capacity of 1,000.

Lawton, Okla. Ter.—The Bd. of School Directors is stated to have voted to erect 2 schools, one a high school, to cost $25,000, the other to cost $15,000.

Aberdeen, S. D.—The Bd. of Educ. is reported to be considering the erection of a school, to cost about $25,000.

Denver, Colo.—E. P. Varian, 413 Taber Blk., has prepared plans for a $10,000 brick and stone school to be built for the State Home at S. Iliff and Clarkson Sts.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Mayor Low has approved an ordinance authorizing the issue of $141,144 bonds for new stocks and plant for the Street Cleaning Dept., Boro. of Brooklyn, and $165,557 bonds for stock and plant for the Boroughs of Manhattan and Bronx.

Philadelphia, Pa.—The following bids were opened Dec. 1 by Dir. of Pub. Wks. Wm. C. Haddock, for cleaning the streets, private alleys and public market houses, also for the removal of ashes for the entire city, for the year 1903: Jas. Curran, $714,000; Harmer & Quinn, $691,000; David Peoples, $690,000; Ruch & Bates, $680,000.
Bids were opened at the same time for above work by districts. The lowest bids received were as follows: Districts 1 and 2, from Ruch & Bates, at $115,000 and $168,000 respectively; Districts 3, 4 and 5 from Thos. Parker at $56,000, $159,000 and $119,000 respectively; District 6, from Richard P. Bennis at $23,400. Total by districts, $640,400.

Rochester, N. Y.—Local press reports state that the Bd. of Contract & Supply will soon ask bids for the disposal of garbage.

Chicago, Ill.—The Council has ordered the sum of $14,000 spent for a garbage crematory at the bridewell.

Ft. Brady, Mich.—See "Government Work."

Parkersburg, W. Va.—City Clk. Jesse L. Cramer writes that contracts for the removal of all kitchen garbage and offal accumulating in this city for 1 year from Jan. 1, 1903, have been awarded as follows: 1st and 5th Wards to John W. Curry at $798 and $500 respectively; 2d and 4th Wards to R. A. Little at $639 and $490 respectively; 3d Ward to Richard Ellis at $783.

Des Moines, Ia.—In a proposition submitted by the American Underwriting Co. (represented in Des Moines by A. N. Talcott) to Secy. Milo Ward of the Commercial Exchange, in reference to the disposition of waste of this city, said Co. offers to collect all garbage and all other waste matter, excepting night soil, at $1.40 per ton, and to collect and dispose of night soil in a sanitary and odorless manner at $1.75 per cu. yd. A franchise for not less than 10 years is asked by above Co.

Elwood, Ind.—Local press reports state that estimates are being prepared by S. H. Digel, under instructions from Mayor Smith, of the probable cost of a new garbage furnace.

Monroe, La.—A Com. of the City Council has under consideration the question of the disposal of city garbage.

Oakland, Cal.—The City Council has passed an ordinance granting a franchise to the Pacific Odorless Incinerating Co. to erect a Dixon steel shell crematory; the ordinance provides that after 20 years the crematory shall become the property of the city.

GOVERNMENT WORK.

Ft. McKinley, Me.—Bids are wanted Dec. 27 for constructing a sewer system, with all manholes, outlets, flushing tanks, etc., at Ft. McKinley, Gt. Diamond Island, Me. Address, Capt. A. W. Yates, Q. M., Portland, Me.

Ft. Banks, Winthrop, Mass.—Bids are wanted Dec. 29 for constructing granolithic walks and macadam roads at this post. Address, Lieut. H. B. Grant, Q. M.

Ft. Williams, Me.—Bids are wanted Dec. 26 for constructing, plumbing and electric wiring hospital stewards' quarters. Address, Leroy T. Hillman, Q. M., Ft. Williams, Me.

Portsmouth, N. H.—The Bureau of Yards and Docks, Navy Dept., Washington, has awarded the contract for constructing building No. 60, at the Portsmouth Navy Yard, to Snare & Triest, 39 Cortlandt St., New York City, for $67,750.

Boston, Mass.—Bids are wanted Jan. 2 for constructing at Ft. Strong, Boston Harbor, Mass., an Administration Bldg., a Double Set, N. C. O. Quarters and an Ordnance Storehouse. Address, A. M. Palmer, Depot Q. M., Boston.
Bids are wanted Jan. 5 for dredging in Cohasset Harbor and Weymouth and Town Rivers, Mass. Lieut.-Col. W. S. Stanton, Corps Engrs., U. S. A.

New Castle, Pa.—A correspondent writes that the location of the new government building at New Castle has been decided upon, and contracts will be let for a building to cost about $100,000.

Washington, D. C.—Bids will be received by Jas. Wilson, Secy. Dept. of Agriculture, Washington, until Dec. 17 for erecting a 3-story stone building for the use of the Weather Bureau, U. S. Dept. of Agriculture, on the summit of Blue Ridge Mountains, about 1½ miles from Trappe, Loudoun Co., Va., and 60 miles from Washington, D. C.

Philadelphia, Pa.—The following bids were opened Nov. 29 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the removal of 500,000 cu. yds. of material from the waters of the Navy Yard, League Island, Pa.: American Dredging Co., Philadelphia, 37c. and 40c. per cu. yd.; Bowers Hydraulic Dredging Co., Kansas City, 35c. and 37c. per yd.; H. Steers, Jr., New York City, 25¾c. and 27¾c. per yd.

Philadelphia, Pa.—Bids will be received until Jan. 3 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a retaining wall at the Navy Yard, League Island, Pa. Appropriation available, $85,000.

Washington, D. C.—Bids will be received by the Bureau of Supplies & Accounts, Navy Dept., Washington, until Dec. 16, for furnishing a quantity of steel, steel castings and forgings, structural steel, pipe, pipe fittings, asbestos covering, etc. A. S. Kenny, Paymaster Gen., U. S. N.

Ft. Barrancas, Fla.—Bids are wanted Dec. 23 for constructing a wharf at Ft. Pickins, Fla. Address W. E. Cole, Q. M.

Norfolk, Va.—Bids will be received until Dec. 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for installing an electric passenger elevator in the U. S. Court House and Post Office Bldg., at Norfolk.

Ft. Brady, Mich.—Bids are wanted Dec. 24 for constructing a garbage crematory and shed for same at this post. Address Col. E. B. Atwood, Ch. Q. M., Chicago, Ill.

Mobile, Ala.—Bids are wanted at the U. S. Engineer Office until Dec. 29 for dredging in Pascagoula River and Mississippi Sound, as advertised in The Engineering Record.
Bids are wanted Jan. 8 for furnishing, delivering and completing the metal work for Sabine Bank Light Station, Tex. Bids will also be received at the same time for furnishing, delivering and constructing the Sabine Bank Light Station, Tex. Lieut. Col. A. N. Damrell, Corps Engrs., U. S. A.

St. Louis, Mo.—Bids are wanted Jan. 6 for installing in complete working order an ash elevator in the U. S. Custom House and Post Office Bldg., St. Louis. Address, Custodian, U. S. Custom House and Post Office, St. Louis.

Louisville, Ky.—Local press reports state that contracts will be let, so that construction can begin by Jan. 1 for lock No. 6 on Green River. Amount available, $180,000. Maj. Geo. McC. Derby, Corps of Engrs., U. S. A., Engr. in Charge.

New Orleans, La.—Bids will be received until Dec. 28 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Naval Station, New Orleans, a power plant. A. S. Kenny, Paymaster Gen., U. S. Navy.

Emporia, Kan.—The following bids were opened Dec. 3 at the Treasury Dept., Washington, D. C., for the construction including plumbing, heating and ventilating apparatus, electric wiring and conduits for the U. S. Post Office at Emporia: Latimer & Benning, Kansas City, Mo., $34,407; J. S. Morse, Topeka, Kan., $34,973; J. W. Berry, Jewell City, Kan., $37,277; Congress Const. Co., Chicago, Ill., $39,923.

Carson, Nev.—Bids are wanted Dec. 20 for furnishing material and constructing a bathhouse and furnishings, at the U. S. Indian School, Carson. For further information apply to Jas. K. Allen, Supt.

Helena, Mont.—Bids are wanted at the Treasury Dept., Washington, D. C., until Jan. 14 for the installation of a conduit and electric wiring system for the U. S. Public Building at Helena, as advertised in The Engineering Record.
Bids are wanted Jan. 3 for installing an electric passenger elevator in the U. S. Public Bldg., at Helena. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Los Angeles, Cal.—The following bids are reported to have been received Nov. 26 by Capt. Edgar Jadwin, Corps of Engrs., U. S. A., for completing the jetty work at San Diego Harbor: P. A. Howard and F. D. Lanterman of Los Angeles, at $2.17 per net ton (awarded); W. H. Healy of San Francisco, $2.39½; Atlantic, Gulf and Pacific Dredging Co., $2.50; Rudolph Axman, $2.47 and Waldo S. Waterman, San Diego, $2.30.

Norfolk, Neb.—Bids will be received until Jan. 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Norfolk.

MISCELLANEOUS.

North Adams, Mass.—The City Council has voted to buy the syndicate property on North Church St. for park purposes, the price to be $24,000.

New York, N. Y.—Bids are wanted Dec. 15 for furnishing labor and material required for constructing and delivering fire pumps for a new fire boat. Thos. Sturgis, Fire Comr.
Bids will be received by the Park Bd. until Dec. 11 for regulating and grading Dewitt Clinton Park. Wm. R. Willcox, Comr. of Parks.

Asbury Park, N. J.—See "Sewerage and Sewage Disposal."

Norfolk, Va.—The Norfolk, Hampton Roads Shipbuilding and Dry Dock Co. (John T. Gamble, of Columbus, O., Secy.) proposes to build a solid concrete or stone 1,000 ft. dry dock.

Richmond, Va.—The Common Council on Dec. 1 passed an ordinance from the Finance Com. recommending that $38,000 be appropriated for the purchase of a new dredge and scows for the improvement of the James River harbor.

Terre Haute, Ind.—Bids are wanted Dec. 10 for 1 100 bbl. steel compression tank; 1 100 bbl. galvanized iron storage tank, for the Bigo Co. Home for Dependent Children. Jas. Soules, Co. Aud.

Ashland, Wis.—A correspondent writes that on Nov. 22 the iron ore dock of the Wisconsin Central Ry. Co. (C. N. Kalk, Ch. Engr., Milwaukee), was burned. Insurance, $173,000.

Indianapolis, Ind.—The Niel Improvement Co. has been incorporated, its purpose being to erect dykes, dams and the like along the banks of Eel River and its tributaries in Clay Co. The incorporators are Henry W. Smith, Harry H. Hyatt, G. M. Williamson, and others.

South Bend, Ind.—The contract for constructing the Austin Heston ditch 12 miles in length, in Union township, has been awarded by the County Surveyor, South Bend, to John Hughes, of Napanee, Ind., at 5.94 cts. per cu. yd., or a total of about $10,000.

Houston, Tex.—The Brazos River Improvement Asso. will, it is stated, request the incoming Legislature for the appointment of a board of engineers to determine on a plan which will be feasible and economical for preventing the overflows which periodically destroy property along the river and its tributaries; also a request will be made to submit to the people a constitutional amendment permitting land owners of the counties along the Brazos and its chief tributaries to form themselves into taxing districts for the purpose of raising money to carry out the plan proposed and adopted by the engineers aforesaid. Estimated cost of work is placed at $5,000,000.

Abbeville, La.—The Inland Canal Co. has been incorporated, and obtained from the police jury of this parish a franchise for 99 years to dig and maintain a system of canals and waterways connecting Bayou Vermillion with Mermentau River by way of Schooner, White Lake and Grand Lake.

NEW INDUSTRIAL PLANTS.

Sellers & Montgomery, Marshalltown, Ia., are erecting a threshing machine factory. The main building will be 2 stories, 40x80 ft., and a 25-H.-P. engine will be installed.

The Goshen, Ind., Novelty & Brush Co. have awarded the contract for a 48x100-ft. factory building and a 20x30-ft. engine room.

The A. A. Cooper Wagon & Buggy Co., Dubuque, Ia., will erect a branch factory in St. Louis.

The Sherwin-Williams Co., Cleveland, O., paint and varnish makers, will build a new plant in Montreal.

A. M. Woolson, Toledo, O., is erecting a 3-story and basement, 40x98-ft., manufacturing building to be occupied by the Toledo National Bread Co., who will install a 25-H.-P. electric motor. The building will be provided with freight elevator, steam heating apparatus, electric wiring, etc. Bacon & Huber, archts.

The Rockland-Rockport Lime Co., Rockland, Me., expects to rebuild its recently burned plant, consisting of a 2-story, 40x90-ft. saw mill, 2-story, 40x100-ft. cooperage and a 30x40-ft. pencil plant, on an enlarged scale and make a number of improvements in the machinery. A 100 to 125-H.-P. engine will be required.

The Norfolk-Hampton Roads Shipbuilding & Dry Dock Co., Norfolk, Va., has been reorganized with the following directors: Wm. P. Harrison, Cincinnati, O., Pres.; Wm. H. Knauss, Columbus, O., Vice-Pres. and Treas.; John T. Gamble, Columbus, O., Secy.; T. J. Davis, Cincinnati, and J. V. Ewan, Covington, Ky. The company has bought 679 acres with a 4,700-ft. water frontage, and will erect a shipbuilding plant, including a 1,000-ft. concrete or stone dry dock.

Rice & Hutchins, 6 High St., Boston, Mass., will erect a 4-story and basement, 50x203-ft., shoe factory at South Braintree and install a 150-H.-P. engine and 200 H.-P. in boilers.

T. Millen & Co., Wayland, N. Y., makers of Portland cement, will double the capacity of their dry kilns. The iron work has been contracted for and the buildings will be erected in the spring.

The Bellefontaine, O., Foundry & Machine Co. has been incorporated, with a capital of $50,000, to make hydraulic and pneumatic machinery, and will erect an 85x100-ft. foundry, 95x100-ft. machine shop, 38x75-ft. forge shop, etc. A 50-H.-P. power plant, with generator and motors, will be installed.

The Crabbs Reynolds-Bell Grain Co., Lafayette, Ind., will erect an elevator and install an engine of about 80 H.-P. and a 66-in.x16-ft. boiler.

BUSINESS NOTES.

The Libbe Engineering & Construction Co., Ltd., Toledo, O., has equipped a temporary shop for making sewer and trench machines.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: A 125-H.-P. engine for the electric plant of the City of Farmville, Va.; a 100-H.-P. engine for the Lord & Burnham Co., Irvington, N. Y.

Dodge & Day, of Philadelphia, have been commissioned by the Heating, Ventilating & Foundry Co., of Pittsburg, to equip as engineers their plant at Wheeling, W. Va.

The Sprague Electric Co. reports among recent sales of direct-current apparatus the following: Twenty 200-Kw. turbine generators, three 75-Kw. generators and four 20-Kw. generators to the De Laval Steam Turbine Co., Trenton, N. J.; a 200-Kw. belted type and a 200-Kw. engine type generator to H. O. Wilbur, Philadelphia; a 200-Kw. engine type generator to the Otis Elevator Co., Yonkers; a 200-Kw. belted type generator to W. D. Ewart, Chicago; a 40-Kw. and two 35-Kw. belted type generators to the Criterion Hotel, New York; a 75-Kw. belted type generator to C. Poyet, New York; a 50-Kw. belted type generator to the American Express Co., Chicago; two 3-H.-P. round type motors to the West End Theatre, New York; eight 8-Kw. generators, six 5-H.-P. and four 1-H.-P. motors to the Fisher Motor Vehicle Co., Hoboken, N. J.; a 40-H.-P. medium speed motor to J. F. Perkins Co., Brooklyn; a 15-H.-P. S. S. type motor to L. W. Pond Machinery & Foundry Co., Worcester, Mass.; a 40-H.-P. belted type motor to the Miehle Printing Press Mfg. Co., Chicago; two 20-H.-P. M. S. type motors to the Sigourney Tool Co., Hartford, Conn.; a 17-H.-P. S. S. type motor to the Martinique Apartment House, New York; two electric hoists each to the Phoenix Iron Works, Phoenixville, Pa., and the Michigan Alkali Co., Wyandotte, Mich.; an electric hoist each to Landis Tool Co., Geiser Station, Pa.; American Car & Foundry Co., Berwick, Pa.; Scranton, Pa., Supply & Machinery Co.; Pond Machinery & Tool Co., Plainfield, N. J.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Dec. 11.	Chicago, Ill.	Dec. 6
Dec. 13.	Ft. Leavenworth, Kan	Dec. 6
	Adv., Eng. Record, Dec. 6.	
Dec. 15.	Springfield, Tenn.	Dec. 6
Dec. 16.	Wellsville, O.	Dec. 6
Dec. 17.	Wilbur, Wash.	Dec. 6
Dec. 18.	Long Island City, N. Y.	Dec. 6
Dec. 20.	Pumping engines, Louisville, Ky.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Dec. 6.	
Dec. 20.	Havre, Mont.	Dec. 6
Dec. 26.	Searcy, Ark.	Dec. 6
Dec. 27.	Cincinnati, O.	Dec. 6
Dec. 27.	Meters, Cleveland, O.	Dec. 6
	Adv., Eng. Record, Dec. 6.	
Dec. 29.	Gillett, Wis.	Nov. 15
Jan. 1.	Sacramento, Cal.	Nov. 22
Jan. 2.	Kansas City, Mo.	Dec. 6
	Adv., Eng. Record, Dec. 6.	
———	Great Notch, N. J.	Dec. 6

	SEWERAGE AND SEWAGE DISPOSAL.	
Dec. 10.	St. Petersburg, Fla.	Nov. 22
Dec. 12.	Cincinnati, O.	Nov. 22
Dec. 15.	New York, N. Y.	Dec. 6
Dec. 15.	Boston, Mass.	Dec. 6
Dec. 15.	Toledo, O.	Nov. 29
Dec. 15.	Montevideo, Uruguay	Sept. 13
Dec. 17.	Brooklyn, N. Y.	Dec. 6
Dec. 20.	Oakland, Cal.	Dec. 6
Dec. 22.	Chillicothe, O.	Dec. 6
Dec. 22.	Norristown, Pa.	Nov. 29
Dec. 22.	Wabash, Ind.	Nov. 29
Dec. 27.	(Ft. McKinley) Portland, Me.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
Jan. 3.	Pumping Station, Washington, D. C.	Nov. 15
	Adv., Eng. Record, Nov. 15, Dec. 6.	
Feb. 2.	New Orleans, La.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
———	Miami, Fla.	Dec. 6

	BRIDGES.	
Dec. 9.	Buffalo, N. Y.	Dec. 6
Dec. 9.	Franklin, Pa.	Nov. 15
Dec. 11.	Allegheny, Pa.	Dec. 6
Dec. 11.	New York, N. Y.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
Dec. 11.	Remington, Va.	Nov. 29
Dec. 12.	Buffalo, N. Y.	Dec. 6
Dec. 15.	Sault Ste. Marie, Ont.	Nov. 29
Dec. 17.	Columbia City, Ind.	Nov. 29
Dec. 17.	Chicago, Ill.	Nov. 1
Dec. 18.	Portland, Ind.	Dec. 6
Dec. 19.	Columbia City, Ind.	Dec. 6
Dec. 30.	Georgetown, Colo.	Nov. 29
Jan. 5.	Montezuma, Ia.	Dec. 6
Jan. 5.	Cumberland, Md.	Nov. 29
Jan. 7.	Webster, S. D.	Nov. 29

	PAVING AND ROADMAKING.	
Dec. 8.	Toledo, O.	Nov. 15
Dec. 9.	Albany, Ore.	Dec. 6
Dec. 9.	Schenectady, N. Y.	Dec. 6
Dec. 10.	Chicago, Ill.	Dec. 6
Dec. 10.	Louisville, Ky.	Dec. 6
Dec. 10.	Brooklyn, N. Y.	Nov. 29
Dec. 10.	Bloomfield, Ind.	Nov. 29
Dec. 10.	Hartford, Conn.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 11.	Green Bay, Wis.	Nov. 22
Dec. 11.	Laporte, Ind.	Nov. 29
Dec. 11.	Guthrie, Okla. Ter.	Nov. 1
Dec. 12.	New York, N. Y.	Dec. 6
Dec. 13.	Glenville, O.	Dec. 6
Dec. 15.	New York, N. Y.	Dec. 6
Dec. 15.	Cincinnati, O.	Nov. 29
Dec. 16.	Somerville, N. J.	Nov. 29
Dec. 17.	Ft. Dodge, Ia.	Nov. 29
Dec. 18.	McKeesport, Pa.	Dec. 6
Dec. 19.	Galion, O.	Nov. 29
Dec. 20.	Williamsport, N. J.	Dec. 6
Dec. 22.	Cincinnati, O.	Dec. 6
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	
Dec. 27.	Kalamazoo, Mich.	Dec. 6
	Adv., Eng. Record, Dec. 6.	
Dec. 30.	St. Augustine, Fla.	Dec. 6
———	Wichita, Kan.	Dec. 6

	POWER, GAS AND ELECTRICITY.	
Dec. 9.	St. Louis, Mo.	Dec. 6
Dec. 15.	Springfield, Tenn.	Dec. 6
Dec. 18.	North Amherst, O.	Dec. 6
Dec. 20.	Havre, Mont.	Dec. 6
Dec. 20.	Philadelphia, Pa.	Nov. 22
Dec. 26.	Searcy, Ark.	Dec. 6
Dec. 27.	Cincinnati, O.	Dec. 6
Jan. 15.	Rome, Ga.	Oct. 11
Mar. 4.	Franchise, Manila, P. I.	Nov. 15

	GOVERNMENT WORK.	
Dec. 8.	Newport, R. I.	Nov. 8
	Adv., Eng. Record, Nov. 8 to 29.	
Dec. 8.	New York, N. Y.	Nov. 8
	Adv., Eng. Record, Nov. 8 to 29.	
Dec. 9.	Ft. Meade, S. D.	Nov. 29
Dec. 9.	Annapolis, Md.	Nov. 29
Dec. 9.	Norfolk, Va.	Nov. 29
Dec. 10.	Jetty work, Galveston, Tex.	Oct. 11
	Adv., Eng. Record, Oct. 11 to Nov. 15, Dec. 6.	
Dec. 11.	Chilocco, Okla. Ter.	Nov. 22
Dec. 12.	Los Angeles, Cal.	Nov. 29
Dec. 12.	Detroit, Mich.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 12.	Wheeling, W. Va.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 13.	Pipe, etc., Ft. Leavenworth, Kan.	Dec. 6
Dec. 13.	Dover, Tenn.	Nov. 22
Dec. 15.	Vancouver Barracks, Wash.	Nov. 29
Dec. 15.	Norfolk, Va.	Dec. 6
Dec. 15.	Wilmington, Del.	Nov. 22
Dec. 15.	Cement, Duluth, Minn.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 16.	Supplies, Washington, D. C.	Dec. 6
Dec. 16.	Ft. Hancock, N. J.	Nov. 29
Dec. 16.	San Francisco, Cal.	Nov. 29
Dec. 16.	Ft. Columbus, N. Y.	Nov. 29
Dec. 16.	Snagboat and barge, Montgomery, Ala.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 16.	Towboat, dredge, etc., Montgomery, Ala.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 17.	Washington, D. C.	Dec. 6
Dec. 17.	Baltimore, Md.	Nov. 22
	Adv., Eng. Record, Nov. 22 to Dec. 6.	
Dec. 17.	Mobile, Ala.	Nov. 22
Dec. 18.	Olympia Harbor, Seattle, Wash.	Nov. 29
Dec. 18.	Lake Wash. Canal, Seattle, Wash.	Nov. 29
Dec. 18.	Milwaukee, Wis.	Nov. 22
	Adv., Eng. Record, Nov. 22 to Dec. 6.	
Dec. 19.	Steam tenders, Nashville, Tenn.	Nov. 22
	Adv., Eng. Record, Nov. 22 to Dec. 6.	
Dec. 20.	Carson, Nev.	Dec. 6
Dec. 20.	Sheridan, Wyo.	Nov. 29
Dec. 20.	Charleston, S. C.	Nov. 15
Dec. 22.	Savannah, Ga.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29.	
Dec. 23.	Ft. Barrancas, Fla.	Dec. 6
Dec. 23.	Garbage crematory, Ft. Getty, S. C.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
Dec. 23.	(Ft. Rodman) Newport, R. I.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
Dec. 23.	Mobile, Ala.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
Dec. 24.	Ft. Brady, Mich.	Dec. 6
Dec. 26.	Ft. Williams, Me.	Dec. 6
Dec. 26.	Dredging, Savannah, Ga.	Nov. 29
	Adv., Eng. Record, Nov. 29, Dec. 6.	
Dec. 27.	Ft. McKinley, Me.	Dec. 6
Dec. 27.	Portsmouth, N. H.	Nov. 29
Dec. 27.	Sewers (Ft. McKinley), Portland, Me.	Nov. 29
Dec. 28.	New Orleans, La.	Dec. 6
Dec. 29.	Mobile, Ala.	Dec. 6
	Adv., Eng. Record, Dec. 6.	
Dec. 29.	Ft. Banks, Mass.	Dec. 6
Jan. 2.	Boston, Mass.	Dec. 6
Jan. 3.	Richmond, Va.	Dec. 6
	Adv., Eng. Record, Dec. 6.	
Jan. 3.	Elevator, Helena, Mont.	Dec. 6
Jan. 3.	Wall, Philadelphia, Pa.	Dec. 6
Jan. 5.	Boston, Mass.	Dec. 6
Jan. 6.	St. Louis, Mo.	Dec. 6
Jan. 8.	Mobile, Ala.	Dec. 6
Jan. 14.	Helena, Mont.	Dec. 6
	Adv., Eng. Record, Dec. 6.	
Jan. 15.	Norfolk, Neb.	Dec. 6
Jan. 15.	Machinery for dredge, Wash'ngton, D.C.	Nov. 29
	Adv., Eng. Record, Nov. 29.	

	BUILDINGS.	
Dec. 8.	Municipal bldg. plans, Wash'gt'n, D. C.	Aug. 30
Dec. 9.	Church, Birmingham, Ala.	Nov. 15
Dec. 9.	Pub. bldg., Toronto, Ont.	Dec. 6
Dec. 9.	Pub. bldg., Owen Sound, Ont.	Dec. 6
Dec. 10.	Hospital, Utica, N. Y.	Dec. 6
Dec. 10.	Hospital, Middletown, N. Y.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 10.	Hospital, Kings Park, N. Y.	Nov. 29
	Adv., Eng. Record, Nov. 29.	
Dec. 10.	Bus. Bldg., New Kensington, Pa.	Nov. 22
Dec 11.	Hospital, New York, N. Y.	Dec. 6
Dec. 11.	Bus. Bldg., Omaha, Neb.	Dec. 6
Dec. 12.	Hospital, Brooklyn, N. Y.	Dec. 6
Dec. 12.	School, Buffalo, N. Y.	Dec. 6
Dec. 12.	School, Chicago, Ill.	Dec. 6
Dec. 13.	Library, Santa Rosa, Cal.	Dec. 6
Dec. 15.	School, New York, N. Y.	Dec. 6
Dec. 15.	School, Long Island City, N. Y.	Dec. 6
Dec. 15.	School, Braddock, Pa.	Dec. 6
Dec. 15.	College bldg., Cincinnati, O.	Dec. 6
Dec. 15.	School, Spartanburg, S. C.	Dec. 6
Dec. 15.	School, Cincinnati, O.	Nov. 15
Dec. 15.	Htg. Capitol, Columbia, S. C.	Oct. 4
Dec. 16.	Engine house, New York, N. Y.	Dec. 6
Dec. 16.	Library, Fond du Lac, Wis.	Nov. 29
Dec. 17.	Pub. bldg., Brooklyn, N. Y.	Dec. 6
Dec. 19.	Almshouse, Scranton., Pa.	Nov. 22
	Adv., Eng. Record, Nov. 22.	
Dec. 20.	Library, Waukesha, Wis.	Dec 6
Dec. 20.	Pub. bldg., Canton, O.	Dec. 6
Dec. 20.	Schools, Sterrett, Pa.	Dec. 6
Dec. 20.	Library, Milwaukee, Wis.	Nov. 29
Dec. 20.	Y. M. C. A. Hall, Akron, O.	Nov. 29
Dec. 20.	School, Baton Rouge, La.	Nov. 29
Dec. 20.	Armory Plans, Brooklyn, N. Y.	Nov. 8
Dec. 24.	School, Albany, N. Y.	Nov. 29
Dec. 27.	Library, Port Huron, Mich.	Nov. 29
Dec 29.	Jail, Marion, Ind.	Dec. 6
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11
Jan. 7.	Jail, Morristown, Tenn.	Dec. 6
Jan. 15.	Library plans, Binghamton, N. Y.	Nov. 15
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Feb. 1.	School, Dickinson, N. Y.	Dec. 6

	MISCELLANEOUS.	
Dec. 9.	Wharf, Burk's Falls, Ont.	Nov. 29
Dec. 9.	Concrete Walls, Columbus, O.	Nov. 22
Dec. 10.	Dredging, Brooklyn, N. Y.	Nov. 29
Dec. 10.	Terre Haute, Ind.	Dec. 6
Dec. 11.	Park work, New York, N. Y.	Dec. 6
Dec. 13.	El. Ry., Morgantown, W. Va.	Dec. 6
Dec. 15.	New York, N. Y.	Dec. 6
Dec. 15.	R. R. work, Salt Lake City, Utah	Dec. 6
Dec. 15.	Railroad Work, Sault Ste. Marie, Ont.	Nov. 29
Dec. 15.	Excav. & Const. R. R., San Francisco.	Nov. 15
Dec. 19.	Garb. Disp., Kansas City, Mo.	Nov. 22
Dec. 24.	Garb. crematory, Ft. Brady, Mich.	Dec. 6
Jan. 2.	El. R. R. Franchise, Vallejo, Cal.	Nov. 22
Jan. 14.	Dredging, Chicago, Ill.	Nov. 22
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
———	R. R. work, Chicago, Ill.	Dec. 6
———	Garb. disposal, Rochester, N. Y.	Dec. 6

THE ENGINEERING RECORD.

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Standards of Measurement.

Very close to the foundation of the structure of civilization lie the principles of standards of measurement, measures of value, space, weight, and of any and all other quantities and forces which form the basis and substance of commercial intercourse. Even among the uncivilized, among peoples with the crudest institutions, some standards of measurement, however imperfect, are found; and one of the best criteria of a people's advancement in civilization is the degree of perfection to which it has carried its standards. But the greater the progress and enlightenment, the greater the achievement in the arts and the more multiplied the industries of a nation, the more intimately do its standards become interwoven into all the processes of its life and the more difficult becomes a radical change. Such a change has been debated in this country for a century, and that the issue is not a dead one is indicated by the length of time and the animated discussion given to the matter in the recent annual meeting of the American Society of Mechanical Engineers, as well as by other evidences.

That there is yet much opposition to the adoption of the metric system, on the part of a class of men whose operations would be very vitally affected by the enforcement of a new set of standards was quite apparent in the meeting. Many expressions of opinion have been made by individuals and by organizations, but there is a feeling in some quarters that much of the loudest talking and most voluminous writing, on both sides of the question, has been done by a comparatively small number of persons and that many of those most deeply concerned have, for various reasons or without reason, abstained from statements of their positions. Why this indifference or apathy on so vital a question? Is it not that there exists a deep-seated conviction that neither coercive legislation nor any other sort of law-making can force such a change upon a people any more than imperial decree could change the language of a race?

The question affects the whole people and enters as far into the ordinary relations of life as, perhaps, any that could be raised; it has a practical interest for every man, woman and child of the population. Why, then, should it not be settled by the people? We believe, however, that there is no provision for such a popular referendum, and the matter is in the hands of Congress in the form of a bill. But whether the question be printed upon the ballots and answered at the polls or no, it, after all, will be the people who will give the final and practical answer. The metric system has had so large a place, from time to time, in engineering discussions and publications that it has become wearisome, and so we hesitate to mention it again; but some questions were raised by the authors of papers and the speakers at the meeting of the American Society of Mechanical Engineers which do not seem to have been answered to everybody's satisfaction. Will the metric system, if adopted, supplant the existing system, even if forced by compulsory legislation? If it will, how long must the transition period be? If it has taken so long a period to advance the system even as near to adoption as it has now come, is it to be expected that the assimilation of it in daily use will be so rapid as to be accomplished within a few years? What will the common people gain by the change; how great a benefit will accrue to any class, trade or profession? How much will it cost to introduce and establish the new system? For it will cost something. All prejudice aside, would the proposed units of measurement be as convenient as those that we now use? What, for example, would be given in exchange for our convenient 1-foot and 2-foot rules which are so common a piece of pocket furniture?

Let us remember that declining the proposed standards of measurement does not mean the rejection of all the advantages of the decimal system of computation. Decimal subdivisions can be applied to existing units with any desirable degree of freedom, and are so applied whenever distinct advantages are to be gained by so doing. Instances of this are so common as to require no mention by way of illustration.

A sentence quoted in one of the papers at the above mentioned meeting is a fitting theme for prolonged and earnest contemplation. The sentence is this: "Measures of length are irrevocably tied to the past." Think over it for a while and see what a change of standard means along the lines of thought which this statement will suggest. There is another stumbling block in the path of the suggested system, it may be but a trivial one, namely, that the names of the units being of Greek and Latin derivation, do not readily fit the mouths of Anglo-Saxons. Those who have hesitated to espouse the metric system have sometimes been accused of being in the rear of modern progress, but it has been suggested recently that while the Anglo-Saxon peoples lead in manufactures and commerce, the units of measurement which they employ will be accepted by the nations with whom they trade.

Instead of adopting another system of standards which, judging by the experiences of other nations, will, at least for many years, increase the number of standards in use rather than supplant existing standards, would it not be more sensible to direct our energies towards the perfecting, the wider dissemination and the surer establishment of the English system?

The Assouan Dam on the Nile was completed December 10, when the Duchess of Connaught laid the last stone. The foundation stone was laid by the Duke of Connaught February 12, 1899. The dam was finished ahead of contract time at a total cost of about $12,500,000. Its greatest height is 131 feet, width on top 23 feet and length about 1¼ miles.

The Meeting of the American Society of Mechanical Engineers.—II.

In the report last week of the December meeting of the American Society of Mechanical Engineers, much in the way of brief reviews of some of the papers and of digests of the discussion of those of likely interest to the readers of this journal was crowded out owing to lack of space. While the convention must always remain one that was devoted largely to a serious consideration of the adoption of the metric system, there was the usual collection of papers of varied scope. Before taking up any of these topics, however, mention may well be made here of the disposition that was finally made of the metric system question. Toward the close of the Friday morning session a motion was passed instructing the council to obtain by letter ballot from the voting membership of the Society an expression of opinion regarding the subject. It is intended that both Mr. Halsey's paper and a record of the entire discussion be issued, and that an answer be requested as to whether or not the member is in favor of the House of Representatives bill providing that the metric system shall be adopted in the business transactions of all departments of the Government and as to whether or not he favors the provision that the system shall subsequently (in 1907, according to the present bill) be declared the legal one.

Prof. Reeve's paper on the entropy analysis of the Otto cycle in gas-engine work was presented to call attention to the advantages and ease of submitting records of tests of gas engines to the temperature-entropy diagrams and to show among other things that the combustion in the Otto cycle takes place in a definite time, after which there is no further development of heat and that there is an interchange of heat between the working fluid and the cylinder walls, similar to that taking place in the steam engine. He believes no observer of a gas-engine test has done his proper duty until he has submitted his results to the entropy analysis.

Mr. J. M. Barnay's paper on a 44-foot lathe described a machine, for which some 480,000 pounds of cast iron were used in construction and which is driven by means of a compressed-paper friction roller, 18 inches in diameter, bearing on the 15-inch rim of the large face plate, which is 30 feet in diameter. The machine has cut 64⅓ cubic inches of cast iron per minute, and on the basis that 0.35 horse-power is equivalent to 1 cubic inch per minute, the friction roller succeeds in transmitting an effective power of 22½ horse-power.

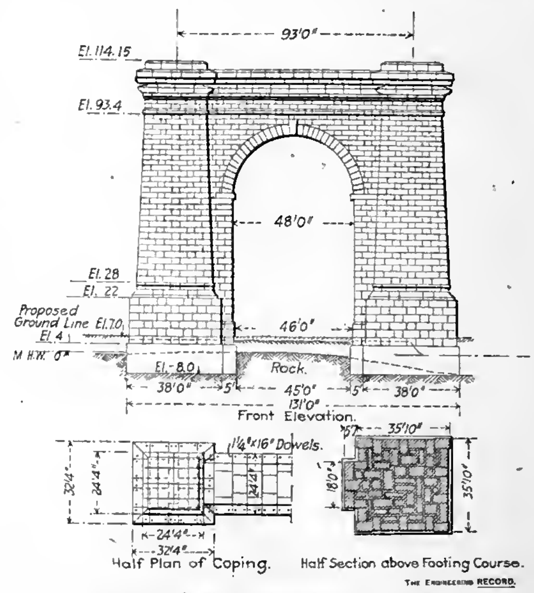
The paper presented by Mr. Chas. T. Porter on finer screw threads argued that the existing system of threads reduces the area of cross-section of the bolt unnecessarily, and that the steep inclination allows the nut to jar loose easily. He advocated a finer thread to avoid these two evils, and incidentally to secure a greater strength to resist stripping. He submitted a table of his system of dimensions for bolts ¼ to 6 inches in diameter with 24 to 6 threads per inch instead of the present standard of 20 to 2¼ threads per inch.

In addition to what has already been noted in the foregoing and in last week's account, a number of subjects were considered as topical discussions, including that of oil burners and that of oil separation from steam. A number of members expressed the belief that generally speaking all burners were good, and that if trouble arose in their operation it was not unlikely due to too small a furnace or an improperly designed one. Prof. Arthur L. Williston called attention to the fact that the necessary storage of oil sometimes increased the cost of fire insurance to such an extent as to favor the use of coal. On the subject of oil separation, Mr. David J. Lewis, Jr., said that he had good success with the baffle-plate type of separator, but it was necessary to clean the plates at more or less frequent intervals. For this purpose the plates were first washed with benzine and then boiled in a solution of soda and potash for 10 hours. He considered it essential that the steam be received as hot as possible, and that therefore the separator be placed between engine and feed-water heater.

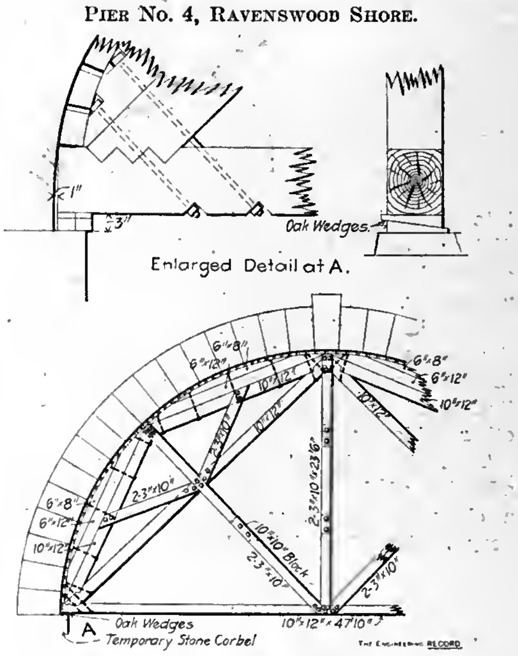
Construction of the Blackwell's Island Bridge Masonry.

Bridge No. 4 crosses the East River between 59th and 60th Streets, New York, the western approach being at grade at Second Avenue, borough of Manhattan, and the eastern one at grade at Jackson Avenue, Ravenswood, borough of Queens. The center line of the bridge is a straight line running nearly northwest and southeast, and is about 8,338 feet long including approaches of about 1,100 feet in Manhattan and 3,440 feet in Queens. The superstructure is divided into five spans of a total length of 3,673.5 feet between anchorages, and includes a west channel span of 1,184 feet, an east channel span of 894 feet and an island span of 630 feet, all cantilevers, as was necessitated by the depth of water, the strong current and the heavy traffic in the river. For a length of 400 feet the bridge has a clear height of 135 feet above mean high water, and both approaches have a uniform grade of 3.41:100. The bridge capacity is two elevated railroads and four trolley tracks, two roadways and two sidewalks. The trusses are 170 feet deep and will be much heavier than those of any bridge ever yet built, not excepting the Forth bridge, the chords having maximum cross sectional areas of about 1,000 square inches. The total estimated weight of the superstructure is about 100,000,000 pounds and the estimated cost is $12,500,000, including $3,000,000 for the right of way. There have been some changes made in dimensions of the superstructure, but it still corresponds in most respects to the data published in The Engineering Record of March 16, 1901.

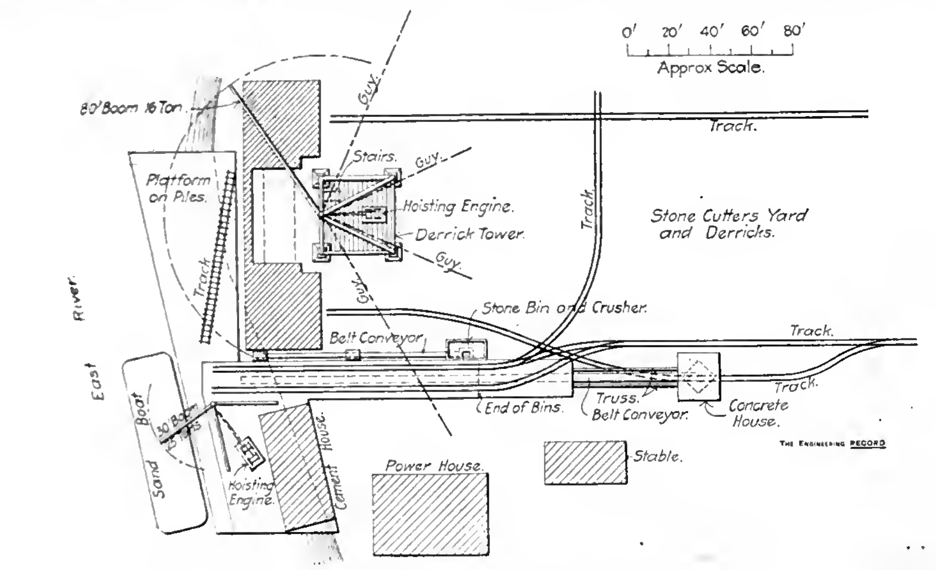
Preliminary surveys were completed in June, 1899, and thirty-six diamond drill borings were made to a depth of 10 feet or more in bed rock at the pier sites and were completed in August, 1900. The lengths of spans and locations of piers were determined by triangulation from a base line 1,671.03 feet long intersecting the center line of the bridge nearly at right angles on the high ground in the center of the island. The base line extended 1,122.05 feet north of the center line and 548.98 feet south of it, each portion being made one side of a triangle for the determination of the distance across each channel. The base line was measured three times with a difference of only 0.002 foot. The angles of the four main triangles were measured 100 times each with a transit having a 10-inch circle graduated to 10 seconds. The variations of the sums of the angles in each triangle from 180 degrees were 0.1—0.35—2.7 and 4.9 seconds. The distances across the channel were com-



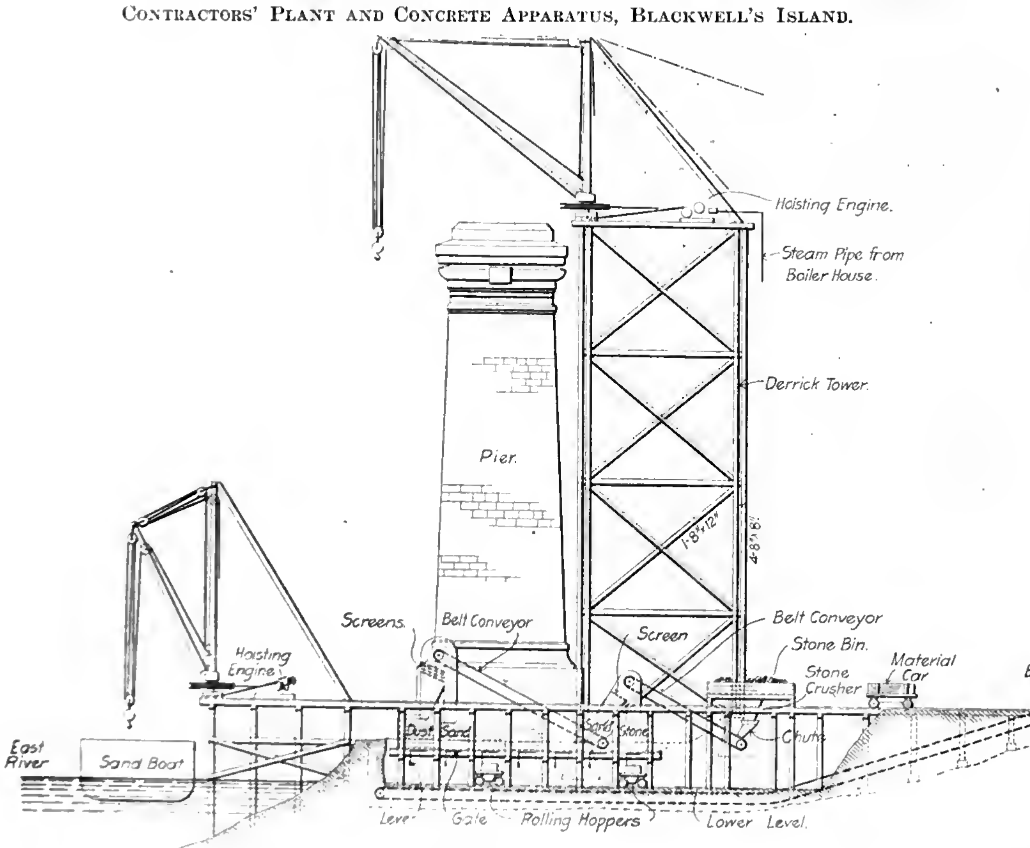
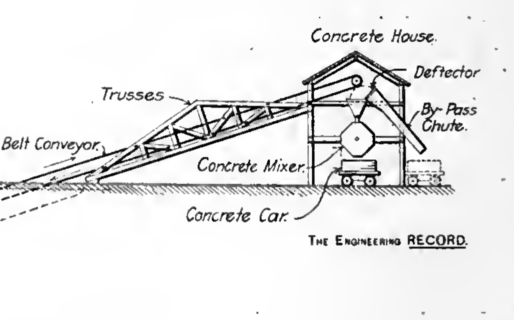
Pier No. 4, Ravenswood Shore.



Centering for Pier Wall Arch.



Contractors' Plant and Concrete Apparatus, Blackwell's Island.

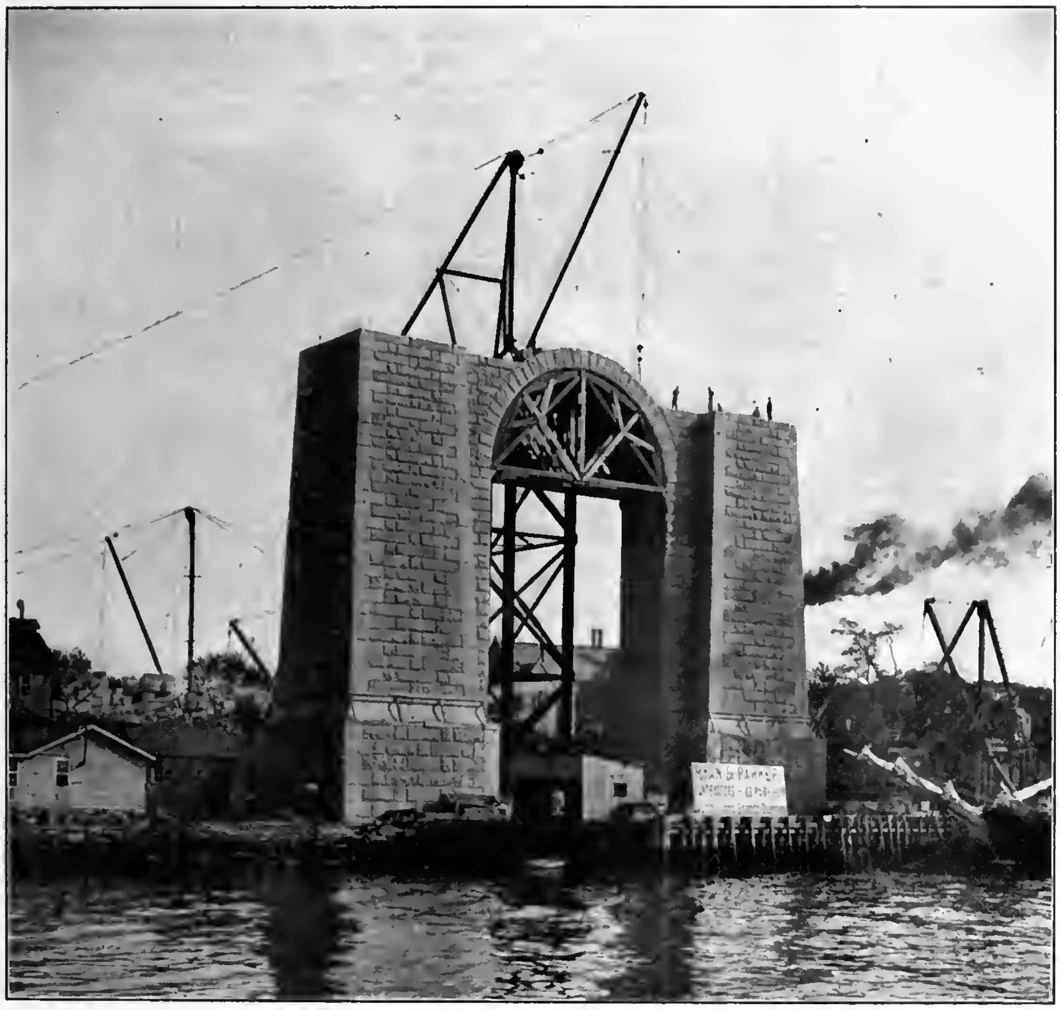



PARTIAL ELEVATION OF BLACKWELL'S ISLAND PLANT.

puted from the triangles and from them the length of one portion of the base line was calculated and checked the measured distance within 0.009 foot.

The base line was measured with a 200-foot steel tape, with a spring balance and adjusting screw, supported in a straight, but not horizontal line, at intervals of 25 feet, on pegs set in holes ¼ inch apart on vertical wooden rods which had steel points resting on line stakes and were clamped at the top to the heads of special extension tripods. At each end of the tape there was attached a brass chain, which passed over a saddle in an adjustable tripod and was fastened to a pin driven in the ground. The end of each measurement was marked on a paper pasted to the top of a horizontal 6x6-inch steel plate clamped to a vertical iron bar driven firmly in the ground. The tape was a steel ribbon 0.125 inch wide and 0.025 inch thick which was compared with the New York State standard at Albany and assumed to be correct at standard temperature under a tension of 11 pounds if supported throughout its entire length, or under a tension of 12½ pounds if supported at intervals of 25 feet. The ends of the base line and other reference points, were marked by monuments, nine of which were set in the center line of the bridge. These are vertical granite pillars, 12 inches square and 3 feet high, set in rammed earth with the dressed upper surface just above grade. The center point is a ⅛ inch hole drilled in a square brass plate which has a dowel pin 6 inches long wedged and cemented into the stone. The transit was supported at the ends of the base line on platforms 12 feet high with a separate outside platform for the observer and a wooden box reaching down nearly to the ground to enclose the plumb bob and protect it from the wind.

There are four main piers and two anchorage piers, each made with two separate shafts connected by a thick transverse wall, all substantially shown in the elevations of pier No. 4, which is on the Ravenswood shore of the river. The other piers vary somewhat in height and bottom dimensions according to the depths of the foundations, and the anchorage pier shafts are only 20 feet square on top and are connected by transverse walls only 12 feet thick. The shafts are battered 1:24, the belt course below the coping has a projection of 4 feet and the full centered arch has a clear span of 48 feet and voussoirs 4 feet deep in the ring courses. All the foundations are carried down to solid rock in open pits, those of the main piers being 6 to 12 feet in depth and easily kept dry by moderate pumping. The surface of the rock is leveled and concrete footings built up to the grade where the rock faced ashlar of the sub-base commences. The face stone is coursed rock-faced granite with point-dressed quoins. The cap and moulded base courses are four-cut work. The arch soffit and the faces of the arch ring are rock faced. The backing is concrete except in the shafts on the main piers, where it is limestone.



Pier No. 2, Blackwell's Island.

There are, in the six main piers, about 22,000 yards of granite, 22,000 yards of limestone backing and 15,000 yards of concrete. The contract for them was let in June, 1901, to Ryan & Parker, for $745,547. Excavations were made to rock inside sheet piling and cofferdams for both the island piers and for the pier on the east shore of the river, and were easily kept dry by pumping. A plant for storing materials and mixing and handling concrete was established near pier 2 on the west side of the island, to serve piers 2 and 3, and another plant was established on the east shore between pier 4 and the anchorage pier to serve both of them. A third plant will be established on the west shore to serve pier 1 and the west anchorage pier. In all these plants the arrangement and system of operation are different and are especially adapted to secure a large output and rapid and efficient work with the greatest economy of labor.

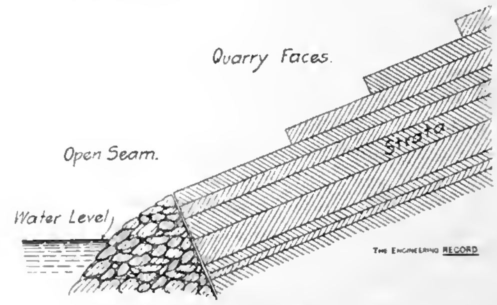
All the stone is brought from the contractors quarries, the limestone from Cobleskill on the Delaware & Hudson Railroad, and the granite from Crotch Island on the coast of Maine. It is stored on Blackwell's Island between piers 2 and 3, and is there cut by a large force of stone cutters. There is about 15 per cent. waste which is all put through a Gates crusher to make broken stone and sand for the concrete and mortar. The spawls are delivered by derricks and cars to the crusher, which discharges on a Robins belt conveyor. The conveyor delivers to an elevated screen of ¾-inch mesh, which is set at an angle of 45 degrees. The material which the screen rejects falls down a chute into a storage bin and is used for concrete. The material which passes through the screen falls on a second conveyor which elevates and discharges it over a set of four ⅛ inch mesh screens set at an angle of 45 degrees. The fine stuff that passes through the screens is sold for top dressing for macadam roads and the remainder falls into a chute which delivers it into a storage bin, from which it is taken as required for use as sand. The grains are very sharp and hard and tests of briquettes made with them are superior to others made with standard sand. The sand and broken stone thus provided are not sufficient for the demand when large quantities of concrete are being made and sand and gravel are delivered by boat and kept in storage to supply the deficit.

The storage and handling of materials on the island is very ingeniously and efficiently arranged. A pile dock is built close to pier 2, projecting far enough into the river to receive schooners and barges at low water. On it is built a cement storage house and the deck is continued to make a horizontal platform 21 feet wide and 23 feet above mean high water, extending 100 feet back from the shore line. A stiff-leg derrick with a 30-foot boom on the outer end of the dock unloads stone, sand, broken stone, gravel and cement from the boats to cars which run on two tracks on the platform, parallel to the bridge axis, and dump into storage bins under the platform, alongside those for the products of the stone crusher. The bottoms of these bins are about 6 feet above a low level track parallel to those on the dock platform and have holes about 1 foot square, closed by horizontal steel plates, operated by levers. When these holes are opened, the contents of the bin are delivered to measuring hoppers mounted on trucks on the low level track. The hoppers are run under any bin, are filled, and discharge their measured contents through the open track platform on a Robins belt conveyor parallel to the track. At the river end of the belt the cement bags are emptied on its surface and the hoppers are so proportioned that one hopper of sand, one hopper of broken stone and nine bags of cement are sufficient for one two-yard batch of concrete.

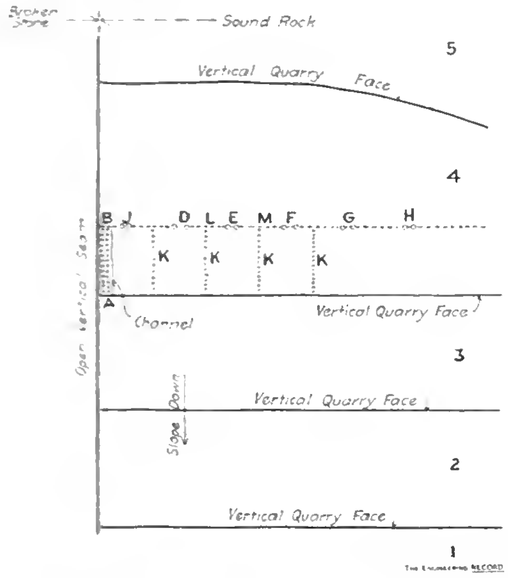
The belt conveyor is about 30 inches wide and about 200 feet long and passes through a trench and out from under the land end of the platform at an inclination of 20 degrees upwards and is carried over a roadway on the surface of the ground by a 50-foot span bridge having two wooden Fink trusses 5 feet apart. The upper end of the belt is supported on a tower about 30 feet high and 15 feet square in which the 2-yard Carlin concrete mixer is set. The belt discharges its contents directly through a funnel into the mixing box. The funnel is swung out of the way, the box closed and revolved until the concrete is mixed, when it is dumped into a scale box on a car on the surface tracks and is hauled by mules to either pier 1 or 2. With one man to attend the mixer and one man to put sand, stone and cement on the belt conveyor, this plant will mix 75 yards of concrete in 8 hours; with a third man to attend to the cement while the second attends to the sand and stone the capacity is doubled. The concrete mixer is driven by an 8x12-inch engine, and the engine, conveyors and rock crusher and six mason's and stone cutter's boom derricks are operated by steam from a 120 horse-power boiler.

A very ingenious arrangement has been devised by which, when the belt conveyor is not in use for supplying the concrete mixer it can be utilized for distributing sand and broken stone from the screens to remote bins beyond the reach of the chutes. When concrete is being mixed the materials are thrown off from the upper end of the belt and striking against a deflection board fall into the mixer funnel. The deflector can be revolved into such a position as to close the opening of the funnel and at the same time serve as an apron to a by-pass chute. Then the broken stone or sand carried by the belt falls on it and is discharged past the mixer to a car on the surface tracks and can be run back over the upper platform and dumped into any of the bins which ordinarily receive the sand and gravel delivered by the boats.

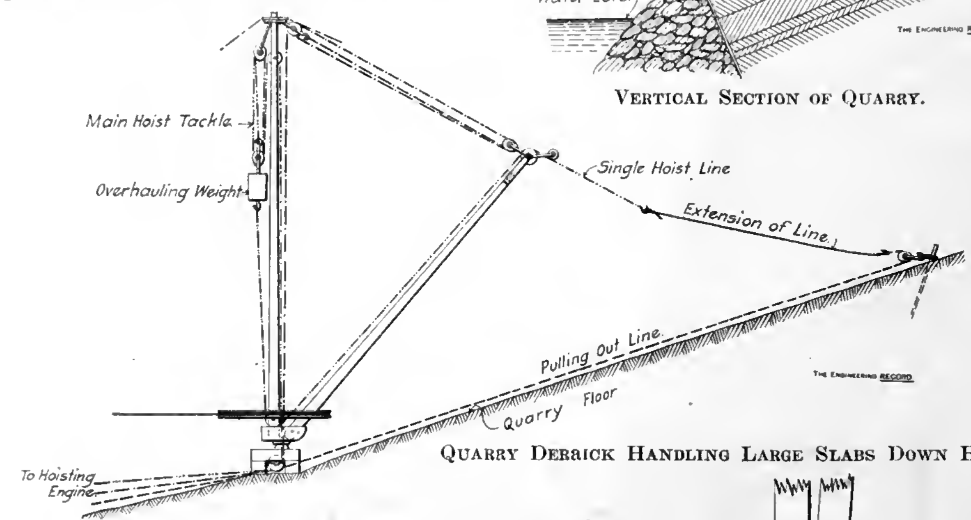
Pier 2 has been built by a stiff-leg derrick with a 40-foot mast and 80-foot boom set on a tower 36 feet square and about 100 feet high. The tower has a vertical post at each corner and one in the middle of the long side, on the center line of the bridge, to receive the derrick mast, each of which is set on concrete piers 8½ feet high and 8 feet square at the bottom. Each post is made of four 8x8-inch pieces with lap spliced butt joints. Each face of the tower is braced in four vertical panels by 8x12-inch timber, and at each panel there is horizontal diagonal bracing. The top is floored over and the two-drum Lidgerwood hoisting engine is located there. Access is had to the top of the tower by a flight of stairs and the derrick boom commands all parts of the tower. The arch voussoirs were set on five falsework trusses made of 10x12-inch timbers and covered with 3-inch lagging. They were supported on corbels left temporarily projecting from the faces of the stones in the skewback course. After the arch was sprung and the centers removed these corbels were cut off and the faces dressed smooth to correspond with the rest of the masonry there. The face courses of the pier shafts were made of handsome stones weighing up to 16 tons each and from 2½ to 3½ feet thick, alternate headers and stretchers. The stretchers were 6 or 8 feet long and were lifted by dogs engaging holes in the centers of the long sides. In order to avoid permanent dog holes in the faces of the stretchers a projecting lump or boss was left temporarily in the face of each and the dog hole was sunk in it. After the



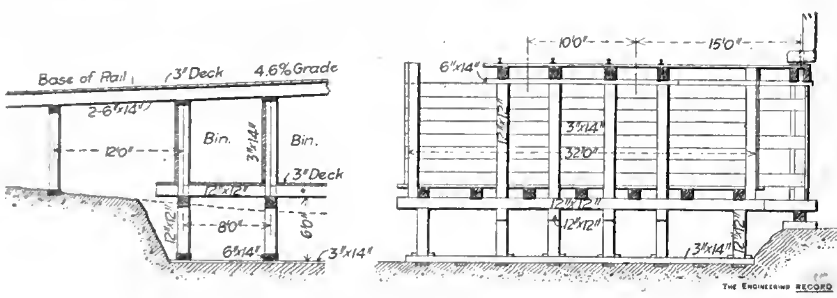
Vertical Section of Quarry.



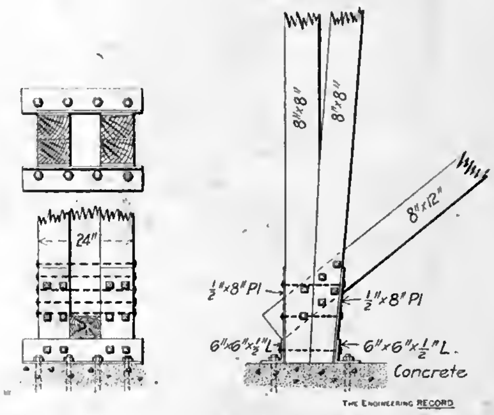
Method of Blasting Large Dimension Stones.



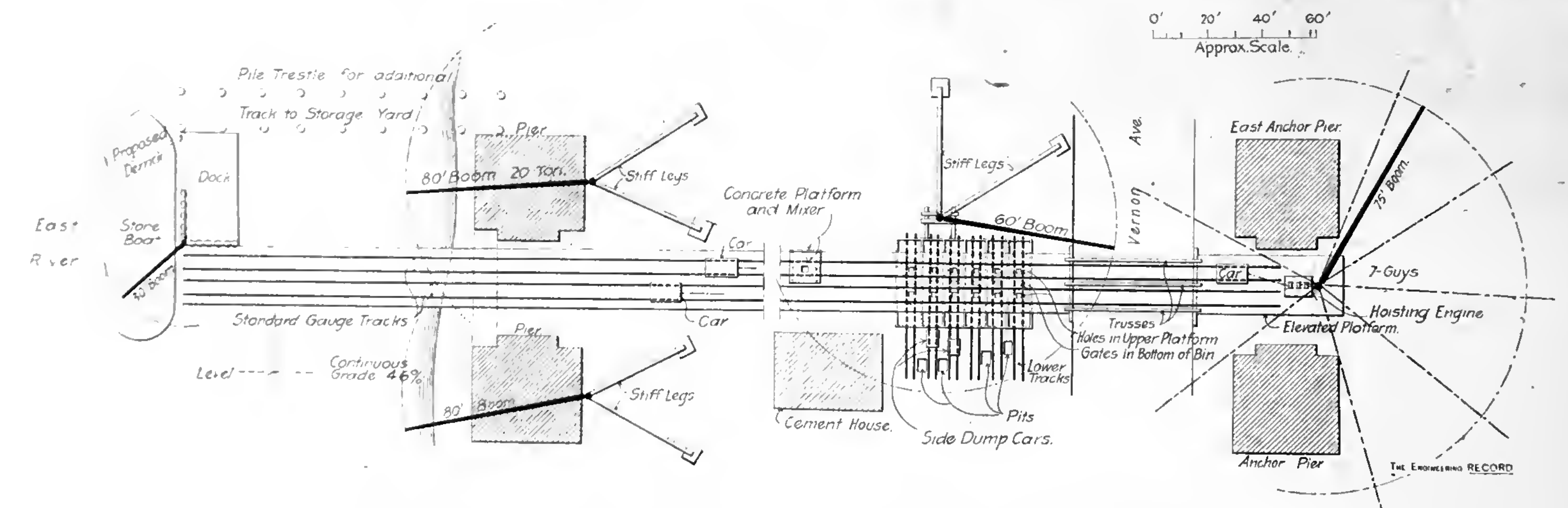
Quarry Derrick Handling Large Slabs Down Hill.



Storage Bins, Ravenswood.



Details at Foot of Derrick Tower, Pier 2.



Contractors' Plant and Concrete Apparatus, Ravenswood.

stone was set this boss was cut off and a perfect face was secured for the stone. After the completion of pier 2 the engine and derrick will be removed from the top of the tower and the latter will be moved across the island and used for the completion of pier 3, which has now been built up to a height of about 40 feet above the water.

At the east end of the bridge, the contractors have built a temporary pile dock with its face about 100 feet beyond the face of pier 4, and from it there extends on the center line of the bridge, a pile and trestle platform about 20 feet wide and 600 feet long which slopes up on a 4.6 per cent. grade to a height of about 30 feet above the ground over the east anchor pier. This platform is carried over Vernon Avenue, adjacent to the anchor pier, by a three-truss wooden bridge and it has two standard gauge tracks from end to end. Scale boxes on flat cars are pulled up the tracks by a cable and hoisting engine at the head of the incline and return by gravity. Underneath the platform, near the upper end are six flat-bottomed storage bins 8 feet wide, 10 feet deep and 30 feet long. They are filled with sand and gravel or broken stone delivered by boats and dumped from cars on the upper tracks, and have horizontal steel gates in the bottom, through which their contents can be drawn into side dumping measuring cars on six 30-inch transverse tracks under the bins. These tracks extend beyond the bins and between their ends, on the arc of the circle described by the 60-foot boom of the concrete derrick, are four 4½x5½-foot pits, 4½ feet deep. Charging boxes are set in these pits and bags of cement from the adjacent store house are brought to them by hand trucks on a run way and enough put in one of them for one batch of concrete, a car of sand and a car of broken stone are then brought from the bins on the track both sides of the pit, and, their contents being dumped into the box, the latter is lifted by the derrick, swung around and dumped into the concrete mixer.

Concrete is delivered by the mixer into scale boxes on cars which are pulled up the incline empty and return loaded by gravity to pier 4, where they are hoisted by a derrick for each shaft. These derricks are carried up independently as the masonry rises and dispense with the necessity of a tower and stiff-leg derricks at this end of the bridge. Alternate storage bins are filled with sand, the others with broken stone and the delivery cars dump on either side so that each pit is supplied with sand from one side and with stone from the other side. The bins have their floor-beams about 6 feet clear of the ground and are supported on trestles set on the rock bottom of an excavation made in the side hill to provide for the delivery tracks and mixing pits. The inclined platform is carried on the bin posts and elsewhere is supported on ordinary framed trestle bents with mud sills on the surface of the grounds. A force of about 250 men is now at work on the piers and it is expected that they will be completed in about one year. The concrete buckets have a capacity of 1.7 yards and can make a round trip every five minutes. Over 175 yards of concrete has been mixed and delivered by this plant and put in pier 4 in one 8-hour shift, and it is expected that when concrete is delivered simultaneously to the anchorage pier and pier 4 this output may be nearly doubled.

The stones in the coping course of pier 2 have maximum dimensions of 9½x3½x4½ feet and weigh as much as 25,000 pounds, an amount which was thought to be too large to lift 125 feet at the extremity of the 80-foot boom of the tower derrick, although it was proportioned for 20 ton loads. These stones were therefore delivered from the yard on cars to the short boom of the dock derrick, transferred by it to a transverse track on the low level dock and taken to the middle of the tower face. There they were lifted with a comparatively short radius by the long boom of the tower derrick which was then in the most favorable position, bisecting the angle of the stiff legs and pulling against both legs and the four guys, two in the lines of the legs and two at a wider angle. After the stone was lifted to the top of the tower by chains attached to dogs, it was set down on the masonry, picked up by Lewis bolts and swung carefully to place at an elevation only just clearing the top of the pier, so that in case of any breakage it would not drop far.

The granite is of a very uniform, warm gray color, is coarse grained and has a high crushing strength. It is quarried in regular rectangular blocks with sharp true edges and straight sides and of any required dimensions. The quarry reaches from the water's edge to the top of a knoll about 125 feet high. The strata worked are very regular, from 1 to 12 feet in thickness and are intersected by two open fissures, normal to the surface and about 500 feet apart, which define the limits of the quarry. The dip is about 20 degrees and the surfaces in contact are entirely separate and very smooth planes. The strata are uniform and continuous and fifteen or twenty of them are being worked upwards from the lower edges, giving faces of from 1 to 12 feet high. Where the superimposed rock is stripped off from a wide surface of a stratum it will split across in long straight lines, but where it is heavily loaded with upper strata extending nearly to the working face it splits in curved lines convex toward the pressure.

Crotch Island Granite Quarry.

A diagram of the method of working is shown on the sketch of the quarry plan, not made to scale or true dimensions, but merely indicating the operation. 1-2-3-4 and 5 are successive strata of increasing height and from 5 to 12 feet thick. Suppose that stratum 4 is 9 feet thick and it is desired to quarry from it stones 12 feet long. On the required line B-H a pair of holes about 12 inches apart and 9 feet deep are made at D with a compressed air drill and black powder is fired in them, they are swabbed out, recharged and refired, and so on several times until a crack has been opened from J to L. Another similar pair of holes is made in the line of the crack about 40 feet away at E and they are similarly fired. Holes are drilled at G-H and so on, and the crack is produced as far as desired, extending everywhere through to the stratum below. Holes 9 feet deep are drilled 12 inches apart in two rows 12 inches apart from A to B, adjacent to the open seam which bounds one side of the quarry. The pair of holes nearest A are heavily loaded with dynamite and fired, then the next pair are fired, and so on. Each blast pulverizes the granite between and close to the holes and throws the fragments so far that these blasts are fired at night when only the two men in charge remain on the island. When the whole set of holes has been fired a channel has been formed about 24 inches wide which extends through the stratum from A to B and gives a free face. The slab A-B-H-M, 12 feet wide, 9 feet thick, and perhaps 300 feet long, is thus detached from the stratum, but is not moved more than the fraction of an inch from its original position. Blocks of any required width are laid off by lines K-K-K, etc., of small holes, which are drilled by hand, and the stone is split along them by the regular plug and feather method.

The method of removing these blacks is ingenious. Dog holes are made in them and the main line from a derrick is attached and a strain is put on by the engine, but does not move it. The crack B-H is perhaps ⅛ to 1/16 inch wide, and in it, opposite the center of the blocks, are poured two cups of thick black oil at points about a foot apart. Between these points is poured a handful of black powder, which is covered with dirt, and has a fuse attached. The powder does not spread beyond the oil line, and so is confined in a thin sheet, filling the crack from top to bottom. When the fuse is lighted there is a light explosion which does not break the stone, but suffices to kick it out of its place and thus started it is easily pulled by the derrick line, over the smooth steep slope of the underlying stratum to a point within reach of the derrick boom. There it is split and cut in any required sizes by plug and feather, and the pieces are loaded by the derrick on cars lowered down inclined track by cables to the two docks where other derricks load them on schooners for shipment.

All the derricks are swung by bull wheels and are operated by hoisting engines driven by compressed air, which is furnished by a McKiernan compressor. Steam is supplied by a 200 horse-power boiler, and air is piped all over the quarry. There are ten guyed derricks, most of them with 10-ton 50-feet booms, and they and the inclined cable roads are operated by fifteen Lidgerwood and Mundy hoisting engines. With a force of about 140 men the output of the quarry is about 1,500 yards of stone a month, all of it practically without waste. The larger sizes are all required for the contractors work in New York, but that which is cut from strata less than 2½ feet thick is sold by the ton for miscellaneous building purposes. This quarry can furnish stone up to 12 feet in thickness, and of any desired length and thickness, the dimensions being limited only by the possibilities of handling. On one occasion a single stone weighing 2,500 tons was split off from the face of the stratum, kicked free by one pound of powder and dragged 120 feet to the derrick boom, as described, and when cut up made sufficient large blocks to load four schooners and did not leave a single yard of waste.

The quarry derricks are rigged in a special manner, as indicated in the diagram. The hoisting line is a single 1½-inch wire rope reeved through a single sheave at the point of the boom. Thence it is led around a sheave at the foot of the mast and thence to the heavily loaded three-sheave lower block of a six-part vertical tackle. The upper block of the tackle is fastened to the top of the mast, and its fall line leads over a single sheave on the opposite side of the mast and thence down around a bottom sheave and to the engine drum. This arrangement provides a hoist line with a single part, free from blocks, which, for hauling the immense blocks of stone down the slope to the boom radius is often extended by another line of the required length to reach as far away as necessary. The end of this line is hooked to the ring on a light return line and the latter being led around an anchored sheave beyond the block, is wound up by the capstan head of the hoisting engine and pulls the heavy hoist line up the slope to the required position, where it is detached and secured to the stone which it pulls down with the main tackle.

The bridge is being built by the Department of Bridges, New York City, Mr. Gustav Lindenthal, commissioner, and Mr. Oscar Erlandsen, assistant engineer in charge.

The "Clean Street Ordinance" of Chicago, passed February 18, 1901, provides for the use of metal receptacles for garbage and ashes, and the abolition of wooden boxes. In the first efforts to enforce this ordinance it was found necessary to call upon the police department for assistance, and three officers were assigned to each ward superintendent, a total of one hundred and six officers being used for this work. Mr. M. J. Doherty, superintendent of streets, states in his last annual report that with the assistance of these officers there were distributed from May to September, 1901, inclusive, 314,430 copies of the ordinance, 99,939 notices to provide metal receptacles, 82,489 notices to remove wooden garbage boxes, and 15,854 notices to remove manure boxes; 795 arrests were made for non-compliance with the ordinance. Within two months after enforcement of the ordinance, wooden garbage boxes, with but few exceptions, were removed, and 218 cement, stone, or brick manure vaults built.

Submerged Steel Pipes for the Jersey City Water-Works.

A new water supply of 50,000,000 gallons per day will be provided for Jersey City, N. J., by the works now under construction at a contract price of nearly $7,000,000, as described in The Engineering Record of July 21, 1900. A masonry dam at Boonton, N. J., which will be over 110 feet in extreme height and 3,400 feet long on the crest, will impound 12,660,000,000 gallons of water. From this reservoir water will be delivered through a steel and masonry conduit nearly 23 miles long. The masonry portion of the conduit is to be built at hydraulic grade and have a capacity of 70,000,000 gallons a day. There is in all about 94,000 feet of 6-foot riveted steel pipe under pressure up to 100 pounds per square inch.

Each length of pipe is made of a single sheet of steel with a lapped longitudinal joint having a double row of 1⅛-inch rivets, and the lengths are put together with telescopic taper joints. The circular seams have single rows of rivets, and all seams are caulked inside and outside with pneumatic tools. The submerged pipe at the river crossings is made with 25-foot sections, field-riveted together, each composed of five 5-foot lengths shop-riveted together. Elsewhere four 7½-foot or five 6-foot lengths are shop-riveted together. The 25-foot and 30-foot sections are delivered along the line by special trucks which hold the pipe on pairs of longitudinal skids swung low between the axles. These trucks are drawn by four or more horses. Before shipment the sections are dipped in a bath of hot asphalt and are all consecutively numbered and delivered in order, although many sections are duplicates. All vertical and horizontal deflections are made with flat curves by cutting the forward end of a length of pipe to a bevel while the rear end is cut square. The estimated weight of the steel pipe is about 30,000,000 pounds and it is being manufactured and laid in several separate contracts awarded to the same firm.

At the Hackensack River crossing there is approximately 840 feet of pipe 11/16 inch thick which weighs about 600 pounds per linear foot and is submerged to a maximum depth of about 40 feet. It is a continuous rigid section, without flexible joints, riveted together on one shore, with vertical curves corresponding to the plotted profile, and laid in an open dredged trench 70 feet wide over all with a bottom width of 15 feet and side slopes not steeper than 4:1. The method of laying and protecting the pipe is somewhat unusual and has been executed rapidly and successfully. The pipe was riveted together complete on shore, enclosed in a continuous protecting tube of concrete, drawn across the river under water and suspended just clear of the bottom by the aid of floats and trestles.

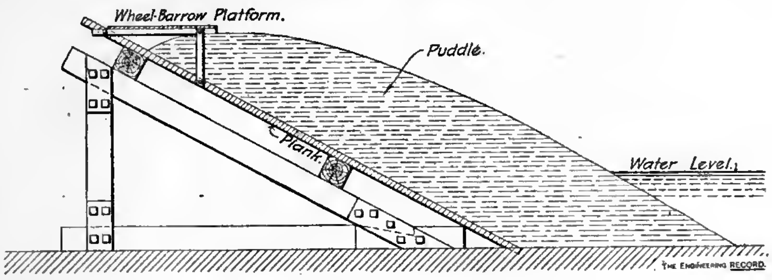
The first section, 25 feet long, had the forward end closed with a water-tight steel bulkhead, pointed in front, and was suspended at an angle of about 20 degrees from the horizontal by tackles from a double pair of sheer legs. It was guyed securely in a convenient position and rings of armored concrete 5 feet long were slipped over the upper end, their adjacent ends cemented together and the space between the rings and the pipe poured full of grout. Lines attached to the pipe were wound up on the drum of a hoisting engine and pulled the pipe forward over the center line of its trench.

The total weight of the empty pipe and the concrete covering being about 40 pounds per linear foot more than that of the water displaced imposed only a moderate stress on the suspending tackles and allowed it to move easily. The forward end was carried in a loop of rope suspended under the bottom of a boat, and the rear end of the pipe was held back by tackles and supported by jacks on low timber blocking on shore, just above the water line. Another 25-foot section of steel pipe was then connected to the shore end of the first length and held in position by two boom derricks until the joint was bolted up. The rivets were then driven, the seams caulked and painted, five concrete rings slipped over the pipe and grouted, and finally the whole pipe was pulled forward. Other sections were added successively in the same way. The rivet holes required very little reaming and the 92 field rivets for one joint were driven in about 2 hours.

Assembling and Launching Pipe.

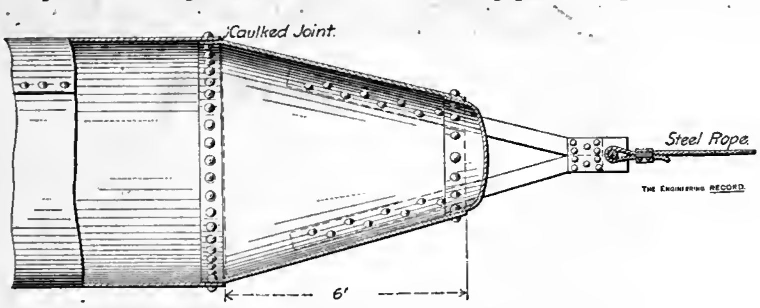
The concrete rings were put on and cemented and one complete 25-foot section finished and pulled forward ready for the next in 12 hours by a total force of about 46 men including the dredge crew. The concrete rings have an internal diameter of about 6.73 feet, external diameter of 7.70 feet, length of 5 feet and weight about 10,000 pounds each. They were made, at the site, of 2:5:9 Atlas Portland cement concrete mixed very wet and rammed into steel moulds. They are reinforced with welded rings of ½-inch square steel, 12 inches apart, and with six lines of ½ inch square twisted steel longitudinal rods. The pipe is laid everywhere with the longitudinal seams up and alternately on each side of the middle. The concrete rings rest on its upper side so as to leave a clearance of about 5 inches on the lower side, thus having an eccentricity of a little more than 2 inches. As the rings were successively slipped in place, each joint between abutting ends was covered by a thick rubber band 6 inches wide having its ends riveted to short transverse steel angles making flanges by which the band was drawn very tight, with two bolts. At the land end of the last ring, a temporary wooden collar was attached to close the space between the steel pipe and the loose ring and retain, until it set, the 1:1 grout which was then poured in to make a solid filling and cement the ring to the pipe.

Temporary piles in groups of four about 150 feet apart were driven both sides of the pipe and capped with transverse horizontal timbers



DIVERSION DAM.

just above the water level. In some cases these caps supported longitudinal rollers, one on each side of the pipe, on which the ends of the suspension ropes were wound. The rollers were 10-foot lengths of 6-inch gas pipe with cross holes through the ends for capstan bars which made it possible to hold, wind up or slack, the ropes. In the other cases the rollers were replaced by vertical screw rods passing through holes in the caps, one on each side of the pipe, with nuts bearing on washers on the caps. The ends of the suspension rope slings were secured to eyes at the lower ends of the rods. Between the groups of piles four canal barges were moored with their longitudinal axes in the vertical plane through the pipe and were used as floats to support the pipe while it was being moved across the river. From each side of each barge ropes were suspended to form



BULKHEAD FOR LAUNCHING PIPE.

slings passing under the bottom of the boat and carrying the pipe. After each successive section had been riveted on the shore end of the pipe and the concrete rings threaded on it, the slings under the floats were carefully adjusted to the same tension as those suspended from the pile caps, and the latter were then slacked off, completely so as to gradually throw the weight of the pipe entirely on the floats and release the stationary slings without changing the position of the pipe. Then the shore tackles were slacked off and snubbed carefully, and, if the pipe did not, as usual, move forward under its own weight, it was assisted by putting a pair of 20-ton differential screw jacks under the shore end to raise it free of the cribbing on which it was assembled and by pulling on two four-part tackles attached to the rear end of the pipe and to dead men between the end of the pipe and the river. The tackles were operated by a hoisting engine on shore near the concrete plant, and when the pipe was nearly completed the engine was taken across the river to wind up the line attached to the forward end of the pipe and pull it up out of the water, this being the only part of the operation which required much force to move the pipe.

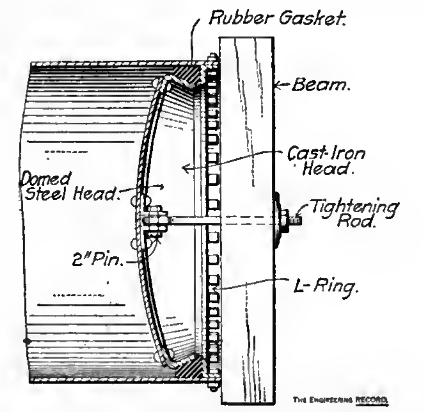
The wire hauling rope was attached to the forward end of the pipe by a 2-inch pin passing through a pair of jaw plates, to each of which was riveted a pair of 5x1-inch steel bars. These bars were riveted equidistantly to the conical part of the bulkhead which, together with a domed head 3 feet in diameter closed the end of the pipe. By this arrangement the tension was applied to the elements of the cone without eccentricity or danger of distorting the bulkhead.

As the net weight of the submerged pipe between supports was only about 6,000 pounds the stress produced by the moment of flexure was entirely negligible, considering the section of pipe as a tubular grinder, 6 feet in diameter and 150 feet long. It was considered of great importance to keep the pipe at all times in exactly the required vertical position, and to maintain equal stresses on all the slings. The former object was attained by frequently raising and lowering the pipe and locating its position by measurements checked with the distances on a profile of the bottom of the trench as plotted from soundings; the latter was attained by inspection of the ropes and testing their tension by feeling the rigidity.

As the pipe is a rigid tube fitted to the profile of the river bottom it was not parallel to it until completed, and its successive positions were determined by the location of the extremities, the shore end being fixed and the forward end movable. It resulted that the whole pipe revolved in a vertical plane around the shore end as a center, and that the weight and inclination of the portion of the rear end of the pipe above the surface of the water was generally sufficient to make it move forward by gravity when released, without pulling on the tackle provided to haul it across the river. The proper manipulation of the pipe in its slings was considered a very delicate and important matter and was successfully accomplished.

The principal advantages of this method of laying submerged rigid heavy pipe in long lengths are that all work is done on shore with plenty of room and complete stability; that it can be sunk and its weight adjusted without admitting water ballast or complicated temporary loading; that it is efficiently and permanently protected without back filling or rip-rapping; that it is kept at all times entirely free from the bottom so as to be easily handled and at the same time deep enough to clear passing boats and offer no obstruction to navigation; that it is uninfluenced by storm, flood or tides and that except during the brief intervals when it is actually in longitudinal motion it is firmly secured to solid pile bents. After the pipe was pulled entirely across the river and the forward end appeared above the surface ready to join the shore section, it was lowered to its final position on the bottom of the trench by men simultaneously operating all the pipe windlasses and screw adjustments. As the concrete jacket is considered ample protection and will hold it down if it is ever necessary to empty it for inspection or repairs, there will be no back filling or additional covering except that resulting from the silting and washing of the river bed.

On both shores of the river the ground is low and soft and special methods were devised for laying, supporting and covering the steel pipe. On the west shore the embankment around the pipe is back filled by side dump cars drawn by a locomotive, bringing spoil from a cut which the contractor is making for the Delaware, Lackawanna & Western Railroad. The



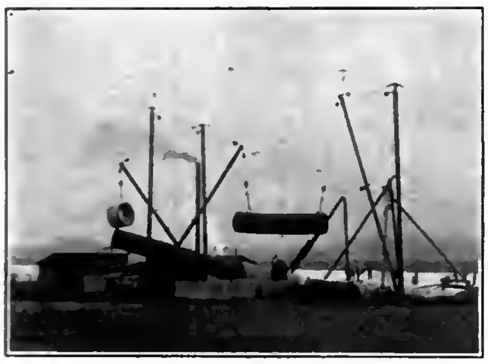
BULKHEAD FOR PIPE TESTING.

track is laid on top of the pipe and none of the fill is made by hand. On both sides of the river the line is carried for several thousand feet over marshes where it was necessary to first build a clay bank causeway. Enough clay was dumped into the causeway bank on the east side of the river to fill it up to the level of the center line of the pipe and to leave extra material on the sides so that after the excavation has been made for the pipe and it is laid, riveted and tested, there will be sufficient earth there for all the required covering of a minimum depth of 3 feet.

In some places the swampy ground was sheet piled and with constant heavy pumping a trench was dug, in which 3 feet of clay were filled to make a bed for the pipe. On the east side of the river there is a power house with a Rand air compressor from which compressed air at about 90 pounds is piped along the line to operate pneumatic caulkers, reamers and hammers. Holes are left in the top of the pipe about 50 feet apart to insert the pressure hose for driving rivets inside, and are afterwards closed by screw plugs.

After being riveted and caulked in the trench the pipe is tested in sections of 5,000 to 20,000 feet by hydrostatic pressure of 120 pounds per square inch, applied with a contractors steam pump. Generally the ends of the section under test are closed by the regular valves of the pipe line, but when these are not conveniently located for this purpose the ends are closed by a special removable bulkhead patented by the contractor. This consists, as shown in the sketch, of a domed steel head with a circular cast-iron flange having clearance inside the pipe. The outside of the flange is finished smooth and beveled to fit a solid circular rubber gasket which abuts against an inside circular flange of heavy angle iron, bolted through the rivet holes in the end of the pipe. The domed head is pin-connected at the center to a horizontal screw rod with a nut bearing on a transverse straining beam, by which the bulkhead is pulled tightly to place and leakage is prevented while the pipe is being filled with water; afterwards the internal pressure keeps the joint tight and the screw is removed.

At the Lyndhurst, N. J., crossing of the Passaic River, there is about 450 feet of pipe submerged to a maximum depth of about 15 feet which will be laid like that across the Hackensack river, but entirely different methods were employed for the two submerged pipe crossings near Boonton. Temporary dams were built across the Rockaway River above and below the pipe line and the river was carried between them in a wooden flume 12 feet wide, 4 feet deep and 30 feet long about on the center line of the old channel. The flume was caulked and floated into place in 3 feet of water and sunk on sills, after which the water was drained out from between the dams, a trench 11 feet deep dug across the 80-foot channel and under the flume. Then the pipe was laid and back filled, and the dams and flume removed.



Handling Pipe Section and Concrete Sleeve.

At the Passaic River crossing the topography favored the construction of a canal to by-pass the flow of the river around the dams, and where this canal intersected the pipe line the water was carried over the latter in a short length of flume so as to allow the pipe to be laid continuously, without waiting to return the river to its original channel. Here the river channel was 80 feet wide and 4 feet deep. At both crossings the bottom was of hard sand or gravel. The diversion dams were made with a puddle bank laid against a tight plank apron inclined about 30 degrees to the horizontal and supported on triangular timber frames about 10 feet apart. They were built with 2-inch planks and 8x8-inch timbers and had horizontal wheeling platforms on top from which the puddle was dumped in place.

The work is being built for the Jersey City Water Supply Company, Mr. W. B. Fuller, resident engineer in direct charge of all construction work, Mr. J. H. Gregory, division engineer in charge of all conduit lines, Mr. J. W. Smith, consulting engineer, and Mr. E. W. Harrison, chief engineer of the Jersey City Water Supply Company. The pipe is built, laid and tested under the supervision of the engineer corps and some of its special features were devised by Messrs. Smith, Fuller and Gregory, to whose efforts and ability as well as to the skill and experience of the contractors credit is due for the satisfactory execution of the difficult work involved in the construction at Hackensack River crossing of one of the largest and deepest of submerged pipes. The pipe is built and laid by the T. A. Gillespie Company, which has a plant at Paterson, N. J., for making riveted pipe, and has built several of the largest steel pipe lines in this country, including nearly 60 miles for the East Jersey Water Company, and lines for Allegheny, Minneapolis and other cities.

Concrete-Steel Piles and Their Driving.

While the new method of reinforcing concrete by embedded steel in various shapes has rapidly gained favor among the engineers of the world, the main attention has been given to that application which promised to be the most fruitful, concrete beams reinforced by steel. Now that the advantages of the concrete-steel combination for sustaining loads by flexure have been definitely established, the attention of engineers has turned to concrete-steel in the form of long columns and piles. Concrete steel piers were used on the X-bridge at Mans, France, by its able chief engineer, Harel de la Noè, and concrete columns reinforced by steel in the form of wires and rods have heretofore been used for various purposes, but there now appears to be a tendency to give more room to the application of this form of post. The experiments conducted by the Austrian Society of Civil Engineers and Architects, described in The Engineering Record of November 23, 1901, proved the great value of properly reinforced concrete in compression.

In a recent paper before the Institution of Civil Engineers of England on "Construction in Concrete and Reinforced Concrete," Mr. C. F. Marsh says: "The fact that piles made of reinforced concrete stand driving proves that beams, etc., of these materials may be subjected to moving loads without damage." He further describes the piles used in the Hennebique system. The square piles of concrete have a rod of mild steel in each corner about one inch from the surface of the concrete; the rods are bent inwards at the bottom and embedded in the shoe, which is of the ordinary form, and are held in position by 3/16-inch wire distance pieces, which are bent to fit loosely around the rods. These are dropped down from the top as required, and the sets are placed about six inches apart. The piles are moulded in an upright position, supported in timber racks, and about 3 inches of concrete are allowed over the tops of the rods, although piles can be driven with the tops of the rods flush with, or even slightly above, the top of the concrete without shattering.

Piles can be made of any length, size or shape required, and should it be desired to add to the length, when the pile is driven, or to connect piles to columns, it is only necessary to break away the concrete for the required distance, insert additional bars, and mould to the required height. The piles are driven with an iron cap in which a bag of sawdust is placed. Piles constructed in this way, 14x14 inches in cross-section, have been driven by a 2-ton monkey with a drop of 6 feet, and have stood perfectly. The driving of 12x12-inch piles with a 3,000-pound monkey and a drop of 4 feet is quite usual. The piles can be driven with perfect safety 3 weeks after moulding in the summer, but it is better to leave them for a month or 6 weeks in the spring and autumn, and, if not required after that interval, they can be taken from the rack and stacked.

Groups of piles driven to carry columns have the concrete at the top of the piles broken away for the required distance after being driven to the necessary depth; the rods of the column are then placed so as to overlap the rods of the piles and the concreting of the column is commenced. Columns and other vertical members are formed in much the same manner as the piles, but are generally moulded in place; the wire or flat iron cross-pieces need not be so close together as in the piles, being usually about 15 inches apart. The rods of the columns terminate at the bottom just above a steel plate which is embedded in the upper part of the foundation block. These foundation blocks are also of concrete reinforced by steel.

In the "Zeitschrift des Oesterreichischen Ingenieure und Architecten Vereins" of November 7, Mr. F. von Emperger describes a special pile driver built for concrete piles and the driving of such piles for the pier foundation of a small bridge. The pier rests on 11 piles, which form one solid body with the pier proper. This was attained by breaking away the concrete on the top of the piles and embedding the extended reinforcing bars in the pier. The piles were 16x16 inches, and were made in one length 14 to 16 feet long while lying horizontally. The ground was about 6.5 feet swamp on coarse gravel. The driving weight was 8,800 pounds and through the soft material it caused a penetration of 8 to 12 inches under a fall of 20 inches. When the gravel was reached the fall was increased to 3.3 to 4.25 feet, and at the beginning the pile sank 2 inches, but finally was driven practically to refusal by 80 to 120 blows with a penetration of 5/16 to 0.4 inch. Computing the bearing power of the pile by the well-known Ritter formula, the resistance to further penetration is:

$$W = \frac{h}{e}\,\frac{Q^2}{Q+q} + Q + q, \text{ in which}$$

Q = Weight of hammer in pounds = 8,800
q = Weight of pile in pounds = 8,800
h = Height of fall in inches = 48
e = Last penetration in inches = 0.4

This gives for W, 546,000 pounds. The load allowed per pile is controlled by the character of the material and about 22 tons or 178 pounds per square inch has been adopted as the upper limit. The latter value offers considerably more than the usually required safety and with it an increased stability of the structure. To determine the resistance of the concrete against shock the work done by the falling weight, 48x8,800 = 422,400 inch pounds is computed and distributed over the cross-section of the pile, giving 1,650 inch pounds per square inch as the impact resistance of the concrete.

Inquiry made by Mr. von Emperger on the behavior of the above described concrete-steel piles from the ministry of Elsass-Lothringen resulted in an elaborate reply which concludes that only good workmanship will give good results. The shattering of the concrete by the blow was of no account. In the case of one pile only the concrete broke away at the top of the pile and even this is believed to be avoidable. Another bridge built on concrete-steel piles has been decided upon by the same administration.

Siberian Coal was produced in 1900 to the amount of 320,000 tons, according to a British contemporary. There are a number of very rich and extensive fields which are being developed with increasing rapidity. In the Government of Tomsk there is a coalfield 270 miles long and 70 miles wide which contains seams of great thickness. In central southern Siberia there are five valuable deposits of coal and further eastward, in the Government of Irkutsk, there is a coalfield which produced 80,000 tons in 1900. A large supply of coal, accessibly situated, is of the utmost importance to the great railway lines recently built and now in progress.

Rail Tracks for Highway Traffic.

For some time past attention has been directed to the development of a suitable wheel track, especially for the use of heavily loaded wagons, which could be laid in streets and roads. The desirability of such a smooth track for wheels is evidenced by the persistency with which teamsters make use of street car tracks. Such a track should be of a gauge and width to accommodate a variety of vehicles, and the rails should be of such form as to facilitate turning into or out of the track and should not be dangerously slippery for horses' feet.

In a recent issue of the "Organ für die Fortschritte des Eisenbahnwesens" Herr A. Nessenius publishes an extensive study of the efforts and experiences of German engineers in the construction of an economical and serviceable iron track for highway purposes, which is abstracted below. The importance of this subject is well known and the discussion of the desirability and construction of iron tracks on highways has also been taken up among American engineers.

The first practical attempt to lay iron tracks on a highway was made in Germany in the year 1894, in the Province of Hannover, by the engineer Gravenhorst, where some 1,600 feet of iron track were laid as an experimental section. This first attempt was made with a cheap flat rail weighing 6.7 pounds per linear foot. The rails were in 33-foot lengths and their joints were made on cast-iron seats, which also secured the position of the track. There were no cross-ties nor any cross connections between the rails, which were supported on a layer of cement mortar laid on a continuous solid concrete foundation. The rail was depressed about 0.1 inch and longitudinal depressions were intended to provide a foothold for the horses. The width of this rail was about 5 inches.

While even this cheap and simple track proved to be in favor with most drivers, especially for the heavier traffic, it appeared very soon that it was not sufficient to offer a smooth rail for vehicles, but a more reliable guide must be provided to keep poorly horsed, carelessly driven and badly maintained vehicles on the track. It also proved to be wrong to depress the rails in the pavement, as was done in the trial section. The rough edges of the projecting stones were not sufficient to form a guide but caused shocks to the vehicles and rapid abrasion of the paint of the wheel-rims. It became further apparent that it was not sufficient to secure the flat rails at their joints to the concrete stringer which served as their foundation. When the sun heated the track, the loosely lying rails became wavy and began to rattle, while in rainy weather water and mud collected under them and spattered all around. An attempt was made to secure the flat rail to the concrete foundation by short pieces of Z-bars, but it proved to be a failure.

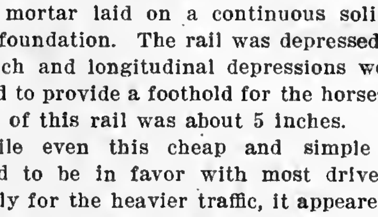


Fig. 1

A second trial with the section, shown in Figure 1, was successful. The flat rail is stiffened by two continuous Z-bars bolted to it from underneath, the space between them is filled with concrete and to prevent the separation of the filling from the rail a thin sheet of iron is bolted to the under side.

In the meantime, in another district a trial section was laid with an experimental rail similar to the street railway T-rail. After several experiments the section shown in Figure 2 proved to be serviceable and was adopted. Some difficulties were at first experienced in rolling this section, but they were soon overcome. The rail is now rolled the same as an I-beam section and the guide is bent up in passing the finishing rolls. These rails are manufactured in lengths of from 30 to 40 feet and weigh about

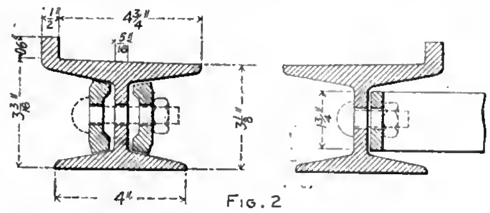


Fig. 2

50 pounds per yard. No difficulty is experienced in bending them to the required curvatures. The joints are made, as shown in Figure 2, the same as in railroad track. The rails are connected crosswise by light bars 1¾ inches by about ⅜ inch, and the weight of the completed track is 36 pounds per running foot. The rails must be laid with both guiding ribs on the inside, so that they will be between the wheels of the vehicles and thus provide secure guidance.

This arrangement makes the leaving of the track easier than when the guides are laid outside, since if a wagon has to leave the track and the horses draw in an oblique direction the externally running wheel is lifted up as with a lever. The drainage of the rainwater also offers no difficulty with this arrangement, while it would stay between the rails if the projecting guides were placed outside. In the Gardelegen district the gauge of track has been made 4.4 feet to centers of rails or 4.1 feet between guides. This makes the least width between wheels of vehicles using the track 4.1 feet.

With the adoption of the section shown in Figure 2 with its width or rolling surface of 4¾ inches in height of guide 0.6 inch, the correct form of the head of the rail seemed to have been found. The new track proved to be so successful that it was immediately laid on several long stretches of road. The guiding offered by the track is so secure that no special attention of the driver is required. Thus, for instance, a hunting party of the Imperial court, with about twenty wagons, drove a long distance over the track at night at the fastest trot, without any difficulty whatever. Three wagons coupled together always remain on the track notwithstanding sharp curves. It should be pointed out, what can be seen everywhere, that the horses begin to run faster as soon as the wagon gets on the track, due to the considerably reduced traction resistance. Vehicles passing across the track are not much annoyed by the projecting guides.

The favorable results which were obtained with the above described tracks induced the Province of Hannover to utilize them, but the box section first used was continued. This was done because the stresses in the different parts of the section are better distributed in the box section than in the T-section and thinner metal may therefore be used. When a crossing vehicle hits the guiding rib bending moments of considerable amount are caused in the T-rail section; this cannot occur in the box section where the bending moments must be very small on account of the direct support of the guiding rib. The greatest bending moment takes place in the box section in the upper level portion when a heavily-loaded narrow wheel runs in the middle; but even if the solid filling is neglected, the computed stresses are comparatively small. Still less are the stresses due to heavy vehicles with wide rims. It was further taken into consideration that the wide bearing area of the box rail will be less pressed into the soil than the comparatively narrow foot of the T-rail.

As a result of the above considerations Gravenhorst developed a rail section shown in Figure 3. It weighs 34 pounds per yard without appurtenances. Cross-connections are not provided. The hollow space is carefully filled with bricks or with concrete so that the rail bears with its full width on the foundation and

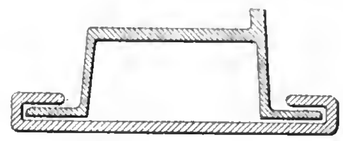


Fig. 3

the bearing area is thus made as large as possible. The sheet-iron bottom shown in Figure 1 is omitted, because the filling, consisting either of bricks grouted with a thin cement mortar and leveled up with a stiffer mortar, or of concrete, adheres firmly to the iron so that the rail can be overturned after 36 to 48 hours without loosening the filling.

The apprehension that the filling would gradually loosen under the effect of the vibrations and the unavoidable changes of temperature of the rails has not been realized so far; but even if a loosening should take place little harm would result, as the rails are secured to the foundation and the filling cannot drop out. The total width of this rail is 8⅝ inches and the rolling area is 4.8 inches; the guiding rib is 0.6 of an inch high and for ease in rolling and reduction of friction on the wheels the ribs have a 10 per cent. bevel. Trouble was at first experienced with the joining of this box rail, but finally the splice shown in Figure 3 was adopted. The box-rails are supported for their whole length by the foundation and secured by the pavement against displacement sidewise. No such displacement can be observed even at the ends of the track. The splices are, therefore, not stressed so severely as in railroad tracks. They have little to hold and thin iron wedges are sufficient to keep the rails in place. At the same time the rail can be straightened and the ends properly aligned.

The connection between the street pavement and the railroad track of street railways is generally one of the principal difficulties encountered in paving streets. The wagons using the track strike every time they get off the track against the adjacent pavement and once a slight depression is formed the wheels are easily guided along the rail and always hit the same spots of the pavement. The latter is thus comparatively easily depressed and is soon destroyed. The same difficulty is experienced with the above described tracks, but not in so high a degree, since the vehicles are securely guided by the track and commonly leave it only when passing each other or turning into another road. It should also be considered that the traffic on highways is much smaller than on city streets having railroad tracks. For cobble stone pavement, all that is necessary is to select the deeper stones and put them near the projecting rib and the shallower stones near the external edge of the rail. If the rails are deeper than the stones, they can be let into the foundation for the required amount or shallower rails used. With the box-rail the cobble stones lean against the walls and rest on the lower flanges. The level of the track is secured by the solid foundation which is required for this kind of pavement; the only precaution to be taken is that the sand cushion should be made sufficiently thin.

Should it be desired to lay the track on macadam roads having a foundation, the same would also prove sufficient for the rails; but the joint between the broken stone surface and the rails is so difficult to make, so unenduring and so troublesome in maintenance that the laying of tracks on such roads cannot be recommended. Even if the stones immediately adjacent to the rails could resist the wheel pressure of the vehicles hitting them accidentally, it could not resist the constantly recurring attacks of the horses. Recently the experiment of paving for a short distance the space between and adjacent to the rails with broken stones has been repeated; but has failed, as have all similar experiments.

For first-class pavements of large blocks or bricks, the foundation must be designed in each case. A good method is to fill the space in the rail section with tamped gravel. If conditions are favorable, the track will prove satisfactory even if laid on sand, but in most cases tracks laid on sand without foundation were soon distorted. Where gravel is not abundant and where good coarse sand which could be mixed with some cement is also scarce the rails may be laid on a layer of bricks.

To obtain a satisfactory joint between the rail and the pavement a new rail section has been invented which is shown in Figure 4. It weighs 12 pounds per linear foot. The rails are pushed in from both sides in the splice shown in the section, and are secured with thin metal wedges. Holes are bored in the rails, in which end pieces of the splices are bent over for further security. The lower ends of the sides of

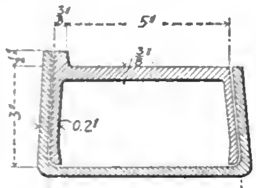


Fig. 4

the rails are somewhat bent in while passing the finishing roll to prevent the concrete filling from falling out should it get loose. For better drainage the surface of the rail has a slight inclination outwards. This is hardly necessary since the rails show a tendency to bend slightly outwards; for when a vehicle, with wheels further apart than required by the gauge of the track, passes over the rails, one pair of wheels will, as a rule, be near one guiding rib and the other pair will bear fully on the outer edge of the other rail; furthermore, the inner edges of the rails will usually bear the wheel load only when the vehicle goes on or off the track; and the T-rail would tend to overturn because of its narrow foot if the cross-ties did not prevent, but even with cross-ties a slight, though harmless, rotation of the rails takes place. Observations made recently by Gravenhorst at twenty points have shown an angle of inclination of 4 degrees 45 minutes in the average; but it should be remarked that no observations were made immediately after the track was laid and that it is therefore impossible to tell how much of the inclination was there initially and how much of it is due to later rotation. On good foundations the rotation of the box sections has been the smaller, notwithstanding the fact that there are no cross connections at all. Soon after the track is laid a slight side inclination can be noticed, but it does not seem to increase after the foundation has had time to settle.

There has been little experience to determine the allowable grades on the above described tracks. In 1900 a mile and a quarter was built with long grades varying from 2.5 per cent. to 3.8 per cent., with many curves, which proved to be fully satisfactory. Older roads having similar grades have also shown no disadvantages. Curves offer no difficulties and the rails are easily bent in the shop.

The question of the proper width of rail which was assumed 4¾ inches is a very important one. Supposing that the gauge adopted will suit most vehicles and that there will be a tendency to set the wheels to the adopted gauge, there will always remain a sufficiently great number of vehicles which will exceed somewhat the gauge so that their wheels on one side will run outside the rail, on the pavement. Experience affirms it by pointing to the ruts which are formed in the pavement alongside the rails, the width of these ruts varying from 3 to 4 inches, and evidently demands an increased width of running surface. Such a widened rail of a section similar to the one shown in Figure 3 but heavier has been laid on the busy highway between Mainz and Wiesbaden. Its rolling width is about 6 inches and it weighs 54 pounds per yard, but even this rail has not proved to be sufficiently wide. For a recently planned road, a new box section has been rolled which has a rolling width of 7 inches and a depth of 3⅛ inches.

The requirements for the guiding rib are to prevent involuntary derailment and to offer the least resistance to a wagon leaving the track, which are at once seen to conflict. The importance of this difficulty becomes more evident if it is remembered that, for reasons of economy, by far the greater number of highways have only a single track. Every meeting of two vehicles necessitates leaving the track. It was stated above that a ⅝-inch projecting rib kept the vehicles on the track, but it makes too difficult the leaving the track, and breaks of wheels have repeatedly happened. Whether the breaks were due to the bad condition of the wheels, careless driving, narrowness of road and sharp curvature, or to the rib, is not easily determined, but it cannot be disputed that the rims of the wheels are pressed with great force against the guide while turning off the track and that stresses are caused which the wheels were not designed to resist. A tendency to reduce the height of the projecting rib has therefore manifested itself. Experiments on some 120 feet of trial rails having ribs ½ to ⅜ inch high have been made and no objections have developed. An attempt to cut down the rib for a certain length in each rail to ¼ inch has failed, as the drivers pay no attention to these depressed sections.

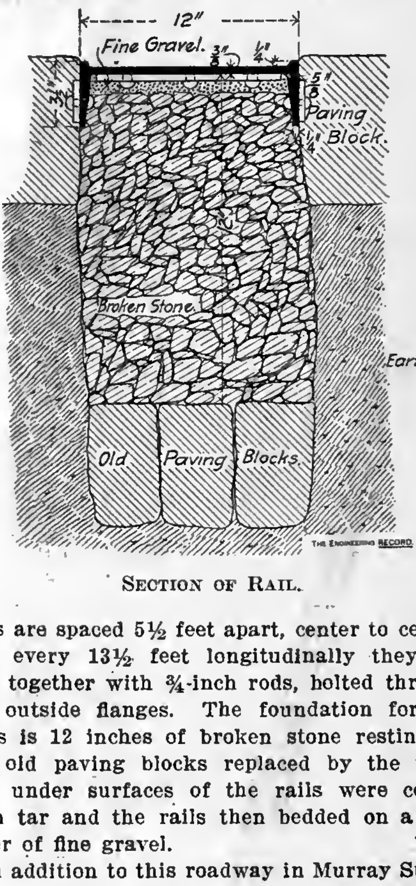
Measurements taken recently by Gravenhorst, and experience on the tracks, laid both with box section and T sections, seem to indicate that the best inclination to be given to the inside face of the guide rib is about 25 per cent., which is the inclination to which the ribs show a tendency to wear. The wear will then not be on the upper edge only but quite uniformly over the whole face and will be reduced in amount.

To the end of 1901 there were laid in Germany some 42½ miles of T-rail track and about 10 miles of box-rail track. From observations it has been found that a horse will move with the same effort a load three to five times as great on an iron track as on a stone pavement. The great favor which the iron tracks, where laid for long distances, enjoy among drivers is therefore understood. As to the effect of the use of iron tracks on the cost of maintenance of the highways, no data are available at present, since such information can only be obtained by many years of experience; but it is quite certain that the pavement near the track is used remarkably little, serving only for occasional turnouts. This will reduce the cost of repairs and maintenance in a considerable degree. Against this reduction the cost of repairs and the first cost and interest of the track must be charged.

A Steel Roadway in New York.

An experimental steel highway has recently been laid on Murray Street, between Broadway and Church Street, New York. The Automobile Club of America has been instrumental in securing this trial, and President Charles M. Schwab, of the United States Steel Corporation, furnished the steel at his own expense. Gen. Roy Stone, formerly head of the Bureau of Road Inquiry, Department of Agriculture, has charge of the experiment.

At present there is only a single roadway up the center of the street, on which loaded teams coming from the North River piers are given the right of way. The accompanying sketch shows a section through one of the rails, the depth of foundation shown, however, being somewhat greater than that finally adopted. The rail section is very similar to that of a 12-inch channel, the main difference being that there are slight ridges along the outside edges of the wearing surface, which tend to keep the wagon wheels in the track. The rails came in 40-foot lengths and were riveted together by means of three splice plates, one on the under side of the main web of the channel, having three rivets for each rail, countersunk on the top surface. The other two plates connect the flanges, each with two rivets to a flange. The



Section of Rail.

rails are spaced 5½ feet apart, center to center, and every 13½ feet longitudinally they are tied together with ¾-inch rods, bolted through the outside flanges. The foundation for the rails is 12 inches of broken stone resting on the old paving blocks replaced by the rails. The under surfaces of the rails were coated with tar and the rails then bedded on a thin layer of fine gravel.

In addition to this roadway in Murray Street, which will be subjected to the heaviest kind of traffic, it is proposed to lay another stretch of the steel road on Seventh Avenue in the neighborhood of 120th Street. Here the pavement is an old macadam, and there will necessarily be modifications of the foundation and the methods of construction to suit the locality. A trial will also be made on some dirt road, for the advantages of the steel rail are considered to be as great for a country road as for city streets.

At the present price of steel it is stated that the rails can be furnished for $4,000 per mile. The cost of construction would of course vary with local conditions, and as the work so far done is experimental and workmen had to be taught how best to perform the various operations of laying the track, no reliable estimate has been made as to the total cost of laying this roadway.

A thorough series of traction tests are to be carried on in connection with the roadway in Murray Street, and the other places where the rails are laid. A dynamometer will be used and the tractive force necessary to draw a truck over the granite paving will be compared with that necessary to draw it along the steel roadway. In addition to this test, records have been made showing the amount and weight of traffic on the street previous to the improvement, and further observations will be taken from time to time to see whether there is any increase in the traffic passing up this street.

Gen. Stone has made a very exhaustive study of steel highways, and has had several patents issued to him in regard to constructive details. These he states are to be entirely free to the city of New York to make use of, should the experiments prove as successful as is hoped. In rolling rails for further experiments it is proposed to make use of a special roll having slight projections on its surface, perhaps an inch square. The last time the rail goes through the rolls this will be put on and will leave corresponding depressions in the finished rail. The object of this is to reduce to a minimum the danger from horses slipping, and is an important consideration. However, it is claimed that the use of the steel rails will so reduce the amount of tractive force required that under ordinary conditions there will not be much danger from that source. Another proposed modification is to have the bead along the outer edges of the tread fluted so as to prevent wheels from skidding as they leave the track. In some cases it might also be advantageous to have the flanges of the rail flaring outward from the web on both sides, thus presenting a wider base.

There have been a few experiments on a small scale in this country with steel trackways, conducted by the Bureau of Road Inquiry, but lack of means to procure the desired shape of rail has hampered the Bureau in its investigations. One of these trials was with an 8-inch trackway on a gravel foundation, the weight of steel being about 100 tons per mile of single track road, furnished at $35 per ton. The most extended use of steel rails for roadways for which data is available, is in Spain on the road between Valencia and Grao, where about two miles of flint stone roadway was replaced by steel rails some ten years ago at a total cost of $9,500. The surface of the rails was placed somewhat lower than the paved road at the sides. The cost of maintenance of this road, over which a traffic of 3,200 vehicles passed daily, was at once greatly reduced, and the result was considered satisfactory in other ways. It seems probable that such a roadway as this would be greatly appreciated by market gardeners in the vicinity of large cities.

The Degree of Doctor of Engineering (Eng. D.) is to be conferred by the Massachusetts Institute of Technology, Boston, upon students in a graduate school of engineering research which is to be opened October 7, 1903. Students of marked ability who have received a degree of Bachelor of Science or have done work equivalent thereto, will be admitted to the school upon proper application and acceptance. Facilities will be afforded for advanced studies in civil, sanitary, mechanical, marine, mining and chemical engineering, applied mechanics, naval architecture, metallurgy and industrial chemistry. Six fellowships of $500 will be open to competition at the opening of the year 1903-04. The degree will be conferred upon candidates from the graduate school who shall have given not less than two consecutive years to special work, after presentation of a written dissertation on a subject previously elected, and examinations by the faculty of the Institute.

The Removal of Snow in New York City.

The form of contract for the removal of snow and ice in the Borough of Manhattan, New York City, this winter differs greatly from any previous contract given in that city. The chief difference is in the method of measurement. The amount of snow to be removed by the contractor and to be paid for by the city is to be determined by multiplying the depth of snow in the city as officially determined by the United States Weather Bureau by the superficial area of snow actually removed; this area to be ascertained from the area of streets as given in a set of maps prepared for this purpose.

Among the advantages of this system over that which has been followed during the past seven winters are, first, the city will have to pay only for work actually done, and not as before for imaginary cart loads corruptly or mistakenly checked off under the complicated system of measuring by cart loads previously pursued; second, the great temptation to dishonesty among the employes of the street cleaning department and others, afforded by the previous system will be avoided; third, under this system the members of the department of street cleaning, in place of being required, as under the previous system, to do a large part of the work for which the contractor was paid, will be employed wholly in the proper work of the department, as in cleaning crosswalks and the like.

It will be seen at once that the number of cubic yards measured by the recorded snowfall and the actual area cleaned will be considerably more than the amount as measured by the cart load. This shrinkage has been estimated at from 50 to 60 per cent.

Last winter under the old system there were removed 1,255,500 cubic yards at a contract price of 36¾ cents per yard, giving a total of something over $420,000. Adding to this amount the estimated value of the work done by the department in the way of furnishing officers and in many cases performing the actual work, the total cost is brought up to $570,000. This winter the contractor is required to furnish all the officers and do the entire work, the only cost devolving on the city being the salaries of eleven inspectors, one for each snow district. Thus the price bid by the contractor this year includes the $150,000 worth of work that the city performed under the old arrangement. At the contract price for this year, 25 cents per cubic yard, it would require the removal of 2,280,000 cubic yards measured on the new basis to bring the total cost up to $570,000. For the 30.36 inches of snowfall during last winter, this would mean about 75,000 cubic yards removed for each inch of snowfall.

There are 155 miles of streets in Manhattan to be cleaned, or over 6,000,000 square yards of surface, and it has been found that for every inch of snowfall there will be 170,000 cubic yards of snow on the complete schedule to be removed. In some cases, however, part of this will have been reduced to 4 inches or less in depth before the last part of the schedule is reached, and will not have to be removed; and as what is not removed is not paid for by the city, the actual amount paid for will in many cases be less than 170,000 cubic yards per inch of snowfall. Moreover when the snowfall is less than 4 inches it is optional with the commissioner whether or not any at all shall be removed. The average snowfall for the past 18 years is 35.27 inches, the smallest was 8 inches in 1900-1 and the largest 77 inches in 1892-3. On the snow maps the streets in which the different gangs will work are distinguished by different colors, and the area of each block, exclusive of intersections is printed on the map. The areas of the intersections are also printed in their respective places. No block will be paid for until it is completely cleaned.

It is interesting to note that under the new system it makes no difference to the city whether streets outside the schedule are cleaned or not, for the contractor can get no pay for such work. Neither does the city care how many times the same load is counted when the snow is being carted away, for that loss will also fall directly on the contractor. All the complicated system of inspection and oversight on the part of the street cleaning department is therefore done away with. In this connection it should be noted that much of the work of snow removal done by the department under the old form of contract was done at the expense of the removal of garbage and ashes, so that the accompanying inconvenience to householders will not occur this year. It may be stated that the contractor to whom the award has been recommended is in a position to do the work as cheaply and efficiently as possible. He is one of the large contractors on the subway, and therefore has a large and fully organized force at his disposal, which at the time of a heavy snow storm could not very well be employed on the subway.

This new manner of measuring the snow has been used in Europe to some extent, and the results of the present trial will without doubt be of much interest to municipal officers throughout this country. Mr. John McG. Woodbury is the present commissioner of the street cleaning department, and Mr. M. D. Bouton, who has advocated the new plan from the start, is the superintendent of the snow office. A few extracts from the contract as published in "The City Record" follow:

The Borough of Manhattan is divided into eleven districts, maps of which are submitted, as well as schedules showing the streets and portions of streets to be cleaned of snow and ice, and the order in which the cleaning is to be done. These maps and schedules herewith submitted form part of the contract. The contractor will have employed and working at least twenty vehicles and drivers and fifty laborers, exclusive of officers, in every gang on the subdivision specified in the schedules, within a period of three hours after the work shall be ordered. Such gangs to be kept continuously employed day and night, until stopped by the commissioner, with whom it shall be discretionary to order additional gangs at any time or at any point that may seem to him necessary.

The contractor shall remove the snow and ice from the streets and avenues hereinbefore specified, and from such other streets or portions thereof as may be designated by commissioner, and also from such portions of the sidewalks designated.

The contractor will secure the use of all necessary dumps and dumping places and will keep the water in and about the slips, piers and bulkheads clear from the snow and ice dumped therein, and the commissioner is to co-operate with the contractor in securing said dumps.

The contractor will furnish a sufficient amount and number of officers, laborers, materials, machines, etc., necessary to prosecute the work with all possible care, efficiency and speed. The contractor will go back over the work, if directed to do so by the commissioner, and will perform as many additional cleanings as the commissioner shall deem necessary.

The contractor will begin all the work at points designated on schedules and follow the schedules day and night without deviation, except by order of the commissioner or snow inspector. The contractor will on scheduled streets cause the snow and ice to be piled at least one long block or three short blocks ahead of each and every gang of vehicles or any division thereof.

The contractor shall promptly pay all laborers and other persons employed by him, and shall provide and keep on hand necessary funds and facilities for such payments and shall make such payments at least once in each week.

If the commissioner shall deem it necessary to use the regular force of the department of street cleaning, or any part thereof, or any other persons, materials, etc., for the removal of snow and ice, or, if surface or other railroad companies shall clean the snow and ice between their tracks in conformity with any law or ordinance, or from the entire width of any street or streets with the consent of the commissioner, the contractor shall not in any way interfere with or molest such other force, persons, etc., and shall carry on the work on the remainder of the schedule, and shall not ask any compensation on account of the work so done by the department of street cleaning or other forces as aforesaid.

The contractor may use machines, appliances, etc., for melting the snow and ice, if approved by commissioner, such melting to be so carried on as not to unnecessarily impede or interrupt traffic.

The amount of work done by the contractor shall be ascertained as follows: The commissioner shall station in each district one or more special inspectors or district superintendents, whose duty it shall be to report in writing to the snow inspector the number of blocks of streets fully cleaned by the contractor during the previous twelve hours; and from these reports the snow inspector shall compute the number of cubic yards of actual snowfall removed by the contractor during the said twelve hours preceding. Only entirely completed blocks shall be considered, and no block only partially cleaned shall be considered in the amount of work for which the contractor shall be paid.

All computations of work done by contractor shall be made from measurements of the area of the department of street cleaning districts drawn from the original surveys made by the Sanborn Map Company for the department of street cleaning, a set of which is attached to contract. In all computations for payment, the cubic yards of actual snowfall shall be the basis of calculation, as determined by said maps.

The depth of the snow for any given snowfall shall be the depth as officially determined and reported by the United States Weather Bureau located in the city of New York; provided, however, that if the commissioner of street cleaning shall establish his own method and appliance for measuring the depth of the snow, then the depth so measured and determined shall be the depth made use of under the contract.

When, from weather or other conditions, the snow and ice shall be reduced to an average depth of four inches or less, it shall be discretionary with the commissioner to suspend the work until the occurrence of another storm. The inspector shall, in all cases, determine the amount of work to be paid for under the contract.

The damages to be paid by the contractor for delay in beginning the work within the period of three hours is fixed at $25 for each and every hour of delay at each and every block. The damage to be paid by contractor in case the drivers or others dump on any public street or place not approved by the commissioner is fixed at five dollars for each and every load so improperly dumped.

The Earnings of the Steel and Iron concerns of the United States for the year 1902 are estimated at nearly $200,000,000.

New Books Received.

It is intended to publish under this heading, from time to time, brief mention of books recently received. These books will be reviewed and more extended notes relating to them printed at as early a date as practicable.

THE CIVIL ENGINEER'S POCKET-BOOK. By John C. Trautwine, C. E., revised by John C. Trautwine, Jr., and John C. Trautwine, 3d. New York: John Wiley & Sons. 16mo., 1,100 pages, illustrated, morocco. Price, $5.

ELEMENTARY APPLIED MECHANICS. By T. Alexander, C. E., M. Inst. C. E. I., professor of engineering, Trinity College, Dublin, and A. W. Thomson, D. Sc., professor of engineering, College of Science, Poona. New York: The Macmillan Company. 8vo., 575 pages, illustrated. Price $5.25, net.

THE RAILWAY CONTRACTORS' HAND BOOK, containing tables of level cuttings or banks, for single or double track and for second track work, etc. By John M. Hazen, 501 New York Life Building, Minneapolis, Minn. 4½x6 inches, 147 pages. Published by the author at $2.

ANCIENT AND MODERN ENGINEERING AND THE ISTHMIAN CANAL. By William H. Burr, C. E., M. Am. Soc. C. E., M. Inst. C. E., professor of civil engineering in Columbia University. New York: John Wiley & Sons. 8 vo., 473 pages, illustrated. Price, $3.50 net.

A DISCUSSION OF COMPOSITION, especially applied to architecture. By John Vredenburgh Van Pelt, Architecte diplomé par le Gouvernement Français; professor in charge of the College of Architecture, Cornell University. New York: The Macmillan Company. 8vo., 275 pages, illustrated. Price, $2 net.

Book Notes.

Information relating to municipal affairs is so frequently presented in an uninteresting tabular form that one is sometimes apt to think that these subjects cannot be presented in such a way as to be attractive and interesting reading. In a book entitled "American Municipal Progress, Chapters of Municipal Sociology," Mr. Charles Zueblin, professor of sociology in the University of Chicago, has succeeded, however, in presenting many statistics and drawing a variety of interesting comparisons in a readable form. The tabular information is not interspersed in the reading pages, but is conveniently collected in appendices. The book treats of transportation, public works, sanitation, public schools, public libraries, public buildings, parks and boulevards, public recreation, and public control, ownership and operation, and is one of the series of the Citizens' Library of Economics, Politics and Sociology edited by Richard T. Ely, Ph.D., LL.D., and published by the Macmillan Company, New York, price $1.25 net. The book is provided with a good index.

In the 1901 revised edition of "Cooper's Specifications for Railroad Bridges," now so well known, the constant increase of weight of rolling stock of railroads has found its expression in the engine diagrams for live load, which now provide axle loadings up to 50,000 pounds and following uniform loads of 5,000 pounds per linear foot. Among new features exemplifying the onward march of the art of bridge construction it may be mentioned that no distinction is now made in the unit stress permissible in eye bars and on riveted tension members. All lateral sway and portal bracing must be made of shapes capable of resisting compression as well as tension and must have riveted connections, rods and bars being thus prohibited. Adjustable members generally are discountenanced, one stipulation being that adjustable counters be avoided where practicable. Floorbeams of through bridges are to be riveted to the posts above or below the pins. All bridges of over 80-foot span are to have hinged bolsters at both ends. For the first time in his general specifications Mr. Cooper specifies the process of manufacture for steel, the open hearth process being called for, and a limit has been placed on the percentage of phosphorus. The elastic limit has been given a specific definition, the so-called yield point being accepted only under clearly defined conditions. Sheared edges must be planed, but the requirements for reaming are less rigid than before. The greatly increased foreign trade of the United States in bridge work is covered in a paragraph on "Export Work," in which special conditions governing such work are given. In an appendix are added useful tables of moments and shears for different lengths of span, and a table of recent heavy passenger and freight engines. At the end of the specifications are some very pertinent remarks about the relative cost of bridges proportioned for the different classes of live load, the probable development of rolling loads of the future and recommendations for the use of the heavier classes of live load for all railroads with a future. Printed by the Engineering News Publishing Company.

Assistant Professor C. E. Coolidge, of Cornell, is the author of "A Manual of Drawing." This book is written principally for the use of students of mechanical drawing. It is designed to give them an understanding not only of the different instruments and materials used in the preparation of commercial mechanical drawings, but also a knowledge of what these drawings are and how they are to be prepared. The system of drafting room practice described is similar to that used in many of the leading commercial drafting-rooms. It is unfortunate that the illustrations in the back part of the book are not of better quality. The book is published by John Wiley & Sons, New York, at $1.00.

While prepared primarily for the use of beginners, a book of value to all persons interested in structural design is Professor Malverd A. Howe's "The Design of Simple Roof-Trusses in Wood and Steel." In addition to the collection of tables and other useful information concerning roofs, this book contains an introduction to graphical statics, a chapter on the strength of wood and steel, and designs for three roof-trusses of short spans. The chapter on framing of joints in wood is interesting and the details therein given can be applied to many forms of wooden structures. There is little that is new in the book, consequently its value lies in the fact that information, which has been heretofore more or less scattered, is now brought together and well arranged. It is published at $2.00 by John Wiley & Sons, New York.

A second edition of the "Diagram of Connections of the Series-Parallel Controller" has been published by Loxley Bros., Sheffield, Eng., price one shilling. This is a chart 13½x18¾ inches, designed by E. A. C. Kochs, engineer in charge, Corporation Tramways Power Station, Sheffield, and shows the various connections of a series-parallel controller for two motors and an electric brake. The diagram is clear and the path of the current can be easily traced for every position of the controller handle. The leads, connections and contacts are shown in colors, which facilitates the use of the chart. All the accompanying devices, such as switches, fuses, circuit breakers, lightning arresters, etc., are also shown properly connected in the wiring system. It is useful for reference to the engineer or electrical worker and equally intelligible to both, the explanatory text being clear and easily understood.

A book intended for use in the metallurgical laboratory of technical school, is "Metallurgical Laboratory Notes," by Henry M. Howe, professor of metallurgy in Columbia University, published by the Boston Testing Laboratories, at $2.50. The author's intention is to work out a system by which the student may become familiar, not so much "with the individual processes each as a whole, but with the individual underlying principles, each by itself," and to familiarize the student with such instruments of precision as those required in pyrometry, calorimetry, and the microscopy of metals and alloys. He has endeavored to make plain all the little details of the various experiments, so that the student may have nothing to distract his attention from the principle which the particular experiment is meant to show. The book is devoted entirely to experiments, beginning with those which would give a large class a smattering of metallurgical conditions, passing on to the examination of the principles of pyrometry and calorimetry and the instruments used therein, the melting points of various silicates and the determination of the relation between the formation point and the melting point, and finally taking up the principles of iron, steel and copper work, giving a fair proportion of attention to the microstructure of various steels and alloys. At the end of the book are given a few tables which are of value to the student undertaking the course.

On account of the present scarcity of books upon the subject, "Stereotomy," by Arthur W. French, professor of civil engineering, Worcester Polytechnic Institute, and Howard C. Ives, instructor in civil engineering in the same institute, just issued by John Wiley & Sons, will prove valuable to many. The book begins with a short description of building stones and the methods of quarrying, dressing and laying them, which is supplemented with a few general specifications for stone masonry. Attention is called to the manner of preparing and using the various bevels and rules needed by the stone cutter. The suggestions made and directions given to study stone work by means of models cast in plaster are useful and practical. A few neat methods of laying out the outlines of arches of various forms are given, together with a number of exercises in the application of descriptive geometry to stone plans, the value of which is chiefly theoretical. Interspersed with these, however, are examples of stone plans for buildings, piers and arches taken from actual practice. The authors properly recognize the increasing use of concrete in places where, a few years ago, cut stone would have been used, by devoting one plate to the working drawings for a concrete arch culvert. In a few places, references to the literature of the subject are given; a larger number of such references would add to the value of the book. The book is illustrated in the text, and has numerous plates. It is sold at $2.50.

The Sanitary Protection of the water supply for Brooklyn, N. Y., for the months of July, August and September is summarized as follows in the quarterly report of Commissioner Monroe: In connection with the patrolling of streams, ponds and wells throughout the watershed, 4,844 privy-closets and cess-pools, 2,327 of them in and about Hempstead, were cleaned. A new map giving the location and nature of all nuisances in the watershed has been prepared with the view of applying to the State Board of Health for more stringent regulations to suppress pollution of water needed for Brooklyn's supply.

Ventilation and Heating in a Philadelphia Department Store.

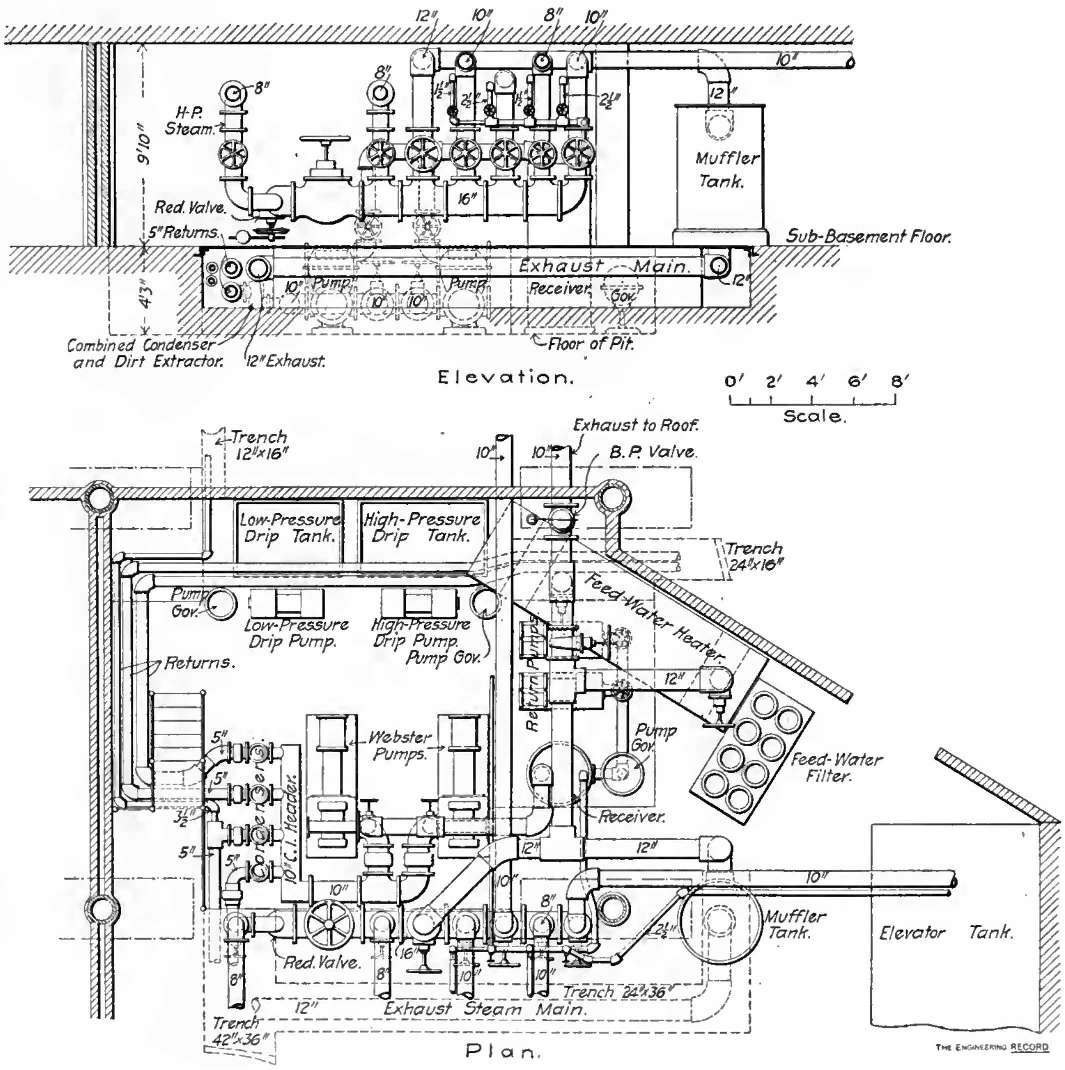
Messrs. Gimbel Brothers, of Philadelphia, have recently completed a large addition to their department store in that city, in which they have combined their mechanical apparatus in a single plant serving both the old and new structures. The design and performance of the new system of ventilating and heating furnishes a good example of a method of performing those operations in a large department store, where each floor consists practically of a single room, of large area as compared with its height. In the lower and most used floors, the combined plenum and exhaust system has been employed, hot air being delivered through generously distributed outlets. The total capacity of the exhaust system is slightly less than that of the plenum system, the purpose being to establish within the store a sufficient pressure to prevent an indraft of cold air every time a door is opened. Special attention has been paid to the warming of the entrance vestibules, no radiators being used, but hot air provided instead.

The building is located on Market Street, between Eighth and Ninth Streets. The new addition is on Eighth and Market Streets and about 300x135 feet in area, which makes the total ground area, now, 95,280 square feet. The main part of the old building and the addition are nine stories in height, with a small tenth story addition on the corner of Market and Ninth Streets, which contains a barber shop, manicure and dental parlors, and dressing and work rooms in connection with a photographic studio. The mechanical work brought about by the additions and changes included the complete erection of the steam power, heating and ventilating plants for the new building, the installation of a ventilating plant for the basement and sub-basement of the old building, of an indirect heating system for the old part of the first floor, the installation of the Webster system for the entire heating apparatus, and the re-arrangement and removal of piping, pumps, boilers, etc., where replaced by the new systems.

There were formerly two separate power plants in the building, but these have been removed and are now replaced by one new power plant. The boiler equipment consists of four Edge Moor steam boilers of 300 horse-power each, which generate steam at 110 pounds pressure. An outlet from each boiler is connected into the high-pressure steam main, dropping down to the sub-basement floor in the form of a drip leg 16 inches in diameter. From this leg, the main pipes are taken with branches to the blower engines, all pumps, the hot-water tank, the refrigerating machinery, the air compressors for the sewage ejectors, the steam injectors, the auxiliary live steam connection to the heating system and the kitchen and lunch room supply mains.

In the last named places, i. e., the lunch room in the sub-basement and the kitchen on the seventh floor, the steam is used for cooking purposes. It is supplied at 40 pounds pressure through reducing valves with the usual by-passes. The returns from the apparatus thus supplied connect to the high-pressure drip system. All sinks and plumbing fixtures likely to accumulate grease are also provided with live steam connections for blowing them out.

All individual branches to engines, pumps, etc., are taken from the top of the mains and have two valves, one near the main pipe and one at the pump or engine, as the case may be.



Distributing Center of the Heating System.

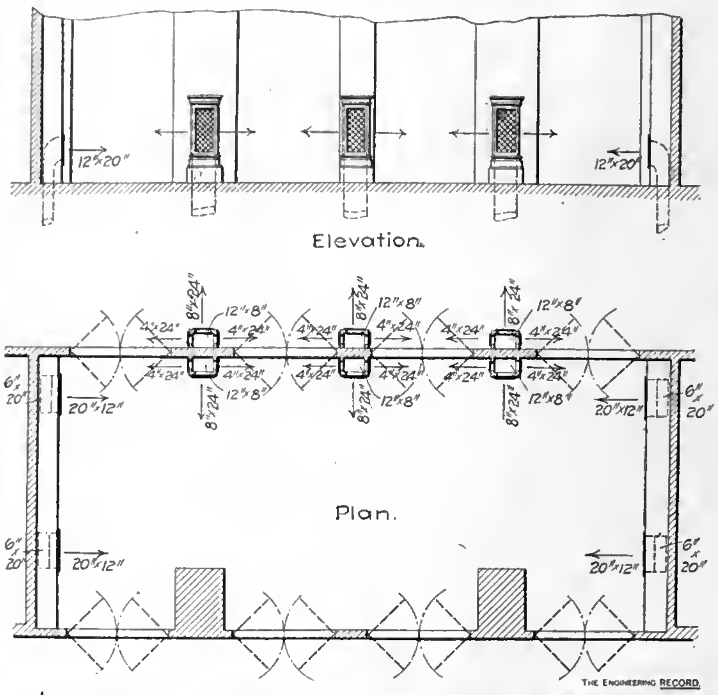
The branches to the elevator pumps, cash system blower engines and to the refrigerating machine are fitted with steam separators.

The drainage from all high-pressure lines is brought to a high-pressure drip tank which is 3 feet 6 inches in diameter by 6 feet long, and made of ⅝ inch charcoal hardened iron, with heads of ½ inch flange iron. It contains a cooling coil of 3 inch seamless brass pipe, containing 60 lineal feet, through which cold water is passed. A 3 inch vent from the tank allows the escape of entrained air and vapor. The tank is drained by a 6x4x6-inch duplex pump, controlled by an automatic governor, and discharges its contents to a 3½-inch main feed line, or may be by-passed to the cess-pool.

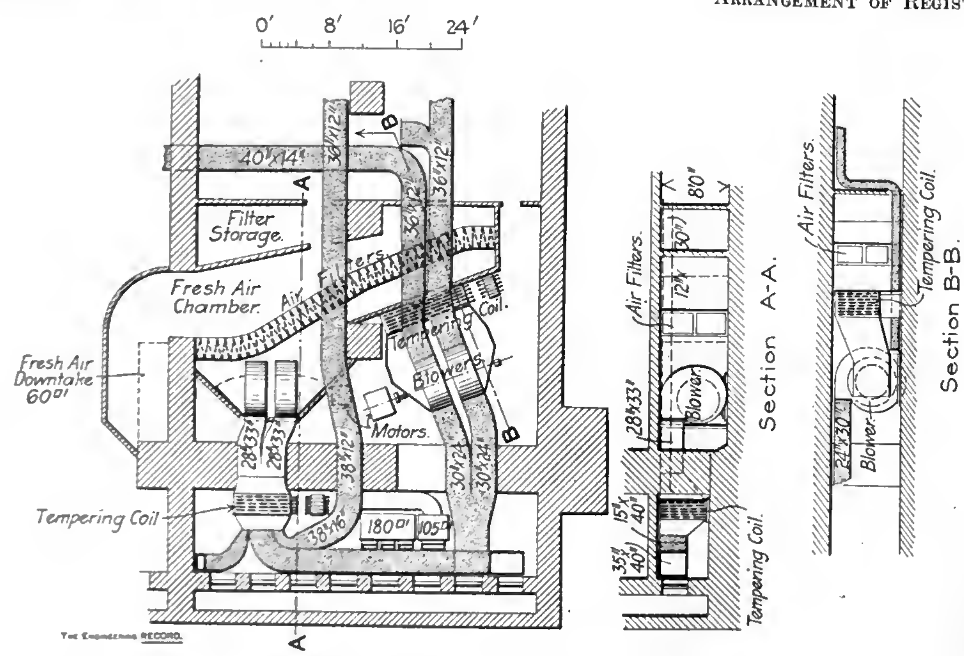
There are five engines in all, two driving the blowers for the cash-conveying system, and three upright engines are each direct-connected to blowers for the hot air heating of the main entrances. Altogether there are sixteen steam pumps. Besides the pump mentioned for draining the high-pressure drip tank, there is one of the same size for discharging the low-pressure drip tank. Three 7½x5x6-inch pumps drain the cess-pool and the blow-off tank and feed the boilers. The heating system is provided with two Webster vacuum pumps, 12x16x16 inches, with a special vacuum controlling valve connected to the return pipe of the heating system, and two return pumps, 7½x5x6 inches, for returning the water of condensation from the heating system and tempering coils to the main feed line. The feed, blow-off and cess-pool pumps, are cross-connected, and being of the same size, may be used interchangeably. The return pumps and the high and low pressure drip pumps are similarly cross-connected. The pumps used for hot water are brass-fitted throughout and built to stand a working pressure of 150 pounds.

The exhaust steam from the cash blower engines and all of the pumps, is collected by branches into a 12-inch exhaust main under the sub-basement floor, and conveyed to a Potter muffler tank. This tank is 4 feet in diameter and 6 feet long, made of the same material as the drip tanks, contains 24 galvanized screen disks, and is dripped to the low-pressure tank. Beyond the muffler, the exhaust main contains a Cochrane grease extractor and then branches, one part going to the 16-inch header from which the mains to the heating system and hot-water tank are taken, and one part to the feed-water heater.

A heavy pressure Berryman closed feed-water heater, 45x173 inches, of horizontal pattern, is used. It contains 300 square feet of heating surface consisting of 2-inch seamless drawn brass tubing. The shell is of steel, 7/16 inches thick with heads ½ inches thick and is supported by pipe columns. The heater has 3½-inch feed-water connections. The exhaust steam inlet and outlet are 12 inches in diameter, and there is a full-size bypass around the heater. Continuing from the heater, the exhaust passes through a back-pressure valve to the 10-inch exhaust riser to the roof. The top of the riser is fitted with an exhaust head of galvanized iron, which is dripped to the low-pressure drip tank.



ARRANGEMENT OF REGISTERS IN A TYPICAL ENTRANCE.



DETAIL OF THE 5 AND 5½-FOOT BLOWERS.

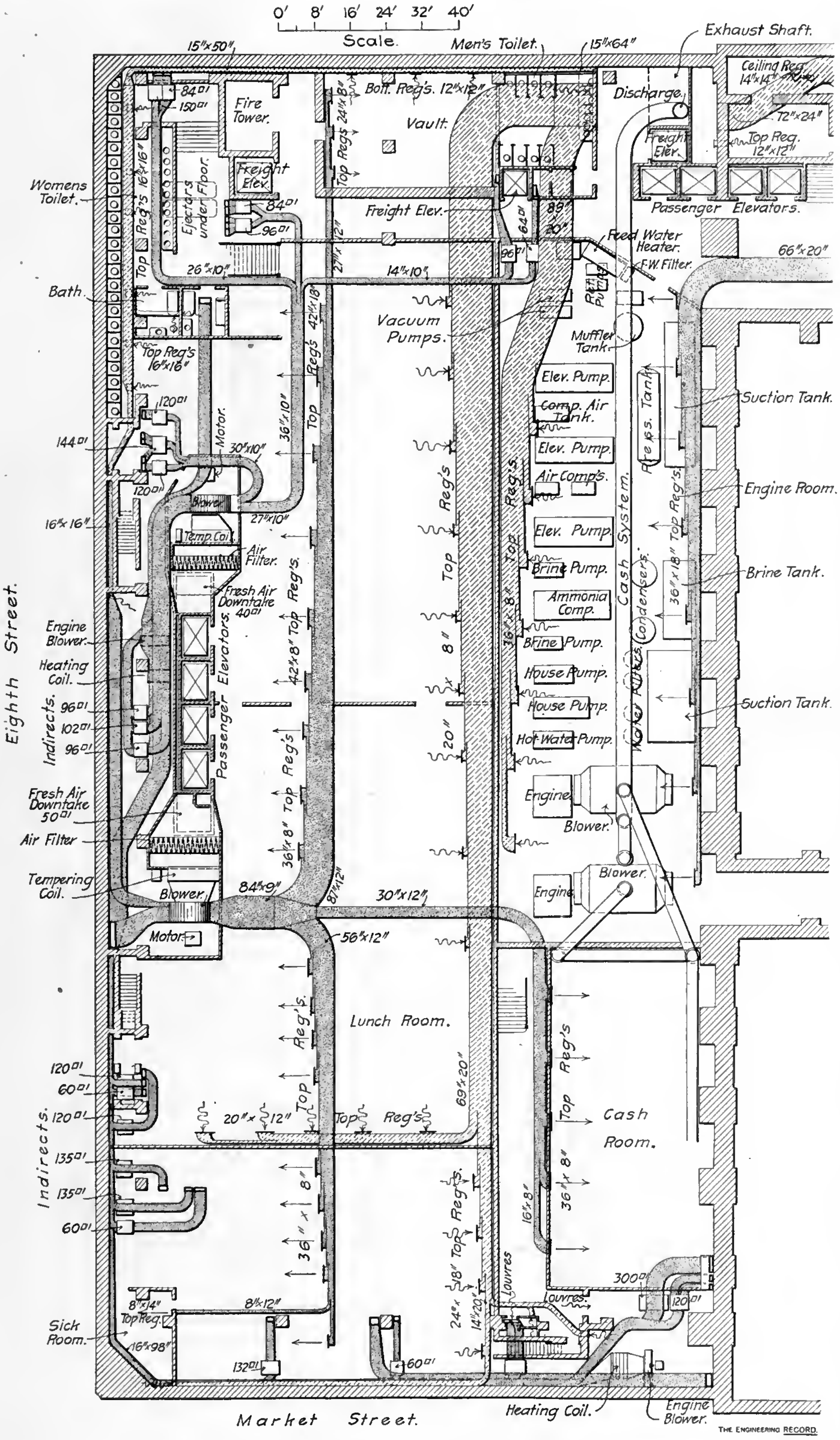
The low-pressure drip tank, which receives all oily drips, is one foot shorter than the high-pressure tank, but is otherwise its exact counterpart. It is drained by a pump, which is controlled by a Kieley automatic governor, and discharges its contents to the sewer. Three-inch vapor pipes from both drip tanks and the blow-off and receiving tanks, with a valve on each, connect to a 5-inch vapor riser to the roof, at which point there is an exhaust head of galvanized iron, similar to the exhaust steam head, and also dripped back to the low-pressure drip tank.

The 16-inch low-pressure header, from which four steam mains for heating purposes are taken, is supplied ordinarily by exhaust steam, but may also be fed with live steam through a reducing valve. One 10-inch main supplies the direct radiators, the indirect stacks for the first floor of the new building, and such low pressure steam as may be required by the fan systems for heating the entrances in the new part. Another 10-inch main supplies the corresponding apparatus in the old building. A third 10-inch and an 8-inch main supply the tempering coils of the ventilation blowers in the new and old buildings respectively.

Direct radiators are used entirely on all floors above the first. The first floor is heated by hot air in connection with the ventilation, the heating being done by indirect stacks located at the bases of flues from the main ventilating ducts in the basement. The indirect stacks are enclosed in casings of galvanized iron No. 20 gauge and stiffened with angle iron. The entire bottom of the casing is hinged to allow ready access to the heating surfaces. This hot-air system is assisted in a few places by direct radiators, and the basement also has a few. As the basement is not so exposed as to require much more heat than rises naturally from the sub-basement, its air supply is merely tempered.

The six main entrances are heated by hot air, through vertical registers set in the sides of cast-iron boxes. The register boxes rest on the floor and form caps to the flues opening under them. Some of the boxes are at the sides of the vestibule, and others are arranged in pairs between the doors of the partition which separates the vestibule from the inside of the store. The placing of the registers is shown on the accompanying detail of one of the Market Street entrances. As the large doors of the entrances are being continually opened, it is necessary to discharge a considerable quantity of air into the vestibules and under high pressure. The velocity through the registers is about 300 feet per minute.

In the proportioning and placing of radiators and indirect stacks, it was designed to warm all rooms in the old and new buildings to 70 degrees in zero weather with a pressure of steam in the heating main not to exceed 5 pounds. There are about 350 radiators throughout the entire building, ranging in size from 36 to 200 square feet of heating surface, the average being about 70 square feet. There are



Plan of the New Part of the Sub-Basement.

14 indirect stacks in as many hot air flues, with an average of about 50 square feet of heating surface in each. The total surface of all radiators is 26,346 square feet, of indirect stacks 699, making a total in both of 27,045 square feet. Adding to this the surface in the tempering and heating coils in connection with the blowers, which will be discussed in their proper place, the complete total of heating surface supplied is 35,745 square feet.

The returns from radiators and heating and tempering coils are brought back in mains under the floor of the sub-basement to combination dirt extractors and jet condensers, and are then collected in a cast-iron header from which the vacuum pumps remove the condensation and pass it to the receiving tank. The receiving tank is 36 inches in diameter and 8 feet long, of the same material as the drip tanks. Its contents are removed by the two return pumps, controlled by a Kieley governor, and delivered to the main feed line, or may be discharged to the cess-pool. The 3½-inch feed main is also supplied with the high-pressure drips. The water is discharged from this main through a filter and the feed-water heater in turn, after which it is delivered to the boilers by the feed pumps. The filter is of the Ward type, composed of 8 cast-iron cylinders, 15 inches in diameter by 7 feet 3 inches high, fitted with a complete set of special cast zinc bars and filled with animal charcoal. Ordinarily the loss of condensed steam through the low-pressure drips, which are wasted, and the loss of steam to the atmosphere, are compensated for in the make-up of boiler feed, by introducing cold water through a 1-inch pipe from the street service, into the high-pressure drip tank.

Blow-off pipes are run from each boiler connecting into a 3½-inch main line leading to the blow-off tank. The suction pipe from this tank is connected with the blow-off pump which discharges to the sewer. The blow-off tank is of the same size and construction as the receiving tank, and like the drip tanks, it contains a cooling coil of 3-inch brass pipe, in this case consisting of 80 lineal feet. The cess-pool is drained by the pump for that purpose, and is discharged into the sewer. It is fitted with a Worthington automatic regulator for controlling the water level in the cess-pool, and a foot valve with a removable strainer.

All steam pipes 4 inches in diamater and above, subjected to boiler pressure, are of extra heavy wrought-iron pipe with extra heavy flange unions and fittings, and the joints are packed with corrugated copper gaskets. All cold water pipes are of galvanized iron with galvanized fittings, and all other pipes are of standard wrought-iron with gray cast-iron screw fittings made up without packing of any kind. All boiler-feed pipes from the feed and return pumps and injectors are of iron-pipe-size hard-drawn brass with brass fittings. The feed-water heater, filter, muffler tank, grease extractor, blow-off, receiving and drip tanks, separators, pump governors, traps, fittings, valves and hot pipes are covered with 85 per cent. carbonate of magnesia covering of the Philip Carey Manufacturing Company's make.

The ventilation of the building combines the plenum and vacuum systems, as will be seen from the accompanying cuts. The basement and first floor are supplied with fresh air by five forced systems, established by seven Sturtevant centrifugal fans in the sub-basement, in connection with tempering coils to heat the fresh air to the proper degree in zero weather, and all floors are vented by two exhaust systems, an east and a west with two Blackman disk fans in houses on the roof.

One fan for the fresh air supply to the new part of the sub-basement and basement, has a blast wheel 9 feet in diameter by 4 feet 6 inches wide. There is a tempering coil in its discharge 10½x8 feet over all, having a heating surface of 2,300 square feet. The blower is driven at 150 revolutions by a 20-horse-power motor and has a capacity at that speed of 48,000 cubic feet per minute.

The old part of the sub-basement and basement is supplied by two blowers on the same shaft, and connected on one side to a 16-horse-power motor. Each wheel is 5½ feet in diameter and 2 feet 8 inches wide. They are driven at a speed of 240 revolutions per minute with a capacity of 17,000 cubic feet each, and their combined discharges are passed through a tempering coil, 10½x6 feet, containing 1,700 square feet of surface.

The first floor of the new building receives fresh air from a blower with an 8x4-foot wheel, direct-connected to a 12-horse-power motor and running at 150 revolutions per minute. It discharges through a tempering coil, 8½x7 feet in size, with 1,700 square feet of heating surface. The old part of the first floor is supplied by two connected fans on the same shaft with a 10-horse-power motor. The wheels are 5 feet in diameter and 2 feet 4 inches wide, run at 240 revolutions and discharge together 22,600 cubic feet of air per minute through a tempering coil with 1,200 square feet of surface and 6½x6 feet over all. The blowers take their cold air from fresh air shafts having inlet windows between the first and second stories.

The air for the engine and boiler rooms is taken from an in-take in the rear of the sub-basement and delivered untempered by a blower with a 6x3½-foot wheel, direct-connected to a 12-horse-power motor. It runs at 225 revolutions, discharging in one minute 23,300 cubic feet of air.

For the combined heating and ventilating of the three main entrances, there are three steam-driven fans in the sub-basement. These have blast-wheels 60x16, 54x14 and 48x12 inches, and are direct-driven, respectively, by 7x5, 6x5 and 5x4-inch double enclosed upright engines of the automatic cut-off type. The 5-foot blower runs at 475 revolutions and discharges 8,000 cubic feet of air per minute through a 5½x4-foot heating coil containing 800 square feet of surface. The 4½-foot blower runs at 500 revolutions and discharges 6,000 cubic feet per minute through a heater 5½x3 feet with a total surface of 600 square feet. The 4-foot blower discharges 4,000 cubic feet per minute, at 550 revolutions, through a 4½x3-foot heater with 400 square feet of heating surface.

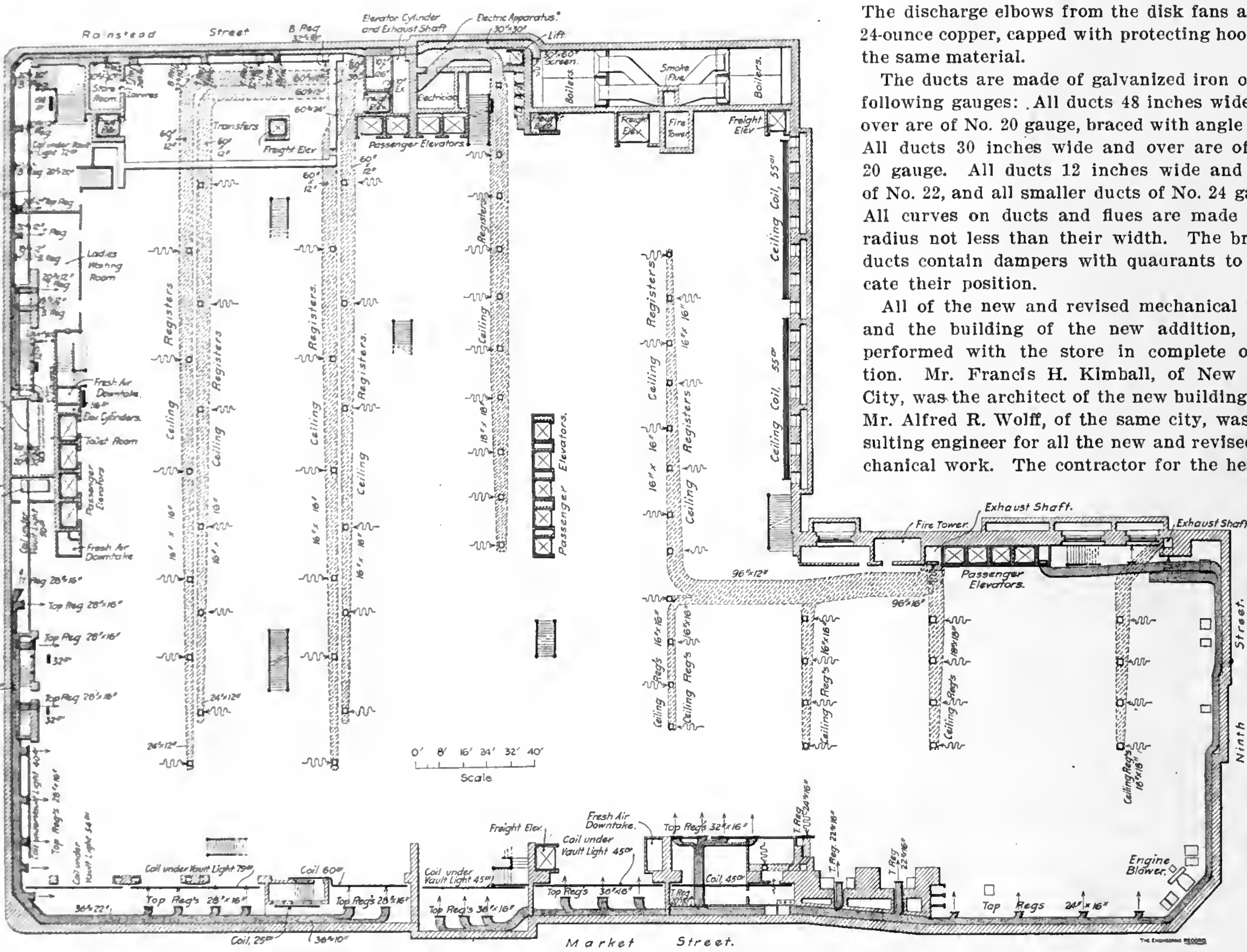
All blowers are encased in full steel plate housings and have wheels with curved blades. Where parts of fan housings extend below the floor level, such parts are built of steel ¼ inches thick, riveted, caulked and made water-tight. All fans have steel shafts of extra large diameter and are connected to their motors by flexible couplings. The tempering coils in connection with each motor-driven blower are divided into seven 2-row sections, making the coils 14 rows deep. The heating coils for steam fans are divided into one 2-row and four 4-row sections, making the coils 18 rows deep. The outside sections of the blower heaters are supplied by the exhaust of their respective blower engines, and return their condensation to the low-pressure drip system. Each section is controlled separately by hand valves on the supply side, and a thermostatic trap on the return. The sections are all made of 1-inch pipes screwed into separate cast-iron headers on steam and return ends, are encased in jackets of No. 12 steel plate, and are supported from the floor by a framework of I and channel beams. The blowers are of the B. F. Sturtevant Company's make and the motors are of the C. & C. type. The latter are equipped with controllers to give them three variations of speed ranging from two-thirds to the full speed as given before. Current for the motors is taken from the street supply.

Each fresh air inlet is provided with a brass wire screen of 3-inch mesh, and operating devices such as dampers, doors or pivoted louvres. The fresh air chambers contain air filters consisting of galvanized wire netting on wooden frames and covered with cheese cloth. The filter area from the 9-foot blower is 720 square feet, that for the 8-foot 860 square feet, and the two 5½ and two 5-foot blowers have a single filter with an area of 1,200 square feet. The frames are supported by galvanized iron, stiffened by T-iron and anchored to the floor and ceiling.

For the removal of foul air from the basement and sub-basement, ducts of large area and many openings are run on the ceilings. These lead to vent shafts rising beside two groups of passenger elevators. On the top floors these shafts are connected by ducts with all of the vent flues from the upper parts of both sections. The east section is exhausted by an 11-foot disk fan coupled to a 30-horse-power motor and running at 150 revolutions per minute, and the west section by a disk fan with a 7-foot wheel and coupled to a 15-horse-power motor running at 250 revolutions per minute. The larger fan has a capacity of 120,000 cubic feet per minute and the smaller one 40,000 cubic feet per minute. The discharge elbows from the disk fans are of 24-ounce copper, capped with protecting hoods of the same material.

The ducts are made of galvanized iron of the following gauges: All ducts 48 inches wide and over are of No. 20 gauge, braced with angle iron. All ducts 30 inches wide and over are of No. 20 gauge. All ducts 12 inches wide and over of No. 22, and all smaller ducts of No. 24 gauge. All curves on ducts and flues are made on a radius not less than their width. The branch ducts contain dampers with quadrants to indicate their position.

All of the new and revised mechanical work and the building of the new addition, were performed with the store in complete operation. Mr. Francis H. Kimball, of New York City, was the architect of the new building, and Mr. Alfred R. Wolff, of the same city, was consulting engineer for all the new and revised mechanical work. The contractor for the heating and ventilating work was Mr. E. Rutzler, of New York City.



BASEMENT PLAN, SHOWING THE VENTILATING SYSTEM FOR THAT FLOOR ONLY.

Malleable Iron Companies controlling seventeen plants and manufacturing 85 per cent. of the output of the United States were recently consolidated in Detroit. The capital represented is reported to be between $16,000,000 and $20,000,000.

The Revised Health Laws of the State of Ohio, taking effect May 4, 1903, provide for a local board of health for each city and village, such board to be composed of five members serving without compensation, appointed by the mayor and confirmed by the council. In villages (incorporations having less than 5,000 inhabitants) the council may appoint a health officer instead of a board of health, such appointee to be approved by the State board of health.

Letter to the Editor.

Typhoid Fever and Oysters.

Sir: In August last there occurred a decided increase in the reported cases of typhoid in this city with a further increase in September, as shown by the following statement:

1901—	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov	Dec.
Cases	1	3	2	1	0	2	3	12	13	19	3	1
Deaths	0	0	1	0	0	1	0	0	0	1	0	0
1902—												
Cases	1	0	1	2	2	1	4	10	36	..	..	..
Deaths	1	0	0	0	0	0	1	1	2	..	..	..

The matter was deemed of such importance that the local Academy of Medicine, aided by the expert services of Drs. A. C. Abbott and Henry Leffmann, of Philadelphia, made a careful examination into the cause of this increase of typhoid. From their report, it appears that the pollution of oyster fattening beds in the vicinity of our sewer outfalls has been the chief source of the disease.

The importance of prohibiting the culture of oysters in close proximity to sewer outfalls is believed to be very generally overlooked by boards of health, in spite of the well known danger incurred; and as population increases and the natural off-shore oyster layings are depleted, the necessity for such restriction is increased.

The subject was taken up some six or eight years ago by the Local Government Board of Great Britain, and the report of Dr. H. T. Bulstrode, covering the shores of England and Wales, contains much interesting and valuable material. While layings located at a considerable distance from sources of contamination, although pollution is remotely possible, are passed by, a number situated in proximity thereto are condemned as unsafe; and the occasional cases of infection that come to light from time to time confirm us in the opinion that many oyster beds between the Chesapeake Bay and Cape Cod should be abandoned.

Yours truly,

Kenneth Allen.

Atlantic City, N. J., Nov. 30, 1902.

Personal and Obituary Notes.

Mr. Julian Kendrick has been re-elected city engineer of Birmingham, Ala.

Mr. Charles Hood has resigned as superintendent of the water-works of Burlington, Ia.

Capt. A. P. Adrian has resigned as county surveyor of New Hanover county, Wilmington, N. C.

Mr. Philip W. Moen, of Worcester, Mass., has resigned as second vice-president of the American Steel & Wire Co.

Mr. E. B. Thomas has been elected president of the Lehigh Valley Railroad Co., and of the Lehigh Valley Coal Co.

Mr. Louis F. Barton has been appointed a member of the board of water commissioners of Newburyport, Mass.

Mr. J. W. Bridge, has been made superintendent of the Uniontown, Pa., division of the Pittsburg, McKeesport & Connellsville Railway.

Civil Engineer, R. E. Peary, U. S. N., according to Washington reports, is to be assigned to duty at the New York navy yard, Brooklyn.

Prof. William Boughton, of Denison University, Granville, O., has been appointed professor of civil engineering in the West Virginia University at Morgantown, W. Va.

Mr. George H. Ross, for some years traffic manager of the Indiana, Illinois & Iowa Railroad, at Chicago, has succeeded Mr. Theodore C. Bates as president of the Union Bridge & Terminal Co., Kansas City.

Mr. Granbery Jackson and Mr. J. A. Omberg, Jr., city engineer of Memphis, Tenn., have entered into a partnership for general engineering work, particularly in municipal lines, with offices in the Randolph Building, Memphis.

Lieut.-Col. William R. Livermore, Corps of Engineers, U. S. A., has been ordered to relieve Capt. William V. Judson, Corps of Engineers, of his duties as engineer officer on the staff of the commanding general of the Department of the East.

The Civil and Irrigation Engineering Society of Colorado, organized recently at Fort Collins, with the following officers: President, Graham Fuller; vice-president, John Thistle; secretary-treasurer, Ralph Parshall; chairman general committee, Prof. S. L. Boothroyd.

Prof. C. E. Houghton, M. Am. Soc. M. E., professor of mechanical engineering at the Arkansas Industrial University, Fayetteville, Ark., has been appointed associate professor of mechanical engineering in the School of Applied Science, New York University. He was formerly an instructor in experimental engineering at Sibley College, Cornell University.

On account of the death of Joseph M. Wilson, announced in this column two weeks ago, the firm of Wilson Brothers & Co., architects and consulting engineers, has been reorganized by Messrs. Henry W. Wilson, John McArthur Harris and Howard S. Richards, the remaining members of the firm, under the new name of Wilson, Harris & Richards, with offices in the Drexel Building, Philadelphia.

The seventh annual meeting of the Brooklyn Engineers' Club was the occasion of a banquet at the Oxford Club, that city, December 11. Mr. J. V. Davies, Col. H. G. Prout and Mr. Foster Crowell were the first speakers, and addresses were made by the incoming and outgoing officers. President W. S. Ford was succeeded by A. J. Provost, Jr.; vice-president W. F. Tuttle by F. S. Woodward; secretary A. J. Provost, Jr. by Joseph Strachan; and treasurer G. C. Whipple by John Middleton.

The Engineers' Club of Philadelphia celebrated by a banquet on December 6 its attainment to the age of 25 years. Toasts were responded to by L. Y. Schermerhorn, Oberlin Smith, Admiral George W. Melville, James Christie, Charles F. Scott, Robert W. Lesley, John Birkinbine, Prof. Arthur W. Goodspeed, Wilfred Lewis, John C. Trautwine, Jr., and Peter Boyd, John Fritz, and Dr. Coleman Sellers were among the speakers. James M. Dodge, president of the American Society of Mechanical Engineers, was toastmaster. There were all told some 260 diners.

Sir William Chandler Roberts-Austen, assaymaster of the Royal Mint in London since 1882, died at the Mint November 22, aged 59 years. He entered the Royal School of Mines, in London, in 1861, with a view to becoming a mining engineer, but in 1869 became an assayer and has ever since been a leader in metallurgical investigations. He was the author of a general work on the subject and of many scientific papers. Much of his contributions has had a practical bearing, relating to the properties of iron and steel, to the hardening and tempering of steel, to the use of an automatic recording pyrometer and to the application of micro-photography. In 1880 he became professor of metallurgy at the Royal School of Mines, and was a member of a large number of societies. He was for two years president of the Iron and Steel Institute, an honorary member of both the Institution of Mechanical and of the Institution of Civil Engineers, one of the founders of the Physical Society of London, an honorary secretary of the British Association for the Advancement of Science.

The following candidates were announced elected December 3 to the various grades of membership in the American Society of Civil Engineers. Members: E C. Barhard, topographer, U. S. Geological Survey, Washington, D. C.; M. W. Cooley, mgr., National Contracting Co., Boston; R. L. Crump, designing engineer, Ford, Bacon & Davis, Kansas City, Mo.; G. R. Ferguson, assist. engineer, Dept. of Bridges, New York City; M. H. Gerry, Jr., gen. mgr., and chief engineer, Missouri River Power Co., Helena, Mont.; W. C. Hawley, chief engineer, Pennsylvania Water Co., Wilkinsburg, Pa.; E. T. Perkins, topographer, U. S. Geological Survey, Washington, D. C. Associate members: W. H. Adey, assistant engineer, Delaware & Hudson Co., Cohoes, N. Y.; Frederick Auryansen, chief draftsman, Atlantic Avenue Improvement, Brooklyn, N. Y.; G. M. Bacon, private practice, Salt Lake City, Utah; C. E. Bright, junior engineer, U. S. Engineer office, Tuscaloosa, Ala.; F. C. French, Atchison, Topeka & Santa Fé Railway, Davenport, O. T.; L. R. Gifford, assistant to structural engineer, Cambria Steel Co., Johnstown, Pa.; F. A. Hastings, assistant engineer, Keystone branch of American Bridge Co., Pittsburg, Pa.; W. N. Hazen, Frink & Hazen, Baltimore, Md.; Arthur Hirst, assistant engineer, Pencoyd plant, American Bridge Co., Pencoyd, Pa.; C. McK. Lewis, with Wm. Salomon & Co., New York City; T. A. Ross, resident engineer, Ping Li Railway, Shanghai, China; E. De Voe Tompkins, assistant engineer, Dept. of Bridges, New York City; E. D. Wickes, Bridge Dept., The Cuba Co., New York City. Associate: Stedman Bent, Overbrook, Pa. Juniors: W. E. Belcher, Pencoyd, Pa.; F. R. Berry, Joplin, Mo.; E. B. Brisley, New York City; R. B. Jackson, Ann Arbor, Mich.; F. J. Lynch, New York City; R. J. Mansfield, Pittsburg; N. A. Melick, New York City; C. J. Schumann, Troy, N. Y.

The Forest Reserve which is proposed in the Appalachian Mountain region of North Carolina, Kentucky, Tennessee, Virginia and West Virginia, is to be represented at the Louisiana Purchase Exposition by an elaborate relief map to be prepared by Mr. F. Cope Whitehouse, of New York.

Water Waste in Chicago is a large item, according to Superintendent H. O. Nourse, who states in his last annual report that a table showing the amount of water used for business and domestic purposes has been prepared which shows conclusively that 75 per cent. of the total pumpage goes to waste. It is stated that much of this waste is due to leaks in both water mains and service pipes, and, owing to the small appropriations for maintenance and for extensions, it has been impossible to make the necessary investigations and to replace mains laid 20 to 30 years ago.

The Lettering of Titles and important legends on drawings is expedited in the drafting rooms of the Bureau of Filtration, Philadelphia, by the use of standard letter sheets about 11x14 inches in size upon which are printed five standard alphabets and sets of numerals in plain Gothic type. These sheets also contain words most frequently occurring in titles and other places printed in the size of letter most frequently used for them. In this way a great deal of time usually spent in spacing is saved, for the draftsman can slip one of the standard letter sheets under his tracing and copy the words needed.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 23, 24 and 36.

WATER.

West Rutland, Vt.—The House has passed a bill incorporating the West Rutland Water Co.

Lexington, Mass.—The citizens of this place, at a special town meeting held Dec. 1, voted to apply for admission to the Metropolitan water system.

Providence, R. I.—Comr. of Pub. Wks. Barclay in his annual report recommended the installation of a third pumping engine.

Portsmouth, N. H.—The Bd. of Aldermen has passed a resolution authorizing the Water Comrs. to use the unexpended balance of the sum realized from the recent sale of water bonds for the purpose of extending the city system to Freeman's Point.

Boston, Mass.—The following bids were opened Dec. 4 by the Metropolitan Water & Sewerage Bd., Frederic P. Stearns, Ch. Engr., for stripping 970,000 cu. yds. of surface soil from 700 acres of Wachusett Reservoir and depositing it in the shallow portion of the reservoir at Oakdale and in embankment of a road across reservoir at W. Boylston:

Items and Quantities.	Bruno, Salomone & Petitti, E. Boston. (awarded).	Newell & Snowling Cons. Co., Uxbridge.	Nawn & Brock, Boston.	Long & Little, Leominster.	Jere. J. McCarthy & Co., Boston.	Jones & Meehan, Boston.
Clearing and grubbing, 100 acres	$60.	$100.	$100.	$100.	$175.	$200.
Soil excav. A on plan, 450,000 cu. yds	.265	.27	.28	.29	.33	.35
Soil excav. B on plan, 310,000 cu. yds	.30	.33	.32	.33	.37	.37
Soil excav. C on plan, 210,000 cu. yds	.34	.39	.36	.39	.45	.40
Earth excav. (enlarge. of River), 65,000 cu. yds	.34	.39	.28	.30	.32	.50
Earth excav., 70,000 cu. yds	.34	.33	.24	.30	.36	.50
Rock excav., 15,000 cu. yds	1.70	2.00	2.50	1.50	1.65	2.50
Paving, on broken stone, 12,750 cu. yds	1.90	2.00	2.35	3.00	3.50	4.00
Paving, on coarse gravel, 10,750 cu. yds	1.75	1.80	2.60	2.75	3.00	4.00
Concrete masonry, 1,200 cu. yds	7.00	6.50	6.50	7.00	7.00	6.50
Overhaul, equivalent to 250,000 cu. yds., 100 ft	.01	.01	.01	.01	.01	.01
Total	$414,987	$449,300	$451,512	$466,412	$533,725	$585,500

Paterson, N. J.—Bids are wanted by the Jersey City Water Supply Co. until Dec. 22 for furnishing all labor and material necessary for building a brick lining in a tunnel 1,100 ft. long, as advertised in The Engineering Record.

Meadville, Pa.—Additional test wells are being drilled and will be utilized in the new water supply; they will be located 1½ miles west of the present pumping station.

Troy, N. Y.—Asst. Engr. Geo. M. Bull writes that the following bids were opened Dec. 5 by the Bd. of Contract and Supply: For 33-in. steel riveted pipe furnished and laid complete, prices are per ft. for 3,100 ft. in rock and 32,200 ft. in earth, respectively: The T. A. Gillespie Co., New York City, $6.80 and $7.40; total, $259,360. Carroll, Porter & Co., New York City, $8.10 and $9.60; total, $334,230. For furnishing cast iron pipe and castings, prices are per ton and per lb., respectively: Camden Iron Co., Camden, N. J., $28.65; total, $169,100. U. S. Cast Iron Pipe & Fdy. Co., Philadelphia, Pa., $29.40 and 3¼ cts.; total, $177,253. Warren Fdy. & Machine Co., New York City, $28.70 and 2.55 cts.; total, $172,324. Bids for a cast iron pipe line were as follows, in rock and earth, respectively: McDonough Const. Co., Troy, $5.50 and $4.81; total, $159,280. Behan & Cavanaugh, Troy, $7.00 and $3.50; total, $137,200. P. H. McKenna, Troy, $3.80 and $2.42; total, $91,640. Frank M. Lewis, Troy, $2.50 and $1.65; total, $62,200. P. H. Harrison Sons' Co., Troy, $4.12 and $2.85; total, $106,822.

Schenectady, N. Y.—A correspondent writes that bids are about to be asked for furnishing 500 meters. J. H. Amo, Secy. Water Comrs.

Tottenville, N. Y.—Bids are wanted Dec. 18 for furnishing building and installing a new boiler and appurtenances at the Pumping Station of the Tottenville Water Works, Boro. of Richmond. Robt. Grier Monroe, Comr. of Water Wks., N. Y. City.

Laurel Springs, N. J.—The Laurel Springs Water Co., registered office Camden, has been incorporated, with a capital of $100,000, to supply water to Laurel Springs and neighboring villages in Gloucester Township. The incorporators are: Sam. S. Cord and Alex. Tomlinson, of Laurel Springs; Geo. Pfeiffer, Jr., of Camden, and others.

Hyndman, Pa.—The Citizens Water Co. has been incorporated, with a capital of $15,000.

Allentown, Pa.—In a recent message to the City Councils Mayor Lewis recommended that work be stopped at Schantz's Spring, in view of the apparently limited supply of water, and that filtration be adopted.

New Castle, Del.—The taxpayers are considering means to borrow money by bonding the city for the purpose of installing new water works that shall be owned by the city in 20 years.

Pittsburg, Pa.—A resolution is before the Councils Finance Com., providing for the appropriation of $200,000 for the construction of water mains in the 22d Ward.

The Council has passed the resolution authorizing the Filtration Com. to employ an engineer to furnish estimates of the total cost of a filtration plant.

Trenton, N. J.—The Bd. of Health has adopted the recommendation of Dr. Alton S. Fell, Health Inspector, urging that a filtration plant be installed at the reservoir.

Yonkers, N. Y.—The Bd. of Water Comrs. has now under consideration the construction of a filtration plant near the tube well station.

Rochester, N. Y.—The Bd. of Aldermen has overridden Mayor Rodenbeck's veto and sustained the ordinance authorizing Comr. McClintock to purchase Cobb's Hill as a site for a reservoir.

Newark, N. J.—Engr. Sherrerd announced, at a meeting of the Bd. of Works' Committees, held Dec. 9, that the Edison Electric Storage Battery Co. had agreed to purchase water from Newark for its plant in the Silver Lake section of Belleville Township; the Engr. was authorized to lay the necessary mains for this extension.

Montclair, N. J.—The Town Council has granted the request of the Newark Bd. of Wks. for permission to lay a 60-in. pipe for a water main through Alexander Ave., Grove St. and Watchung Ave.

East Orange, N. J.—The City Council on Dec. 8 voted to reject the award of the Condemnation Comrs. fixing $425,000 as the value of and the price to be paid for the plant of the Orange Water Co.

Richmond, Va.—The Board of Aldermen on Dec. 9 concurred in the action of the Common Council in voting an issue of $405,000 bonds with which to erect settling and coagulating basins to provide the city with clear water, and construct a stand pipe in the Lee Dist. to increase the pressure in that section.

Columbus, Ga.—Robt. L. Johnson, Supt. of Pub. Wks., writes that the citizens of this place on Dec. 4 voted favorably, by an overwhelming majority, on the proposition to issue $250,000 bonds for the purpose of building water works. This means that the city will proceed at once with the detail plans and arrangements for the construction of a new system of Water Works to be owned and operated by the city.

Barnesville, Ga.—Bonds to the amount of $10,000 have been voted for the purpose of enlarging and improving Gordon Institute, the water and electric light plants.

Chicago, Ill.—Bids are wanted Dec. 24 for furnishing material and remodelling the tunnel system of the Chicago Ave. Pumping Station, involving the construction of 3 shafts, 12 ft. internal diameter, each about 90 ft. deep; about 180 ft. of circular brick tunnel, 6 ft. internal diameter; about 458 ft. of circular brick tunnel, 5 ft. internal diameter, and the setting and placing of a 6 ft. gate valve. F. W. Blocki, Comr. of Pub. Wks.

West Milton, O.—Corp. Clk. John Coate writes that the contract for constructing a system of water works (bids opened Dec. 1) has been awarded to P. H. Porter, of Clinton, Ky., for $23,300, complete.

Bloomington, Ill.—City Engr. Elmer Folsom writes that water mains, sewer and asphalt pavement will be laid on Wood St. and Morris Ave.

Wyandotte, Mich.—Mayor Bishop is said to be in favor of the issue of $175,000 bonds for the construction of a sewerage system, the extension of the water and lighting systems.

Boone, Io.—The City Council has authorized City Engr. Chas. E. Russell to prospect for the purpose of obtaining a water supply from shallow wells.

Negaunee, Mich.—This city is contemplating the renewal of its boiler plant at the water works; the present plant, which consists of 2 60-in.x16 ft. and 1 66-in.x17 ft. horizontal tubular boilers, has been condemned. Cyril Houle, Mayor; Wm. H. Mitchell, Recorder.

Thief River Falls, Minn.—The City Council is considering the subject of water works and a sewer system.

Cincinnati, O.—Plans and specifications have been completed by Gustave Drach, and bids will probably soon be asked for construction of western pumping station of the new water works. Probable cost about $500,000.

Wausau, Wis.—A filtering plant is recommended by Prof. Erasmus G. Smith, of Beloit Sanitary Laboratory, for the city water system, at a cost of $25,000.

Kansas City, Mo.—The sum of $11,148 has been appropriated by the lower house of the Council to defray the expenses of laying water mains and hydrants on several streets.

Supt. Goodwin, of the water works, is preparing to lay before the Bd. of Pub. Wks. the complete plans and specifications for the proposed aqueduct from Quindaro to the Turkey creek pumping station. Said plans contemplate the construction of an aqueduct of concrete, with a diameter of 5 ft. on the inside. The estimate made by the expert engineers of the cost of the proposed aqueduct is in the neighborhood of $225,000.

Baton Rouge, La.—The city has offered to purchase the plant of the City Water Works Co. for $75,000.

Walnut Ridge, Ark.—S. C. Dowell, of this place, writes that J. D. Goldman, of St. Louis, Mo.; S. Riegler, of Walnut Ridge, and he are organizing a company, with a capital of $100,000, to construct water works, electric lights and 2 miles of street railway for Walnut Ridge and Hoxie. Offices to be in Walnut Ridge.

Geary, Okla. Ter.—City Clk. J. M. Waterman writes that this city will build water works, at a cost of $30,000, and bids for same will be wanted as soon as plans and specifications are completed.

Watonga, Okla. Ter.—The question of issuing $16,000 water-works bonds is reported to have carried at the recent election.

Schulenburg, Tex.—The City Council has contracted with the Guenther Fdy. Co., of San Antonio, for the construction of a system of water works for which $11,000 bonds were voted.

Ft. Columbia, Wash.—Capt. Geo. L. Goodale, Constructing Q. M., U. S. A., writes that the contract for constructing a water and sewer system has been awarded to Ferguson & Houston, of Astoria, Ore., for $20,971.

Boise, Idaho.—The Idaho-Iowa Lateral & Reservoir Co. has decided to increase its capital stock from $100,000 to $250,000. Proposed improvements are said to include the construction of several reservoirs. W. C. Annett, Mgr.

State Engr. D. W. Ross is reported to have about completed preliminary surveys for a number of reservoir sites in this State, in accordance with the provisions of the new national irrigation law.

Richfield, Utah.—The City Council has instructed P. D. Schroeber, of Salina, Utah, to make surveys, plans and specifications for the proposed water works system.

Durango, Colo.—This city is reported to have voted, at the special election held Dec. 2, to issue $150,000 bonds for a new gravity system of water works. It is proposed to buy water rights and reservoirs on the Florida River; the present water supply is from Las Animas River.

Nampa, Idaho.—It is stated that bids are wanted Dec. 30 for the purchase of $10,000 bonds for the construction of water works. A. L. Springer, City Clk.

Ogden, Utah.—The City Council has instructed the Com. on Water Supply to secure options on all artesian lands in Ogden Valley, within 2 miles of the present water supply.

Saratoga, Wyo.—A new ditch company has been organized here, which is to be known as the Boulder Canal Co., to operate in Fremont and Carbon Counties. Capital stock, $60,000. Incorporators: W. S. Adams, E. B. Steadman, W. H. Butler, and others.

Salt Lake City, Utah.—Bids will be received by the Bd. of Pub. Wks. until Dec. 26 for constructing all water mains as may be ordered by the City Council from Jan. 1 to Oct. 31, 1903. The approximate quantities of pipe to be furnished and laid, including excavating, special castings, hydrants, valves, etc., are as follows: 15,000 lin. ft. of 6-in., 5,000 lin. ft. of 8-in. and 1,600 lin. ft. of 10-in. Louis C. Kelsey, City Engr.

Mt. Vernon, S. D.—A water works system is said to be projected for next season.

Cody, Wyo.—The Town Council is having surveys and estimates made for a system of water works. Probable cost, $16,000.

Farmington, New Mex.—Bids are reported to be wanted for the enlargement of the Independent Irrigating Ditch, increasing its width 2 ft. from the head to the Waite headgate. Address Otis L. Waite, Secy., Farmington.

Helena, Mont.—At the election, held Dec. 8, it was voted to bond the city to the amount of $615,000 for the purpose of installing a municipal water plant, for fire and sewerage purposes.

Boise, Idaho.—D. R. Cameron, of the Cameron Lumber Co., operating at Harrison, has asked the State Land Bd. for a franchise for the improvement of Couer d'Alene River and its tributaries. Estimated cost of improvement, $66,000.

Idaho.—Local press reports state that F. H. Buhl, of Sharon, Pa.; S. B. Milner and Frank Knox, of Salt Lake City, Utah, and I. B. Perinne, of Blue Lakes, Idaho, are interested in an electrical power deal at Twin Falls, Idaho, which may mean an expenditure of $1,500,000. The scheme is to dam Snake River at Twin Falls and construct a system of canals which will irrigate 270,000 acres, for which work preliminary surveys are being made.

Canon City, Colo.—This city is considering the proposition to secure water from the artesian wells near Chandler; it would probably require about 7 miles of pipe line to bring the water to this city.

Denver, Colo.—The Denver Union Water Co. is reported to have purchased 100 acres of land on the Platte River, and work will begin at once on a reservoir to have a capacity of 300,000,000 gal.

Wyoming.—A. J. Parshall, of Cheyenne, the engineer in charge of the investigation work for the U. S. geological survey, is making a thorough investigation of the country through which Platte River flows in Wyo., with a view to discovering possible reservoir sites where surplus waters from this stream can be stored for irrigation purposes.

Marieville, Que.—It is stated that bids are wanted Dec. 22 for constructing water works. Dupont & Leduc, Engrs., 35 St. James St., Montreal, Que.; G. Bombardie, Secy.

La Cananea, Mex.—W. T. Hiscox & Co., 26 Cliff St., New York City, have received the contract for supplying material for a 10-in. pipe line, 10 miles long, for the Greene Consolidated Copper Co., 377 Broadway, New York City, at its mines, La Cananea, Mexico; amount of contract stated to be about $60,000.

SEWERAGE AND SEWAGE DISPOSAL.

New Britain, Conn.—A correspondent writes that this city will let a contract for a tunnel 1,000 ft. long in connection with its sewage disposal works.

New London, Conn.—The Bd. of Sewer Comrs. is considering the report, of Engr. Walter H. Richards on the sewering of Ocean Beach Park, which includes a plan for the work decided upon after a series of surveys and tests in regard to tide currents. An 18-in. outfall sewer of wood pipe will be necessary for a distance of 1,013 ft. Total estimated cost $9,000.

Jersey City, N. J.—The Bd. of Street & Water Comrs. has directed Ch. Engr. Van Keuren to prepare specifications for the reconstruction of the sewers in Belmont and Gardner Aves. Probable cost, $15,000.

A resolution has been adopted by the Bd. of S. and W. Comrs. asking the Bd. of Finance to appropriate money for the reconstruction of the following sewers: Bay St., estimated cost, $15,600; Second St., $7,428; Van Vorst and Essex St., $8,085.

Plans have been prepared for a 6-ft. steel sewer to help carry off, in lower Jersey City, part of the sewage and surface water of Ravine Road sewerage district.

Philadelphia, Pa.—Bids will be received until Dec. 16 by the Dept. of Pub. Wks., Bureau of Highways, for furnishing material and doing the following work: Repairing sewers, drain pipes, inlets, etc., during the year 1903; for general repairs to sewers; for general repairs to bridges; for grading, paving, repaving or repairing sidewalks; for furnishing and delivering iron pipe; for the maintenance of unpaved and macadamized public highways; furnishing and delivering iron pipe; terra cotta pipe, cement, sand, gravel, etc. Wm. C. Haddock, Dir.

Bradley Beach, N. J.—The Common Council is stated to have received the following bids for the construction of sewers, estimated to cost $23,800: W. J. McCloud of Elizabeth, $24,532; Harrison Const. Co., of Newark, $25,370, and Jas. P. Hall, Jersey City, $46,117.

Yonkers, N. Y.—The Common Council has ordered plans and specifications prepared for Lamartine Ave. and North B'way relief sewer; North B'way, sewer between High St. and Glenwood Ave., Ashburton Ave. relief sewer, Elm St. and Van Cortlandt Park Ave. sewer and Greenvale Ave. sewer.

Canonsburg, Pa.—Bids are wanted Dec. 22 for constructing 410 ft. of 2 and 3 rings. 60 ins. brick sewer. T. M. Reese, Pres. of Council. Jas. S. Haring, Engr., Crafton.

Chambersburg, Pa.—This city is considering the voting for a $30,000 loan for municipal improvements, including lighting and sewerage.

Wilmington, Del.—Engr. of Sewers T. Chalkley Hatton recommends the construction of an 18-in. pipe sewer in 13th St. from Heald St. to Brandywine Creek, as a temporary relief from floods beyond 11th St. bridge, in the spring of the year.

Camden, N. J.—City Engr. Farnham has presented to the City Council's Street Com. a plan for sewering the meadows at an estimated cost of $50,000.

Indiana, Pa.—The Boro. Council has passed ordinances providing for the erection of a complete system of sewers for this place, and filter beds for 6 acres in area. The latter will be located 2 miles south of the town.

Jersey City, N. J.—The contract for constructing a main branch sewer in Marcey Ave. has been awarded to Chas. O'Neill. Estimated cost, $11,275.

Brooklyn, N. Y.—The local administration expects to take up and put through at an early date next year a complete system of relief sewers in this Boro. at an estimated cost of $343,000.

Anglesea, N. J.—The following bids were opened Nov. 18 by Mayor Augustus Hilton, for the construction of a sewerage system; Wm. H. Boardman, Engr.: A, B. F. Sweeten & Son, Camden, N. J., $17,291 (awarded); B, Jas. O'Neil, Jr., Burlington, N. J., $17,745; C, Robt. Hand, Cape May, N. J., $17,437; C, Cahill & Co., Newark, N. J., $31,026. For detail bids see accompanying table.

Items.	A	B	C	D
Pipe—23,370 ft. 8-in....	$0.42	$0.43	$0.42	$0.60
3,740 ft. 10-in........	.52	.55	.58	2.00
2,250 ft. 12-in........	.56	.67	.70	2.00
592 ft. 8-in..........	.95	.85	.90	.75
80 ft. 10-in..........	1.25	1.25	1.35	1.25
20 ft. 12-in..........	1.65	1.64	1.75	1.75
40 plain manholes......	28.00	26.00	28.00	30.00
17 int. manholes.......	30.00	30.00	30.00	35.00
12-in. cast iron pipe.....	85.00	49.00	43.80	75.00
10-in. cast iron pipe.....	85.00	50.00	46.00	75.00
8-in. cast iron pipe.....	85.00	51.00	48.00	75.00
50 M ft. timber........	25.00	30.00	23.85	35.00
Outfalls, each	25.00	25.00	12.50	100.00

Fernandina, Fla.—Bids will be received until Jan. 7 by J. E. Stark, City Clk., for constructing a sewerage system. The work includes approximately, 1,810 ft. of 6-in., 28,700 ft. of 8-in., 2,270 ft. of 10-in., 2,540 ft. of 12-in. and 300 ft. of 15-in. sewer, 144 ft. of 16-in. and 12 ft. of 8-in. cast iron pipe, 30 manholes, 35 lampholes, 24 flush tanks, etc. Roland Woodward, Engr.

Bartow, Fla.—City Clk. W. O. Stanley writes that on Nov. 11 it was voted to issue $15,000 bonds for the construction of an electric light plant and sewerage system.

Atlanta, Ga.—Rudolph Hering, of New York City, has been engaged by this city to recommend a plan for the improvement of the sewerage system and the disposal of sewage.

Fernandina, Fla.—The City Council has accepted plans and specifications for a sewerage system for the entire city, and it is stated that contracts for same will be let at once. Estimated cost, $26,000.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Jan. 2 for furnishing material and constructing a trunk sewer and drain in a portion of Torrence Road. Geo. F. Holmes, Clk.

Dixon, Ill.—Mayor F. A. Truman (temporary address Colfax, Ia.) writes that only one bid was received for sewers recently advertised, and as more contracts are to be let it has been decided to postpone letting until Feb.

Bloomington, Ill.—See "Water;" also see "Paving and Roadmaking."

Walnut, Ill.—Engr. P. C. Knight, of Pontiac, Ill., writes that the letting of the contract for enlarging and repairing the main ditch of Dist. No. 1 has been postponed until some time in Jan. It is estimated that there will be 634,380 cu. yds. of excavation. Jas. Foley, Chmn. Drainage Comrs. of said Dist.

Chicago, Ill.—The Bd. of Local Improve. has ordered the construction of a system of brick sewers in Addison and W. Madison Sts. and Western Ave., to cost $29,000.

St. Bernard, O.—The St. Bernard Improvement Asso. has recommended to the Village Council that a trunk sewer be built through St. Bernard and arrangements be made with other villages of the valley to extend the system all along Carthage pike. Estimated cost, $200,000.

Thief River Falls, Minn.—See "Water."

Cincinnati, O.—The Bd. of Pub. Service has awarded sewer contracts as follows: State Ave. and Lehman Road to Henry Frank for $13,990; Torrence Road, to A. J. Henkel & Bros., for $11,067.

The Bd. of Pub. Service has instructed the Ch. Engr. to prepare plans and specifications for sewers in the northwestern part of Price Hill, which will cost in the neighborhood of $30,000.

South Orange, N. J.—The following bids were opened by the Village Trus. on Dec. 2 for the construction of a sewerage system; Alexander Potter, of New York City, Ch. Engr.:

Items and Quantities.	Ludwig Batt, So. Orange (awarded).	David Peoples, Phila., Pa.	Union Bldg. & Const. Co., Passaic, N. J.	T. J. Shea, Quincy, Ill.	John F. Shanley, Newark, N. J.	Headley & Christie, Newark, N. J.	Harrison Const. Co. Newark, N. J.	Jas. Conway, Newark, N. J.
Pipe—10-in., 0—6 ft., 2,835 ft..	$0.60	$0.76	$0.62	$0.63	$0.70	$0.95	$0.65	$0.88
10-in., 6—8 ft., 2,560 ft.....	0.65	0.84	0.67	0.75	0.75	1.00	0.80	1.13
10-in., 8—10 ft., 4,510 ft....	0.80	0.90	0.82	0.90	0.80	1.05	1.00	1.33
10-in., 10—12 ft., 3,100 ft....	0.85	1.00	0.97	1.15	0.90	1.09	1.15	1.73
10-in., 12—14 ft., 695 ft.....	1.00	1.25	1.27	1.30	1.05	1.10	1.60	1.75
8-in., 0—6 ft., 21,940 ft....	0.55	0.53	0.48	0.53	0.60	0.78	0.65	0.85
8-in., 6—8 ft., 53,650 ft.....	0.60	0.58	0.55	0.65	0.70	0.80	0.80	0.95
8-in., 8—10 ft., 24,200 ft....	0.70	0.66	0.71	0.80	0.73	0.85	1.00	1.30
8-in., 10—12 ft., 4,460 ft....	0.70	0.76	0.85	1.10	0.90	0.90	1.05	1.40
8-in., 12—14 ft., 1,330 ft....	0.80	0.96	1.00	1.25	1.00	0.95	1.50	2.00
8-in., 14—16 ft., 200 ft.....	1.10	1.40	1.25	1.50	1.25	1.10	2.00	3.00
Iron pipe—12 in., (75-lb.), 48 ft.	2.30	2.50	3.10	2.50	5.00	3.50	2.50	5.50
10-in. (60-lb.), 216 ft.......	1.80	2.25	2.65	2.00	4.50	2.25	2.25	5.50
8-in. (45-lb.), 504 ft.......	1.30	2.00	2.25	1.60	4.00	2.10	2.00	5.00
Manholes, 10 ft. or less, 343...	33.00	34.00	42.00	35.00	35.00	38.00	50.00	50.00
Manholes, over 10 ft., 90 ft....	4.00	4.00	6.00	3.50	5.00	7.50	5.00	5.50
Fl. t'nks with syphon & met'rs, 79	60.00	58.00	90.00	60.00	65.00	69.00	125.00	100.00
Branches, 10-in.x4-in., 300.....	0.70	0.80	1.05	1.50	0.90	1.00	1.00	0.60
Branches, 8-in.x4-in., 2,000.....	0.50	0.80	0.70	1.15	0.65	0.75	0.75	0.60
Rock, 2,500 cu. yds...........	0.70	2.00	2.00	2.00	3.20	3.00	3.00	4.00
Sheeting, 50 M ft.............	5.00	30.00	20.00	35.00	30.00	35.00	35.00	20.00
Timber in foundation, 10 M ft..	30.00	30.00	30.00	50.00	50.00	60.00	40.00	40.00
Extra concrete, 50 cu. yds.....	5.00	7.50	10.00	12.00	10.00	9.00	10.00	8.00
Extra brickwork, 50 cu. yds....	12.00	12.00	12.00	12.00	12.00	10.50	12.00	13.50
Tar joints on 10-in., 450.......	0.10	0.30	0.35	0.25	0.30	0.45	0.50	0.25
Tar joints on 8-in., 2,500.......	0.05	0.20	0.30	0.25	0.25	0.30	0.45	0.20
Totals	$98,009	$104,464	$107,586	$115,318	$119,259	$134,682	$144,525	$172,530

Asbury, Park N. J.—The Beach Com. of the Bd. of Aldermen has decided to accept the offer of Jas. A. Brsdley to sell the beach front and the sewer system for $150,000. It is stated that the city authorities contemplate inviting bids for plans and the construction of a new steel board-walk, casino, music stand and bathing establishment, in anticipation of the sale of bonds to be voted upon probably in the near future.

Des Moines, Ia.—The lowest bids received Dec. 2 for the construction of 3,444 ft. of sewer on 12th St. is stated to, have been from O. P. Herrick at $1.37 per lin. ft.

Columbus, O.—Bids are wanted Jan. 6 for the construction of sewers, as advertised in The Engineering Record.

Gibson City, Ill.—The city officials recommend the construction of a sewer system similar to the system in Urbana.

Wyandotte, Mich.—See "Water."

St. Paul, Minn.—An extension of the main sewer along Concord St. has been ordered at a cost of $7,000.

Springfield, Ill.—It has been agreed by the Bd. of Pub. Improv. to recommend the placing of an 18-in. sewer pipe in 2d St.

Ottawa, Ill.—At a recent mass meeting a vote was taken in favor of the construction of a new sewer system on the west side.

Clinton, Ill.—Engr. J. G. McInish, of Bloomington, Ill., writes that the following bids were opened Nov. 22 by the drainage commissioners of Friend's Creek Special Drainage Dist., in the Counties of De Witt and Piatt, for the construction of the main drainage channel in said district; *a*, new channel; *b*, old channel: J. W. Boyer, Manchester, Ind., *a*, 6.9 cts.; *b*, 7 cts.; R. H. McWilliams, Mattoon, Ill., *a*, 6 cts.; *b*, 6 cts.; Canal Const. Co., Chicago, Ill., *a*, 7.5 cts.; *b*, 7.5 cts.; Elkhart Const. Co., Elkhart, Ind., *a*, 7.5 cts.; *b*, 9.5 cts.; R. N. Andrews Co., Hamilton, O., *a*, 8.23 cts.; *b*, 8.23 cts.; John McAndrews, Bradley, Ill., *a*, 6⅞ cts.; *b*, 6⅞ cts.; John A. Brumbaugh, Elkhart, Ind., *a*, 8 cts.; *b*, 8 cts.; J. E. Rogers & Co., Tuscola, Ill., *a*, 8 cts.; *b*, 10 cts.; Chas. R. Lewis, Tuscola, Ill., *a*, 7 cts.; *b*, 7 cts.; total, $12,822 (awarded); Pollard, Goff & Co., Champaign, Ill., *a*, 6⅔ cts.; *b*, 6⅔ cts.; G. A. McWilliams, Melvin, Ill., *a*, 6.8 cts.; *b*, 7.1 cts.; Jos. Lewis, Atwood, Ill., *a*, 10 cts.; *b*, 11 cts.

Kansas City, Mo.—A correspondent writes that bids will be received until Dec. 16 for constructing 4,000 ft. of pipe sewers in Sewer Dist. No. 132, cost $5,000; also for constructing 25,000 ft. of pipe sewers, 5,000 ft. of brick sewers, 102 manholes, 62 catch basins, 7 flush tanks in Sewer Dist. No. 211, cost $60,000. R. W. Waddell, City Engr.

Lawton, Okla. Ter.—Bids are wanted Jan. 5 for furnishing material and constructing a sewer system. D. A. Jacobs, City Clk.; W. S. Shields, Designing Engr., Rm. 1715 Marquette Bldg., Chicago, Ill.

Lake Charles, La.—Plans and estimates for a system of sanitary sewerage have been prepared by John W. Maxcy, of Houston, Tex., and submitted to the City Council. Approximate cost of work, $240,000.

Houston, Tex.—The City Engr. is said to be preparing plans and specifications for a storm water sewer 9 ft. in diameter, which is to drain one section of the city, beginning with Austin St. and extending to the Bayou.

Salt Lake City, Utah.—Bids will be received by the Bd. of Pub. Wks. until Dec. 26 for constructing all pipe sewers that may be ordered by the City Council from Jan. 1st to Oct. 31, 1903. The approximate quantities of pipe to be furnished and laid, including excavatings, manholes, flush tanks, etc., are as follows: 30,000 lin. ft. of 8-in., 1,600 lin. ft. of 10-in. and 1,600 lin. ft. of 12-in. Louis C. Kelsey, City Engr.

Fresno, Cal.—City Engr. I. Teilman writes that this city contemplates building 2½ miles of 30-in. brick sewer to take the place of an 18-in. pipe sewer which is too small. Probable cost, $30,000.

Ft. Columbia, Wash.—See "Water."

South Omaha, Neb.—It is proposed to construct a 5-ft. brick sewer from 20th and N Sts. to the river. Probable cost, $25,000.

Seattle, Wash.—The City Council has ordered the construction of sewers on Madrona Place and other connecting streets, which, according to the estimate presented by the city engineer, will cost $30,000. The construction of a system of sewers for the Lake Dell improvement, has also been ordered at a cost of $19,000.

Listowel, Ont.—The contract for building a sewer and sewage disposal works has been awarded to P. Pigeon, of Sebringville, for $5,710.

BRIDGES.

Providence, R. I.—A bill has passed the House, authorizing this city to repair the bridge on the east side of Exchange Pl., at a probable cost of $120,000.

Boston, Mass.—Wm. T. Pierce, Engr. Metropolitan Park Comn., writes that the following bids for constructing Wellington Bridge (pile structure), Middlesex Fells Parkway, were received by the Metropolitan Park Commission Dec. 1: W. H. Ellis, Boston, $115,900; Jos. Ross, Boston, $111,900; T. E. Ruggles, Boston, $100,661; Benj. Young, Chelsea, $99,700; Wm. L. Miller, Boston, $93,000; Lawler Bros., Charlestown, $89,000; Mayo Contracting Co., Boston, $86,285; Jones & Meehan, Boston, $86,000 (awarded). The bridge will be over 800 ft. long, and the contract calls for about 1,000,000 ft. of hard pine and spruce lumber, and about 1,500 oak piles.

York, Pa.—Bids are wanted Dec. 16 for constructing a bridge in the 12th Ward and one in the 8th Ward. John R. Lafean, Chmn. Highway Com.

Yonkers, N. Y.—Plans and specifications have been accepted for a modern highway bridge, with a paved roadway, to be built across the N. Y. & Putnam Ry. at Caryl Ave.

Pulaski, Pa.—The Bd. of Pub. Bldgs. and Grounds, at Harrisburg, has selected Herman Laub, Lewis Blk., Pittsburg, to prepare plans and specifications for the State bridge to be built in this city. The Bd. of Viewers recommended the building of a 2-arch stone bridge, to cost about $20,000.

Taylorsville, Pa.—Press reports state that the Baltimore & Ohio R. R. Co. has decided to build a stone bridge across Buffalo Creek west of Taylorsville Station, on the Pittsburg & Wheeling division, estimated to cost about $50,000.

Chestertown, Md.—The Comrs. of Kent and Queen Anne Counties are reported to have under consideration the repair of bridge across Chester River, in this city. It is proposed to put in a new draw, etc.

Philadelphia, Pa.—See "Sewerage and Sewage Disposal."

Jeannette, Pa.—The Town Council has voted to construct an iron bridge at 7th St.; also to construct an arch under the tracks of the Pennsylvania R. R. at 3d St.

York, Pa.—The Co. Comrs. have approved the action of the Grand Juries in recommending the building of a bridge at Richland Ave.

Sayre, Pa.—Local press reports state that the Court has approved the recommendation of the Grand Jury that an iron bridge be built across Susquehanna River, in this borough, at a probable cost of $10,000, and the Co. Comrs. will, according to reports, soon ask for bids for constructing same.

Lykens, Pa.—Viewers appointed to report on the building of a county bridge across Rattling Creek, in this borough, have decided in favor of constructing said bridge.

Rensselaer, N. Y.—The officials of the Central Hudson R. R. are said to be contemplating the building of a new bridge across the R. R. tracks at East Greenbush turnpike, to replace present structure, which is in poor condition.

It is stated that petitions are being circulated asking for the building of a wagon and foot bridge at Third Ave.

Roesslerville, N. Y.—Press reports state that the N. Y. C. & H. R. R. R. Co. is about to construct a 9-track bridge across Schenectady turnpike in this city. The bridge is to consist of 2 steel spans, and is to have stone abutments.

Harrisburg, Pa.—The Viewers appointed to report on the rebuilding of the county bridge across Schuylkill River in Schuylkill County, at Shollenberger's Crossing, have filed their report recommending the building of a steel truss structure.

Stroudsburg, Pa.—The Co. Comrs. and the Stroudsburg Passenger Ry. Co. are reported to have reached an agreement whereby the Ry. Co. is to construct a bridge, for said railway, across Pocono Creek.

McKees Rocks, Pa.—It is reported that a petition is in circulation asking for the building of a bridge, 1,200 ft. long, to cross the P. C. & Y. and the Ohio connecting railroads and Chartiers Creek.

Moravia, Pa.—The Court has adopted the report of the Bd. of Viewers in favor of opening the new road to Moravia, which, it is stated, will necessitate the construction of a $30,000 bridge across Beaver River.

New York, N. Y.—The following bids were opened Dec. 11 by G. Lindenthal, Comr. Bridges, for constructing the Manhattan tower foundation of Manhattan bridge (No. 3) over the East River. All bidders of New York City. Item A is work complete above el. —79.15; B, between el. —79.15 and —83 (1,602 cu. yds.): C to G, 1,664 cu. yds. each bet. planes 4 ft. apart down to el. —103:

Items.	John G. Tate.	Degnon-McLean Constr. Co.	Duncan D. Mc-Bean.	John C. Rodgers, 31 W. 125th St.
A.	$480,000	$612,500	$500,000	$450,000
B.	10.00	43.00	7.50	10.00
C.	10.00	36.00	7.50	10.00
D.	0.01	26.90	7.50	0.01
E.	0.01	25.60	7.50	0.01
F.	0.01	24.60	7.50	0.01
G.	0.01	19.50	7.50	0.01
Total. . . .	$512,727	$902,032	$574,415	$482,727

New York, N. Y.—Bids are wanted Dec. 22 for rebuilding Bank Rock Bridge in Central Park. Wm. R. Willcox, Comr. of Parks.

Camden, N. J.—The Bldg. Com. of the Bd. of Freeholders is reported to be contemplating the elevating of Federal St. bridge.

Augusta, Ga.—A bill has passed the House, authorizing the building of a bridge across Savannah River at Sand Bar Ferry.

Metropolis, Ill.—Reports state that a railway bridge is to be built across Ohio River by the St. Louis & San Francisco R. R. in this city.

Oshkosh, Wis.—Erickson & Lehman have prepared plans for a single 60-ft. span steel bridge, which it is proposed to build across Sawyer Creek, at a probable cost of $6,000.

Lancaster, O.—The Co. Comrs. are said to be contemplating the building of a bridge across Hocking River.

Vinton, Io.—It is stated that a bridge is to be built across Cedar River at Vinton, in connection with the Vinton, Belle Plaine & Independence Ry. J. D. Wardle, Engr., Cedar Rapids.

Bridgeport, W. Va.—Local press reports state that bids will be received by F. S. Rice, City Clk., for building a bridge across Wheeling Creek at West St., to cost about $22,000.

Joliet, Ill.—The Boards of Will and Grundy Counties are contemplating the building of a $25,000 bridge across Kankakee River.

Huron, O.—The Lake Shore Electric Ry. Co. is reported to have under consideration the building of a bridge in this city.

Terre Haute, Ind.—Local press reports state that bids will be received by the Co. Comrs. until Dec. 31 for constructing 24 bridges in various parts of the county; 19 of the structures are to be combination steel and concrete, and to range from 12 to 40 ft. in length, and the other 5 are to be steel bridges, ranging from 80 to 110 ft. in length.

Bloomfield, Ind.—Bids will be received by the Bd. of Co. Comrs. until Jan. 6 for constructing the steel superstructure of a 100-ft. bridge in Richland Township, and for constructing the substructure and steel superstructure of a 40-ft. bridge in Taylor Township. Harvey L. Doney, Co. Aud.

Peoria, Ill.—A correspondent writes that bids will be received in January for constructing a concrete bridge across Farm Creek.

Detroit, Mich.—The building of a railroad bridge across Detroit River is reported to be again under consideration.

East Grand Forks, Minn.—The City Council and County Comrs. have agreed to build a bridge across Red Lake River, between Washington and Michigan Aves.

Cincinnati, O.—Press reports state that the Court had determined that the Cincinnati & Indiana Western R. R. Co. may construct at Harrison Ave., in Millcreek bottoms, a temporary wooden trestle, to be replaced in a period agreed upon by the said company and the Cleveland, Cincinnati, Chicago & St. Louis Ry. (over whose tracks it is to cross) by a 500-ft. steel span, so constructed that it will not interfere with the traffic or handling of freight by the C., C., C. & St. Louis Ry. This steel span, the railroad experts are reported to have stated, will cost $75,000.

Springfield, O.—The Park Bd. is reported to have under consideration the erection of a viaduct over Bechtle Ave., in Snyder Park, for the use of the Sidney & Piqua Traction Co.

Hempstead, Tex.—Reports state that the railroad bridge in this city, belonging to the Houston & Texas Central Ry. Co. will be repaired, or possibly a new structure erected.

Meridian, Miss.—It is stated that bids are wanted for a double bridge to be built across the branch of the Marion and Livingston road near Jim Pack Place. B. V. White, Clk.

McKinney, Tex.—The Comrs. Court is reported to have ordered the building of 2 iron bridges, each to have a 50-ft. span.

Lawrence, Kan.—A press report states that the citizens have voted to erect an iron bridge across Stranger Creek in Easton Township.

Tacoma, Wash.—The Council Com. has decided to construct a wood and iron bridge across Puyallup River at 21st St., at a cost of $12,000.

Dale, Colo.—Press reports state that the largest bridge on the Florence & Cripple Creek R. R. has been destroyed by fire. The bridge is situated between Dale and Adelaide.

San Jose, Cal.—Co. Surveyor J. G. McMillan writes that bids for the Endmondson Ave. bridge have been rejected.

Olivet, S. D.—Bids will be received by the Co. Comrs. until Jan. 7 for constructing 2 steel bridges as follows: 1 across Twelve Mile Creek to have 1 span 40 ft. long, and roadway 16 ft. wide, the other to be built across Lone Tree Creek, to have 1 span, 80 ft. long, and roadway 16 ft. in the clear. D. D. Wipf, Co. Aud.

Colorado Springs, Colo.—Local press reports state that the Santa Fe R. R. Co. will construct a steel bridge, 80 ft. wide, at Costilla St.

PAVING AND ROADMAKING.

Philadelphia, Pa.—See "Sewerage and Sewage Disposal."

New York, N. Y.—Bids are wanted Dec. 16 for regulating, regrading, reflagging and recurbing a portion of Edgecombe Ave. and for regulating, grading, curbing and flagging portions of 171st and 172d Sts. Jacob A. Cantor, Boro. Pres.

Baltimore, Md.—Asst. Engr. Jas. A. Paige writes that the lowest bid opened Dec. 3, by the Bd. of Awards, for work on Northwest St., was from Daniel Sullivan as follows: brick paving on 4-in. concrete, $1.97 per sq. yd.; cobble paving in cross streets, 80 cts. per sq. yd.; cobble repaving, 40 cts.; 4½-in. curb, 65 cts. per lin. ft.; old curb redressed and reset, 18 cts. per lin. ft.; old curb redressed in place, 10 cts. per lin. ft.; 4½-in. headers, 45 cts. per lin. ft.; grading, 33 cts. per cu. yd.; total, $10,189. Other bids received were from Owen Patterson at $11,783, and Filbert Paving & Const. Co. at $11,713.

Elmira, N. Y.—The Bd. of Supervisors has adopted the Grand Central Ave. route as the route for proposed macadam road between Elmira and Horseheads. Chas. Chamberlain, Chmn. Special Com.

Reading, Pa.—The Mt. Penn Speedway & Boulevard Co. has been organized by Wm. Abbott Witman, H. T. Shick and Calvin M. Dechant, C. E., to construct a driveway about 3 miles long and 50 ft. wide, along Mt. Penn. Capital stock of Co., $30,000.

Cape May, N. J.—Former Senator Wm. Flinn, Peter Shields and Chas. Fitzgerald, of Pittsburgh; Ellis D. Thompson, of Philadelphia, and Frank G. Edwards, of Bristol, Pa., have been considering with the City Council details of improvements of east Cape May and Two Mile beach at a proposed outlay of several million dollars. They asked that the city expend $100,000 on the beach boulevard along the front of the property. A 20-ft. steel boardwalk is said to have been agreed upon.

Union Center, N. Y.—Surveys are about to be made for a macadam road from Union Center to Maine.

Syracuse, N. Y.—Bids were opened Dec. 8 for paving Grape St., and the lowest prices were, according to local press reports, from the Syracuse Improvement Co., as follows: For Trinidad asphalt, $53,714, $51,935 and $54,011; for brick the bids of said company were: $59,078, $57,299, $65,328 and $65,625.

Brooklyn, N. Y.—Bids will be received by J. Edw. Swanstrom, Boro. Pres., until Dec. 24 for furnishing material and repaving with asphalt on a concrete foundation a portion of Bocrum Place, requiring 1,390 sq. yds. of asphalt; for paving with asphalt on a concrete foundation, a portion of Hinsdale St., requiring 7,825 sq. yds. of asphalt and 1,090 cu. yds. of concrete; also for furnishing and delivering 1 stone crusher and 2 steam road rollers.

Long Island City, N. Y.—Bids will be received until Dec. 20 by Joseph Cassidy, Boro. Pres., for furnishing material and regulating grading, curbing, and paving with asphalt (about 3,100 sq. yds., including binder course), on a concrete foundation, a portion of St. Nicholas Ave.; for furnishing material and repairing and maintaining asphalt pavement on a concrete foundation (about 4,200 sq. yds., including binder course), a portion of Fulton St. Bids will also be received at the same time for furnishing and delivering to the Bureau of Highway 5,000 cu. yds. of screenings of trap rock, in the 5th Ward, Boro. of Queens.

Rodman, N. Y.—This town has petitioned for the construction of 2 sections of road each 2½ miles long, under the Higbee-Armstrong law.

Pittsburg, Pa.—The Allegheny County Comrs. propose to sell only $100,000 worth of the $550,000 road bonds recently offered for sale, the remainder to be sold early next year.

Ft. Myer, Va.—Bids are wanted Jan. 10 for constructing macadam road, as advertised in The Engineering Record.

Canton, O.—Bids are wanted Dec. 29 for $19,100 street improvement bonds. C. C. Loyd, City Clk.

Terre Haute, Ind.—Bids are wanted Dec. 29 for macadamizing 4 streets. Robt. H. Sparks, City Engr.

Cincinnati, O.—Bids are wanted by the Bd. of Pub. Service until Dec. 19 for improving a portion of Woodlawn Ave. by grading, curbing and macadamizing; also for improving a portion of Hand Alley, by grading, setting curbs, and paving the roadway with brick. Geo. F. Holmes, Clk.

Bids will be received by the Bd. of Pub. Service until Dec. 22 for improving a portion of Bassett Road by grading, setting curbs, flagging and macadamizing the roadway. Bids will also be received until Jan. 6 for improving a portion of Front St. by grading, setting curbs, and paving the roadway with granite. Geo. F. Holmes, Clk.

Toledo, O.—Bids are wanted Jan. 5 for furnishing material and improving a portion of Willow Ave., by paving with block on a 6-in. concrete or 8-in. sand foundation, or with asphalt block, on a 6-in. bank gravel or broken stone foundation. Chas. H. Nauts, City Clk.

The lowest bid opened Dec. 1 for paving on Detroit Ave. is reported to have been from Jas. Sheehan at $1.52 for Athens block for concrete foundation or $1.10 with sand foundation; grading, 17 cts.; the contract calls for 8,505 yds. of paving and 2,500 cu. yds. of grading.

Bloomington, Ill.—Brick pavement and sewers will be constructed on Seminary Ave.

St. Paul, Minn.—The Bd. of Pub. Wks. has awarded to W. J. Preston the contract for macadamizing a portion of Concord St., for $17,313.

Findlay, O.—A petition is being circulated for the paving of West Crawford St. with brick.

Chicago, Ill.—The Bd. of Local Improv. has ordered portions of the following streets paved with asphalt: Brigham St., $16,500; Clay St., $13,000; Hastings St., $49,000; West Ohio St., $32,500; Ballou St., $28,000; Elk Grove St., $13,000; West Huron St., $17,000; Keenon St., $15,500; Locust St., $21,500; Wisconsin St., $14,500; Belden St., $77,000; Walnut St., $47,000; Morgan St., $6,500. Streets ordered paved with brick were Center Ave., $11,500, and W. 67th St., $13,000.

Manistee, Mich.—Col. E. W. Muenscher has just completed the survey of a branch of the Manistee County Road from a point on the main line 4 miles out from Manistee to Portage Lake and Onekama, a distance of 7 miles. The grading and claying of this line will be put under contract next spring, and possibly a considerable amount of macadamizing on the main line.

Milwaukee, Wis.—Local press reports state that there are 40 miles of cedar block pavement left in this city, a large portion of which is in such a condition that new pavement will be necessary soon.

New Castle, Ind.—A petition has been signed by South Main St. residents to pave that thoroughfare early in the spring; brick will probably be the material used.

Delphi, Ind.—Carroll Co. Comrs. are reported to have awarded the contract, for 32 miles of free gravel roads in Burlington and Democrat townships, to Hillis & Co., of Cass County, for $53,000.

Saginaw, Mich.—City Engr. Roberts estimates that the street paving work already proposed for next year would cost fully $200,000, while the amount available for the year is said to be only about $30,000; the only solution is said to be a charter amendment. For the 17 streets which it is proposed to pave, bituminous macadam and brick, with possibly some asphalt, will be used.

Columbus, O.—The contract for paving Pearl alley has been awarded to Baldwin Bros. & Graham at a cost of $8,588, Bolen Blk. to be used.

Washington, Ia.—The City Council has passed a resolution to pave with brick the square and 1 block each way and the 4 alleys through the blocks abutting on the public square.

Madison, Wis.—Bids are wanted Jan. 3 for furnishing material and grading, curbing and paving with asphalt on a portion of Mifflin St. O. S. Norsman, City Clk.

Wellsville, O.—Bids are wanted Dec. 27 for furnishing material and laying about 70,000 sq. yds. of pavement in this city; bids on various kinds of material will be received. O. K. Buckhout, Secy.

Battle Creek, Mich.—The City Engineer's final estimate of $19,321 for the cost of paving Muskegon Ave., $8,662 for Third St. and $4,053 for Grand Ave. has been referred to the Street Com.

Laporte, Ind.—The County Comrs. have awarded the contract for completion of unfinished macadam roads in Laporte Co. to Ralph H. Bertsch & Co., of Alexandria, for $38,450.

La Crosse, Wis.—City Engr. Frank Powell estimates the cost of paving, for which contracts are about to be let, at $9,882 for north side macadam, $94,270 for south side macadam, and the total for brick paving, $60,278.

Oklahoma City, Okla. Ter.—The property owners on East Reno St. are circulating a petition for the paving of that street with asphalt.

St. Joseph, Mo.—Local press reports state that King Hill Ave. is to be paved before spring, making a good thoroughfare between this city and South St. Joseph.

Helena, Ark.—A resolution has been introduced in the City Council directing the City Engr. to prepare estimates of the cost of paving Cherry St. with brick and asphalt.

Louisville, Ky.—The Bd. of Pub. Wks. has awarded to Henry L. Kremer the contract for paving 4 alleys with vitrified block at $1.27 per sq. yd., total about $5,700.

St. Louis, Mo.—Delmar boulevard property owners have decided to recommend bituminous macadam as the material to be used in the reconstruction of that thoroughfare.

Ft. Worth, Tex.—City Engr. John B. Hawley writes that the following bids were opened Nov. 21 for brick and asphalt paving on Houston St., work to include 8,000 cu. yds. of excavation, 3,000 ft. free haul, and contracts were awarded Dec. 1 as indicated below—*a*, with concrete foundation of gravel with Amer. Port. cement (Dallas), 6 in. thick; *b*, with concrete foundation of crushed rock with Amer. Port. cement (Dallas), 6 in. thick: For vitrified brick paving—O. Kauder & Sons, Texarkana, Tex., *a*, $1.77½ per cu. yd; *b*, $1.90 per sq. yd.; excavating at 48 cts. per cu. yd.; totals, *a*, $48,215; *b*, $51,340. Parker-Washington Co., Kansas City, Mo., *a*, $1.70; *b*, $1.95; excavating, 60 cts.; totals, *a*, $47,300 (10,000 yds., brick, awarded); *b*, $53,550. Brown & Dabney, Dallas, Tex., *a*, $1.95; *b*, $2.25; excavating 50 cts.; totals, *a*, $52,750; *b*, $60,250. For asphalt paving—Parker-Washington Co., *a*, $2.07; *b*, $2.22, using either sheet asphalt or Uvalde, Tex., rock asphalt; excavating, 60 cts. per cu. yd.; totals, *a*, $56,550 (15,000 yds., rock asphalt, awarded), and *b*, $60,300. Barber Asphalt Paving Co., *a*, $2.24½; *b*, $2.37½ for sheet asphalt; *a*, $1.98, *b*, $2.11, for Indian Territory rock asphalt; excavating 48 cts.; totals, *a*, $59,965 for sheet and $53,340 for rock asphalt; *b*, $63,215 for sheet and $56,590 for rock asphalt.

Great Falls, Mont.—The City Engr. is preparing estimates of the cost of repaving Central Ave., and the contract for said work will probably soon be let by the City Council.

Salt Lake City, Utah.—Bids will be received until Dec. 26 by the Bd. of Pub. Wks. for constructing all cement sidewalks that may be ordered by the City Council from Jan. 1 to Oct. 31, 1903. Louis C. Kelsey, City Engr.

POWER PLANTS, GAS AND ELECTRICITY.

South Norwalk, Conn.—It is stated that bids will be received in January for building an extension to the municipal lighting plant. The cost is placed at $15,000, and contemplates the addition of a 250-H.-P. high speed, 4-valve engine, direct-connected to a 150-Kw., D. C., 250-volt generator, direct-connected closed arc) multi-current generator, direct-connected to a 85-H.-P., 250-volt D. C. motor, also 110 series, D. C., 5 ampere enclosed arc lamps. A. E. Winchester, Des. Engr. and Gen. Supt. of plant.

Massena, N. Y.—A press report states that there is a movement on foot to transmit electrical power from the plant of the St. Lawrence Power Co. at Massena through this northern section of the State as far as Watertown.

Mt. Union, Pa.—W. H. Mondy is stated to have secured a franchise for an electric light plant.

Port Deposit, Md.—The Port Deposit Electric Co. is stated to have decided to expend about $5,000 in improvements.

Milton, N. Y.—A press report states that the Newburg Light, Heat & Power Co. of Newburg will light the streets of Milton from the supply generated in Newburg.

Boyerstown, Pa.—Deem Bros. are stated to have petitioned the Council for a franchise for an electric light plant. Arc lights to be furnished at $65 per year and incandescent lights at $18.

Philadelphia, Pa.—The lowest bid received Dec. 6 by the Dept. of Charities and Correction for the erection of an annealed iron gas holder and steel tank, of a capacity of 75,000 cu. ft., at the House of Correction gas works, is stated to have been submitted by Deily & Fowler, of Philadelphia, Pa., for $11,480.

Buffalo, N. Y.—The Trus. of the City and County Hall, in a report to the Bd. of Superv., are stated to have recommended that the building be lighted with electricity instead of gas, stating that an electric light plant could be installed, at a cost of $45,000.

Chambersburg, Pa.—See "Sewerage and Sewage Disposal."

Palo Alto, Pa.—Clarence P. King and D. J. Duncan are about to apply for a charter for the Palo Alto Electric Co., which proposes to supply light, heat and power in the borough.

Baldwin, L. I., N. Y.—The Nassau Light & Power Co. is about to petition the Bd. of Comrs. of the Town of Hempstead for a franchise to extend its pole line from Hempstead to Baldwin, for the purpose of supplying light, heat and power in Baldwin.

Barlow, Fla.—See "Sewerage and Sewage Disposal."

Barnesville, Ga.—See "Water."

Elwood, Ind.—The Citizens' Heat & Light Co., of Elwood, has been incorporated, with a capital of $200,000, by Jacob Roomis, Herbert P. Carpenter, Wm. A. Mason, and others, all of Elwood

Hayward, Wis.—The Hayward Electric Light & Power Co. has been incorporated; capital, $25,000. Incorporators: T. S. Whitten, J. H. Hellweg and Henry Murphy.

Brooklyn, Ia.—The Brooklyn Lighting & Htg. Co. has been incorporated; capital, $10,000. Incorporators: J. F. Hatcher, R. J. Breckinridge, and others.

Niles, Ill.—The Niles Electric Light & Power Co., of Niles, is reported incorporated, with a capital of $5,000, to furnish light, heat and power. Incorporators: Julius H. Geweke, Adam Harrer, and others.

Baraboo, Wis.—The Baraboo Lighting Co., of Baraboo, is reported incorporated, with a capital of $100,000. Incorporators: Beebe H. Stone, Daniel Ruggles and Geo. McFarland.

Clarksville, Ia.—The Clarksville Electric Lighting Co. is reported to have secured a franchise for an electric light and heating plant.

Wyandotte, Mich.—See "Water."

Cleveland, O.—Bids will be received by the Bd. of Control until Dec. 23 for furnishing, lighting, extinguishing, and keeping in repair, including the furnishing of glass and all material therefor, 1,100 electric lamps, for a period of 1 year. Chas. P. Salen, Dir. of Pub. Wks.

St. Paul, Minn.—The Government is said to be considering the expenditure of $25,000 for a lighting plant in the federal building in St. Paul.

Chicago, Ill.—Bids will be received by Edw. B. Ellicott, City Electrician, until Dec. 18 for furnishing the city with gas, gasoline, or electric light on certain parts of streets in different sections of the city, during the year 1903.

Hot Springs, Ark.—Bids will be opened by the Bd. of Pub. Affairs Jan. 12 for furnishing arc electric lights, of not less than 1,600 c. p., for a period of 10 years from Jan. 1, 1904, on an all night schedule. Hamp Williams, Secy.

Walnut Ridge, Ark.—See "Water."

Lexington, Ky.—Bids will be received by H. T. Duncan, Mayor, until Dec. 23 for lighting the streets with lights of actual 2,000 c. p., on a 5-year contract, as follows: for 1 year with the city having the privilege of renewing the contract each year up to and including the 5 years from Jan. 1, 1903. Bids are to be for 304 lights on all night schedule.

Manchester, Ky.—The citizens are stated to have voted to issue $7,000 electric light bonds.

Plattsburg, Mo.—The Plattsburg Light & Power Co. has been incorporated, to supply electric light, power and heat; capital, $40,000. Incorporators: M. J. Trimble, Claude C. Funkhouser, and others.

Abilene, Tex.—Bids received Nov. 29 for putting in machinery and complete apparatus for power, electric lights, water supply system and steam heating and ventilating, at the Epileptic Colony at Abilene, have been rejected, and new bids will be received by R. M. Love, Compt. of Pub. Accounts, at Austin, until Jan. 3.

Jasper, Ala.—The Mayor and Bd. of Aldermen are stated to have granted J. M. Cranford and associates a franchise for an electric light plant.

Huntsville, Ala.—Engineer Jackson, of Nashville, Tenn., estimates the cost of constructing a municipal electric light plant, at $16,000.

Beaumont, Tex.—The City Council is reported to have passed on first reading, an ordinance granting a gas franchise to R. M. Mothner and Robt. Steiner.

Rugby, N. D.—Allan Tompkins is reported interested in the construction of an electric light plant.

Puyallup, Wash.—The City Council is reported to have granted a franchise to a local company to construct an electric light plant. H. G. Rowland and Carey Stewart are reported interested.

Las Vegas, N. M.—The Comrs. of San Miguel County are stated to have granted the Capitol Power & Lighting Co. a franchise for an electric light system and an electric railway. The company proposes constructing a power plant on the Pecos River. It also has a franchise in Sante Fe.

Canon City, Colo.—The Franchise Com. of City Council has reported in favor of granting H. A. Black, of Pueblo, a franchise for a gas plant.

Idaho.—See "Water."

Reno, Nev.—The Washoe Power & Development Co. has been organized at Reno, with J. N. Evans, Pres., and R. Brown, Secy. The plant will be located 7 miles north of Reno on Truckee River and will have a capacity of 7,000 H.-P.

Winnipeg, Man.—It is reported that the Winnipeg Power Co. will expend $100,000 in machinery for its new power plant.

ELECTRIC RAILWAYS.

East Providence, R. I.—The Town Council is stated to have granted the Rhode Island Co. a franchise to extend its line from Phillipsdale to Pawtucket.

Woodbury, Conn.—Floyd P. Hitchcock, of Woodbury; Chris. Strobel, of Waterbury, and others, are reported interested in the construction of an electric railway from Woodbury to Waterbury by way of Middlebury, and also to Seymour by way of Southbury, Pomperaug, Oxford and Hotchkissville.

Grafton, Vt.—The House has passed the bill incorporating the Grafton & Saxton's River Ry. Co.

Uxbridge, Mass.—The Uxbridge & Blackstone St. Ry. Co. is stated to have petitioned the Selectmen under the name of the Uxbridge, Whitinsville & Douglas St. Ry. Co., for a franchise to build a line from the Rivulet Road to the Northbridge line at Whitinsville.

Stafford Springs, Conn.—The Stafford Springs Ry. Co. is stated to have secured a franchise.

Leominster, Mass.—The Dirs. of the Worcester Consolidated St. Ry. Co. are stated to have decided to extend the line from Greendale to Leominster, passing through West Boylston and Sterling. W. W. McKee, Ch. Engr., Worcester.

Derby, Conn.—The R. R. Comrs. are stated to have approved the plan of the Connecticut Ry. & Lighting Co. for an extension of its lines from Derby to Milford; also for double tracking the Shelton line. J. E. Sewell, Gen. Mgr., Waterbury.

Great Barrington, Mass.—It is stated that the New York & Berkshire Ry. Co. will build an electric line from Great Barrington, Mass., to Copake, N. Y., a distance of 13½ miles, to connect with the Harlem division of the New York Central R. R.

Middleboro, Mass.—The Selectmen are stated to have granted a franchise to the Middleboro, Wareham & Buzzards Bay St. Ry. Co.

Huntington, Mass.—W. A. Whittlesey, of Pittsfield; J. H. Dickinson, of Huntington, and Emory D. Church, of Ashfield, are reported interested in the construction of an electric railway between Huntington and Shelburne Falls.

Perth Amboy, N. J.—The Raritan Traction Co. is stated to have petitioned the City Council for a franchise from Smith St. to the Raritan River bridge, now building. W. G. Rock, Supt., Perth Amboy.

Volney, N. Y.—The Syracuse & Ontario Electric Ry. Co. is stated to have secured a franchise through the town.

Pleasantville, N. J.—The Council is stated to have granted a franchise to the Atlantic City & Suburban Traction Co.

Glen Cove, L. I., N. Y.—The Glen Cove R. R. Co. is stated to have petitioned the Superv. at Mineola for a franchise for a trolley line over certain highways in Glen Cove, extending from the Landing Road to the Long Island R. R. station at Sea Cliff.

Jamestown, N. Y.—It is stated that surveys have been finished by the Jamestown St. Ry. Co. for an electric road from Jamestown to the court house in the village of Mayville. Chas. Griffith, Ch. Engr., Jamestown.

Boyerstown, Md.—The Boro. Council is stated to have granted a franchise to the Trappe-Limerick Electric Ry. Co.

Salamanca, N. Y.—The Village Trus. are stated to have granted a franchise to the Berney Traction Co.

Catonsville, Md.—Jackson C. Gott, 218 N. Charles St., Baltimore, is stated to have prepared plans for a power house for the United Rys. & Electric Co., to be erected near Catonsville. It will be a 1-story brick building, 60x64 ft., and cost about $15,000.

Mt. Holly, N. J.—The People's Traction Co. is stated to have petitioned the Bd. of Freeholders for the use of two stone roads for trolley lines. One from Mt. Holly to Smithville, the other from Mt. Holly to Burlington.

West Chester, Pa.—The West Chester, Kennett Square & Wilmington Ry. Co. is reported incorporated to operate a railway line in New Castle County, Del.; capital, $150,000.

Columbia, S. C.—The Columbia & Lexington Electric Ry. Co. is stated to have petitioned the Council for a franchise. The company will build a steel bridge across the Congaree at the foot of Senate St.

Toledo, O.—Eugene M. Hill is stated to have petitioned the Co. Comrs. for a franchise.

Youngstown, O.—The Youngstown & Ohio River Ry. & Light Co., of Salem, has been incorporated, with a capital of $10,000, to construct an electric railway from Youngstown to East Liverpool. Incorporators: S. Fishel, Ernest Mueller, and others.

Portsmouth, O.—The Portsmouth St. Ry. & Electric Light Co. is reported to be considering plans for a power house.

Michigan City, Ind.—The Michigan City Traction Co. has been incorporated, with a capital of $50,000, by Col. Russell B. Harrison of Indianapolis, Jere. B. Collins, and Minrad A. Schutt, of Michigan City.

Kaukauna, Wis.—G. W. Knox and H. P. Knuth are reported to have secured right of way for an electric railway about 18 miles in length from Kaukauna through Wrightown and Little Rapids to De Pere.

Lansing, Mich.—The City Council is stated to have granted the Michigan Traction Co. a franchise for an electric railway to Battle Creek.

Kalamazoo, Mich.—S. J. Dunkley, W. S. Dewing, and others, of South Haven, are reported interested in the construction of an electric railway between Kalamazoo, South Haven and Paw Paw.

Logansport, Ind.—Surveys are being made for an interurban railway from Frankport to Logansport via Michigantown and Burlington. D. A. Coulter, of Frankport, is at the head of the organization.

Wabash, Ind.—The Wabash & Rochester Electric R. R. has purchased about all its right of way and expects to commence building not later than Jan. 1, 1903. Wm. Tuttle, Pres.

Indianapolis, Ind.—The Co. Comrs. are stated to have granted a franchise to the Indianapolis, Lebanon & Frankfort Traction Co.

Beaver Dam, Wis.—The City Council is stated to have granted a franchise to the Madison & Northeastern Ry. Co. The company proposes constructing a line from Madison to Fond du Lac to connect with the Fond du Lac Bay Line.

Anderson, Ind.—The City Council is stated to have granted the Union Traction Co. an addition of 31 years to its franchise. The company in return proposes constructing a line to Elwood by way of Franklin, a line to Middleton by way of Daleville and to enlarge the central power house in this city.

Buckhannon, W. Va.—A charter has been granted to the Clarksburg & Buckhannon Electric R. R. Co., with a capital of $300,000, to construct a line between Clarksburg and Buckhannon. D. Bailey and G. F. Stocker, of Buckhannon, and D. W. Jacobs, of Clarksburg, are among the incorporators.

Kenton, O.—The Findlay, Kenton & Bellefontaine Electric Ry. Co. is stated to have petitioned the Council for a franchise.

Muskegon Heights, Mich.—Jos. Kirwin, representing the Grand Rapids, Grand Haven & Muskegon Ry. Co., of Grand Rapids, has petitioned the Village Council for a right of way on Lake Harbor St. to Mona Lake.

Wausau, Wis.—Dr. A. W. Trevitt, Neal Brown, and others, are stated to have petitioned the Council for a street railway franchise.

Ft. Worth, Tex.—The City Council is stated to have granted a franchise to the Northern Texas Traction Co.

Louisville, Ky.—Victor W. Lyon, of Jeffersonville, Ind., is making surveys for the Louisville Street Car Co., from Louisville to Jeffersontown, 6½ miles, and from Louisville to Worthington, 10 miles.

The stockholders of the Louisville Anchorage Pewee Valley Electric R. R. Co. are stated to have voted for improvements involving the expenditure of $1,250,000. P. Moore, Mgr., Louisville.

Walnut Ridge, Ark.—See "Water."

Port Gibson, Miss.—A charter is stated to have been granted to the Tri-State and Gulf R. R. Co. to construct a railroad from Port Gibson to Mobile, Ala., or to Gulfport, Miss.

Colorado Springs, Colo.—The City Council is stated to have granted a franchise to the Colorado Springs & Cripple Creek District Ry. Co.

Oakland, Cal.—City Clk. R. W. Church writes that the franchise for a double-track street railway (bids opened Dec. 1) has been awarded to the Oakland Consolidated Co., 12th and Washington Sts.

Berkley, Cal.—Town Clk. Chas. E. Thomas writes that the Oakland Transit Consolidated Co. of Oakland has been granted a franchise. T. W. Nelson, Ch. Engr., Oakland.

Oakland, Cal.—G. W. Reed, acting for J. H. MacDonald, is reported to have petitioned the Superv. and City Council for a franchise for a street railway, as an extension of the one in Pleasant Valley.

RAILROADS.

York Haven, Pa.—The York Haven & Rowenna R. R. Co. has been incorporated, with a capital of $100,000 to construct a railroad from York Haven to Rowenna, a distance of 6 miles. Incorporators: Samuel Rea, Chas. E. Pugh, both of Philadelphia, and others, all officials of the Pennsylvania R. R. Co.

Brooklyn, N. Y.—A press report states that the Pennsylvania R. R. Co. proposes constructing a bridge over the East River at Ward's Island and a railroad around Brooklyn. The plan is reported to be entirely independent of the tunnel plan. This line will connect the terminal at Bay Ridge on the Long Island shore with that at Greenville, N. J., and will be employed for the transportation of freight. W. H. Brown, Ch. Engr.; Samuel Rea, Vice-Pres., Philadelphia, Pa.

Buffalo, N. Y.—The Niagara Transfer Ry. Co., of Buffalo, has been incorporated, with a capital of $200,000, to construct and operate a steam railroad from Buffalo to Tonawanda. Directors: John C. Conway, Wm. H. Alport, Tracy C. Becker, and others, all of Buffalo.

Ralston, Pa.—The Crary Construction Co., 220 B'way, N. Y. City, is stated to have secured the contract for building 16 miles of steam road connecting the Northern Central at Ralston, Pa., with the Lehigh Valley at Towanda. The road is owned by the Susquehanna & New York R. R. Co.

Pittsburg, Pa.—The Council is stated to have passed an ordinance granting the Pennsylvania R. R. Co. permission to construct its East End branch, and also amended the Wabash ordinance so that the Pennsylvania can build an elevated line along Duquesne way under the Wabash tracks that will extend across Allegheny River to the North Side. W. H. Brown, Ch. Engr., Philadelphia.

Thurmont, Md.—The Monocacy Valley & Frederick R. R. Co. has been incorporated with a capital of $120,000 by Alex. Ramsburg, Luther Zimmerman, and others, of Frederick, and L. R. Waesche, of Thurmont. The Monocacy Valley R. R., which is 4 miles long, running from Thurmont to the Catoctin Furnace, will be acquired by the new company and extended to Frederick, a distance of 11 miles.

Bedford, Pa.—The Bedford & Western R. R. Co. has been incorporated, with Geo. H. Stein, of Philadelphia, as Pres., to build a steam road from Mt. Dallas, Bedford county, to Geiger's, Somerset county.

Bluefield, W. Va.—The Norfolk & Western R. R. Co. is stated to have completed plans for the expenditure of $500,000 in improvements in Bluefield.

Cincinnati, O.—The Cincinnati, Dayton & Ft. Wayne Ry. Co., of Dayton, has been incorporated, with a capital of $1,000,000, to construct a railroad with terminals to be at Cincinnati and a point on the Indiana line in Van Wert County, where it will connect with another part of the system running to Ft. Wayne, Ind.

Charleston, Mo.—The Charleston & Mississippi River R. R. Co. has been incorporated, to build a standard gauge railroad from a point in Scott County, Mo., to a point on the Mississippi River opposite Hickman, Ky., and to pass through or near Charleston; length of the road to be about 50 miles. Incorporators: Paul P. Moore and J. Hart, of Charleston, and others.

St. Louis, Mo.—W. S. McChesney, Jr., Gen. Mgr. of the Terminal R. R. Assoc. of St. Louis, is stated to have awarded contracts for terminal extension and improvement, involving an expenditure of about $3,000,000, to Jas. Stewart & Co. of St. Louis and Fuller & Co., of New York, N. Y.

Hazen, Ark.—The Hazen & Northern R. R. Co. has been incorporated, to construct a railroad from Hazen to Des Arc, Searcy and Heber, a distance of 53 miles.

Pocahontas, Ark.—A charter has been granted to the Arkansas & Northern R. R. Co. to construct a railroad from Pocahontas to Newport by way of Black Rock, a distance of 75 miles; capital, $1,000,000. Dr. J. H. Meyers, of Black Rock, is the Pres.

Eldon, Mo.—A charter has been granted to the Osage & Ozark R. R. Co., with a capital of $250,000, to build a line 25 miles in length from Eldon to the Osage Iron Works in Camden County. Incorporators: A. F. Cox, W. H. Glaskin, and others, of Kansas City, Mo.

Granger, Tex.—A charter has been granted to the Granger, Georgetown, Austin & San Antonio Ry. Co. to build a line 80 miles in length, from Granger, through Austin, to San Marcos, Tex.

Ft. Smith, Ark.—A press report states that the Arkansas Valley & Guthrie, the Frisco line will be extended to Fort Smith, Ark. C. D. Purdon, of St. Louis, Mo., is Ch. Engr., Frisco System.

Stockton, Cal.—The Stockton & Beckwith Pass Ry. Co. has been incorporated, with a capital of $15,000,000, to construct a railroad from Stockton to Purdoy, a total distance of 270 miles. Directors: H. F. Fortmann, J. Dalzell Brown, and others.

PUBLIC BUILDINGS.

Marlboro, Mass.—A $36,000 brick building is to be erected for use as a library.

Malden, Mass.—The Trus. of the Men's Club of the Universalist Church are stated to have decided on plans for a new church and a club house, to cost about $70,000.

Providence, R. I.—The plans of Thornton & Thornton have been accepted for a State Sanatorium to be erected at Burrillville. The plans call for 4 buildings all connected to be built of wood, with stone underpinning. Lewis J. Pierce will furnish material and erect the buildings, including heating and plumbing, for $55,150.

Perkasie, Pa.—Local press reports state that Chas. W. Bolden & Co., Archts., Philadelphia, will receive bids until Dec. 20 for erecting a new structure for the St. Stephen's Reformed Church at Perkasie.

Claysville, Pa.—The Presbyterian Congregation is about to erect a $15,000 church. Bids have not yet been asked.

Philadelphia, Pa.—The contract for the erection of 8 steel and glass pavilions for consumptive wards at the Philadelphia Hospital is stated to have been awarded to John H. Jordan, 2118 Oxford St., at $125,000.

Baltimore, Md.—The Comn. having in charge the erection of an armory for Troop A is stated to have rejected bids received for the erection of the building, as all were in excess of the appropriation, which is $50,000.

New York, N. Y.—Bids are wanted Dec. 22 for furnishing material and erecting a comfort station at North Meadow, Central Park. Wm. R. Willcox, Comr. of Parks.

Brooklyn, N. Y.—Bids are wanted Dec. 24 for furnishing material and making general repairs and alterations to interior of Borough Hall, Boro. of Brooklyn. J. Edw. Swanstrom, Boro. Pres.

Schenectady, N. Y.—It is stated that the New York State Electrical Laboratory Comn. has approved plans for a State electrical laboratory; cost of buildings and equipments will be between $250,000 and $300,000.

Batavia, N. Y.—The Bd. of Mgrs. of the State School for Blind at Batavia are stated to have decided to erect a power house, heating plant, and laundry; probable cost, $30,000.

Brooklyn, N. Y.—Bids were opened Dec. 3 for 3 public comfort stations, at Division Ave. and Broadway, Fulton and Joralemon Sts., and Fulton St. and Flatbush Ave. The bid of Thos. Dwyer, 1st Ave., bet. 107th and 108th Sts., N. Y., was the lowest on the first two, being $23,000 for all. On the last Thos. G. Carlin, 215 Montague St., bid $22,950 for hot water heating and $23,000 for steam. The bids exceed the appropriation.

Jesup, Ga.—T. J. Darling, of Waycross, is stated to have secured the contract for erecting the court house for $18,950.

Canton, O.—Bids will be received at the office of L. W. Thomas & Co., Archts., Geo. D. Harter Bank Bldg., Canton, until Dec. 26 (not Dec. 20 as previously stated) for erecting the Canton Auditorium and Market House. C. C. Loyd, City Clk.

Bids are wanted Dec. 29 for $53,000 Auditorium and Market House Bonds. C. C. Loyd, City Clk.

Bids will be received by M. W. Oberlin, Co. Aud., until Dec. 27 for furnishing material and building the superstructure of the Woman's Cottage at the Stark Co. Infirmary, excepting the plumbing and heating.

Denison, Ia.—The plans of Cox & Schoentgen, of Council Bluffs, are stated to have been accepted for the Carnegie Library.

Carthage, Ill.—The Hancock Bd. of Superv. is stated to have decided to erect a court house, to cost about $75,000. Geo. W. Carlisle, of Ferris, Chmn. Bd. of Superv.

Milwaukee, Wis.—The plans of Ferry & Clas, 419 Bway., are stated to have been accepted for a $25,000 building for the Children's Free Hospital.

Huntington, Ind.—Bids are wanted Dec. 31 for erecting the St. Peter's Reformed Church. Ed. Zigerli, Secy.

Ishpeming, Mich.—A $15,000 Carnegie Library will probably be built in the spring.

St. Paul, Minn.—The following bids were opened Dec. 2 by the Bd. of State Capitol Comrs. for the interior stone and marble work for the Minnesota Capitol—*a*, for complete work; *b*, Mankato stone; *c*, Bedford stone; *d*, Joliet stone; *e*, sandstone; *f*, marble; *g*, White Vermont marble: Pickel Marble Co., St. Louis, Mo., *a*, $825,375; *c*, $308,500; *f*, $492,000; *g*, $406,800. Grant Marble Co., Milwaukee, Wis., *f*, $526,000. Butler Bros., St. Paul, *a*, $782,000; *b*, $298,984; *c*, $261,603; *d*, $314,023; *e*, $191,549; *f*, $446,900; *g*, $340,000. Peoria Stone & Marble Wks., Peoria, Ill., *a*, $832,375; *c*, $305,897; *d*, $357,280; *f*, $510,000; *g*, $425,000. Batterson & Eisele, New York City, *f*, $552,244; *g*, $644,475. R. C. Fisher & Co., New York City, *f*, $543,459; *g*, $616,980.

Green Bay, Wis.—Bids will be received until Dec. 16 by the State Bd. of Control, at Madison, for furnishing material and erecting a hospital building at the Wisconsin State Reformatory, at Green Bay. Ferry & Clas, Archts., Milwaukee.

Decorah, Ia.—It is stated that bids are wanted Jan. 6 for the purchase of $75,000 court house bonds. F. A. Maaters, Co. Aud.

Columbus, O.—The citizens of Franklin County are reported to have recently voted to issue $250,000 bonds for the erection of a memorial building.

Gallipolis, O.—Frank Packard, of Columbus, is stated to be preparing plans for 8 cottage buildings for the Gallipolis State Hospital for Epileptics; total cost, $120,000.

Chicago, Ill.—Henry J. McMullen, 1680 W. 124th St., is stated to have prepared plans for an edifice for the R. C. Church of the Blessed Sacrament to be erected on 22d St. and Central Park Ave., to cost about $100,000. Rev. J. Dunne, Pastor.

Warren, Ark.—The Comrs. of Bradley Co. are stated to have adopted the plans of F. W. Gibb, of Little Rock, for a $40,000 court house.

Houston, Tex.—City Secy. D. D. Bryan writes that bids will be received until Feb. 2 for the construction, upon plans prepared by Geo. E. Dickey & Co. of Houston, of a City Hall and Market House combined, a 2-story brick building to cost $80,900.

Grand Junction, Colo.—It is stated that bids are wanted Jan. 23 for erecting a stone and brick jail.

Winnipeg, Man.—Plans and specifications will be received until Jan. 15 by the Chmn. of the Special Library Com. for erecting a Carnegie Library, on William Ave., to be faced with Manitoba stone, and the cost, including the fixtures, is not to exceed $75,000; $300 is to be given for the first plan, $200 for the second and $100 for the third plan. The architect whose plans and specifications are selected is to give his personal attention to the supervising of the work. C. J. Brown, City Clk.

Chepstow, Ont.—It is stated that bids are wanted Jan. 12 for erecting the superstructure of the R. C. Church at Chepstow. Arthur W. Holmes, Archt., 170 Spadina Ave., Toronto.

BUSINESS BUILDINGS.

Laconia, N. H.—The Masonic Temple is reported to have been destroyed by fire Dec. 5.

Boston, Mass.—Plans have been submitted to the Comr. of Bldgs. for approval of a theater to be erected for the R. B. Brigham Estate at 680 to 692 Washington St.; estimated cost, $200,000.

Greenfield, Mass.—Frissell & Keefe have received the contract for a 5-story brick addition, 50x112 ft., to the American House, Greenfield. B. Hammett Seabury, of Springfield, is the Architect. R. F. Hawkins Iron Wks. will do the iron work; there will be metal ceilings, modern plumbing, electric lights, etc.

Brooklyn, N. Y.—Huberty & Hudswell are stated to have secured the contract for erecting the 10-story building at 391 to 393 Fulton St. for the Williamsburg Trust Co. and the Empire State Surety Co.; it will cost about $85,000.

Philadelphia, Pa.—W. Frisbey Smith, 1345 Arch St., is stated to have been selected to prepare plans for a building for amusement and exhibition purposes to be erected by the Philadelphia Casino Co. It will be of brick, 3 stories high, 200x300 ft., and have a seating capacity of 6,000.

Philip Haibach is stated to have secured the contract for a brew and mill house addition to the brewery of Theo. Finkenauer, at Germantown and Columbia Aves. It will be a 4-story brick structure, 50x74 ft., and cost $40,000.

Carl P. Berger, 14 S. Broad St., is stated to have prepared plans for a 7 story brick apartment house and store building to be erected at 1208 Walnut St. for Chas. B. Joy.

Wilkes-Barre, Pa.—It is stated that the Cannon Ball Electric R. R. Co. will erect a depot and freight sheds on E. Market St.

Buffalo, N. Y.—R. A. Wallace, Anderson Bldg., and Esenwein & Johnson, Ellicott Sq., have prepared plans for a 3-story brick building on Franklin and Court Sts. for W. J. Schlaefer, to be occupied by the National Casket Co.; cost, $20,000.

Reading, Pa.—Archt. Head is stated to have completed plans for a hotel to be erected on the Central House and Merzbacher properties, by John Barbey. It will be 7 stories high, with a frontage of 85 ft., of stone, terra cotta and brick.

Charlotte, N. C.—It is reported that the Piedmont Realty Co. of Charlotte, N. C., will soon begin the erection of a hotel at Charlotte, to cost $150,000.

Savannah, Ga.—The contract for erecting an 8-story bank and office building for Germania Bank in Savannah, has been awarded to Grant Wilkins, of Atlanta, Ga., for $198,000.

Norfolk, Va.—It is reported that the New Gladstone Hotel will be renovated, remodeled and an extension erected to contain about 40 rooms.

Upper Alton, Ill.—The Chicago & Alton R. R. Co. will erect a depot at Upper Alton. H. F. Baldwin, Ch. Engr., Chicago.

Angola, Ind.—The Odd Fellows are stated to have accepted plans for an $18,000 building.

Rockford, Ill.—The Mead Building, a 5-story brick structure, occupied by the Wortham Bros. & Co. Department Store and the Rockford Business College, is reported to have been destroyed by fire Dec. 4th.

Milwaukee, Wis.—Crane & Barkhausen are stated to have prepared plans for a warehouse for the R. A. Johnston Co., to be erected on Florida and Clinton Sts., to cost $20,000.

Antigo, Wis.—J. H. Jeffers, of Wausau, is stated to have completed plans for an opera house to be erected in Antigo by the German Maennerchor Society.

Stillwater, Minn.—The Grand Opera House is reported to have been destroyed by fire Dec. 5th.

Sioux City, Ia.—The Baltimore Hotel Co., of Kansas City, Mo., is reported interested in the erection of a hotel at Sioux City, to cost about $500,000.

Cleveland, O.—John Y. Hall & Son, 610 New England Bldg., are reported interested in the erection of an 8-story hotel, 304x208 ft., on Euclid Ave. opposite Kennard St.

Chicago, Ill.—It is stated that the Pennsylvania R. R. Co. will build a roundhouse, 312x108 ft., on Dodge and Stewart Aves., at a cost of $90,000.

Kansas City, Mo.—C. A. Smith, N. Y. Life Bldg., is the architect for a $75,000 brick warehouse to be erected on Walnut St. north of 6th St., for the Merchants' Refrigerator Co.

The Home Tel. Co. is about to build a brick office building on Baltimore Ave. and 11th St., cost $60,000. Architect, C. A. Smith, N. Y. Life Bldg.

St. Louis, Mo.—A press report states that a theater will be erected in connection with the new hotel at Grand Ave. and Olive St. to cost about $750,000. Jas. K. Hackett is reported interested.

Louisville, Ky.—The Louisville & Nashville R. R. Co. is stated to have decided to erect a depot on Baxter Ave. The company also proposes constructing a 10-story office building at 10th St. and Bway. R. Montfort, Ch. Engr., Louisville.

Kansas City, Mo.—The Manufacturers' & Merchants' Bldg. Assoc. is reported incorporated, with a capital of $40,000, to erect a club house on 10th and Wyandotte Sts. for the Manufacturers' Assoc. J. J. Swofford, Pres.; F. P. Neal, Secy.

Jackson, Tenn.—The Dirs. of the Y. M. C. A. are stated to have decided to erect a $20,000 building.

Jackson, Tenn.—The Y. M. C. A. is reported to be considering the erection of a $20,000 building. I. L. Curtis, Pres.

Los Angeles, Cal.—It is stated that the Com. of the local lodge of Elks reported favorably on a plan to expend $200,000 for the purchase of a site and erection of a 5-story structure.

NEW YORK CITY.

473 & 475 E Houston St, br and stone stores & tenemt; c, $25,000; o, Feldman & Weiss; a, G F Pelham.

5th Ave, 17th & 18th Sts, br and stone store, c, $325,000; o, J C Lyons Bldg & Operating Co; a, Buchman & Fox.

11 to 19 W 19th St, 10 to 16 W 20th St, br and stone loft & store bldg, c, $775,000; o, Henry Corn; a, Robt Maynicke.

56 & 58 W 67th St, br warehouse, c, $60,000; o, Chas R Saul; a, Fredk Jacobsen.

309 & 311 W 120th St, br factory, c, $40,000; o, Schinasi Bros; a, H C Carrel & C I Berg.

78 & 80 Broad St, 1 and 6 story extension, to br and stone office bldg, c, $80,000; o, Maritime Assoc of the Port, New York; a, Frank Freeman.

205 to 211 West End Ave, 6 story extension, to br stable, c, $25,000; o, Sherman Square Stable Co; a, Jas E Ware & Son.

DWELLINGS.

Boston, Mass.—Plans have been filed for a $60,000 4-story, brick and stone, one family dwelling, to be located on the Fenway near Boylston St., Back Bay, for Fannie Foster. Builders, McNeil Bros., 196 Freeport St., Dorchester; Architects, Peabody & Sterns, 53 State St.

Richmond, Ind.—Contractors Louck & Hill, 200 N. 4th St., will erect an apartment house, which will cost $60,000.

Seattle, Wash.—Plans have been prepared by Bebb & Mendel for a 5-story apartment house to be built by Antoine F. Stander, at 4th Ave. and Marion St.

NEW YORK CITY.

Permits for the following buildings have been issued: o, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

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200 to 202 Henry St, br tenemt, c, $45,000; o, Kotzen & Livingston; a, Bernstein & Bernstein.

141 & 143 Ludlow St, br tenemt, c, $40,000; o & b, Abraham Silverson; a, Geo F Pelham.

120 E 70th St, br and stone dwellg, c, $30,000; o, Arthur C Train; a, Wm S Post; brs, Geo Vassars Sons & Co.

106th St & Manhattan Ave, 2 br flats, c, $200,000 all; o, Park Construction Co; a, Moore & Landseidel.

West End Ave & 93d St, stone front dwellg, c, $45,000; o, Walther Luttgen; a, Wm B Tuthill.

20 E 54th St, 4 story & basement extension to br dwelling, c, $32,500; o, Granite Realty Co; a, Radcliffe & Kelley.

SCHOOLS.

Arlington, Mass.—This town will build a 4-room brick school, to cost about $20,000. Prescott & Sidebottom, 113 Devonshire St., Boston, are the architects.

Cambridge, Mass.—The Alumnæ of Radcliffe College is stated to have secured $100,000 for the erection of a building as a memorial to Mrs. L. Agassiz.

Boston, Mass.—Contracts for school work are stated to have been awarded as follows: To G. W. Harvey, for erecting a school on Huntington Ave. and Kenwood St. for $123,500, and to A. B. Franklin, 167 Ft. Hill Sq., for ventilating and heating a school on Norman St., West End, for $25,112.

Geneseo, N. Y.—Bids will be received until Jan. 30 by Chas. R. Skinner, State Supt. of Pub. Instruction, Albany, for construction, electric lighting, plumbing and gas piping, and heating of a library building at the State Normal School, Geneseo.

Camden, N. J.—A $50,000 school is to be erected in the spring.

Sharon, Pa.—This city proposes to erect a $60,000 school.

Greenville, Pa.—The School Bd. is reported to be considering the advisability of erecting a school, to cost about $60,000.

Brooklyn, N. Y.—Bids are wanted Dec. 22 for installing ventilating and heating apparatus in School No. 130, Boro. of Brooklyn. C. B. J. Snyder, Supt. of School Bldgs., N. Y. City.

New York, N. Y.—Bids are wanted Dec. 22 for installing ventilating and heating apparatus in School No. 188; also separate bids for erecting School No. 24, both in Boro. of Manhattan. C. B. J. Snyder, Supt. of School Bldgs.

White Plains, N. Y.—Bids will be received by the Bd. of Educ. of Union Free School Dist. No. 1 until Dec. 16 for furnishing material and erecting an 8-room brick school. W. A. McConnell, Clk.

Buffalo, N. Y.—Supt. of Educ. H. P. Emerson, in his annual report to Council, recommends the purchase of sites and the erection of 8 schools.

Glenville, O.—The citizens are stated to have voted to issue $65,000 bonds for the purchase of a site and the erection of a high school.

Forest, O.—Kramer & Harpster, of Findlay, are reported to be preparing plans for a $20,000 school.

New Prague, Minn.—Mahlke & Franksen, of Mankato, are stated to have secured the contract for erecting a high school, for $17,966.

Upland, Ind.—It is reported that Taylor Univ. will erect a $25,000 memorial building.

Bloomington, Ill.—City Engr. Elmer Folsom writes that a $40,000 school is to be built.

Huntington, W. Va.—It is stated that bids will be received until Jan. 1 by J. B. Stewart, Archt., Huntington, for erecting 2 schools at a cost of about $40,000.

Appleton, Wis.—It is stated that the 4th School District is to erect a $20,000 addition for manual training department.

Jackson, Miss.—J. F. Barnes is stated to have secured the contract for erecting a building for the University of Mississippi, for $47,000.

Stockton, Cal.—Jas. A. Barr, Supt. Stockton Schools, writes that the lowest bid received for constructing the high school was $112,000. The architect, Geo. Rushforth, 134 E. Main St., will assume the contract for the sum of $100,000.

Salt Lake City, Utah.—Bids will be received until Dec. 22 by the Com. on Bldgs. and Grounds of the Bd. of Educ. for furnishing material and erecting a 17 room school, excepting steam heating and plumbing. A. G. Giauque, Chmn.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—The only bid received Dec. 6 for the removal of snow and ice in Manhattan Boro. till April 15, 1903, was that of Wm. Bradley, 86th St. and Broadway, for 25 cents per cu. yd. (recommended for award).

Jersey City, N. J.—The Bd. of Street and Water Comrs. has awarded to Henry Byrne the contract for street cleaning and the removal of ashes and garbage for the year ending Nov. 30, 1903, at his bid of 93% of Ch. Engr. Van Keuren's standard price. Appropriation, $68,000.

Franklin, Pa.—The Council has passed a resolution that the Ordinance Com. be instructed to prepare and report an ordinance covering the garbage question, crematory, etc.

Syracuse, N. Y.—Bids will be received until Dec. 15 by the Bd. of Contract and Supply, for furnishing 2 street sweepers for the use of the Dept. of Pub. Wks. Wm. H. Jones, Clk.

Atlanta, Ga.—Dr. E. H. Richardson, Secy. Bd. of Health, writes that the only bid received Dec. 1 for the collection and disposal of garbage, etc., was from the Lester Furnace Co. of Atlanta, John E. Murphy, Pres., for the disposal of all garbage and night soil of the city, for the term of 3 years, by incineration, which bid as follows: For each barrel of night soil 12½ cts.; for each cart load of garbage and trash (each two horse wagon to be counted as two cart loads) 12½ cts., all to be delivered at Co.'s furnace by the city, provided there are as many or more cart loads of garbage and trash as there are barrels of night soil delivered to the furnace each day; provided, that not less than 15,000 cart loads and barrels shall be delivered during each month, or in any case if less than this quantity is delivered compensation shall not be less than $1,666.66 per month.

Massillon, O.—Wood & James, of Toledo, representing the International Waste Utilization Co., has made a proposition to Mayor Bell for the collection and disposal of all forms of garbage of the city.

GOVERNMENT WORK.

Boston, Mass.—The following bids were opened Dec. 6 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a brick and steel smithery building, at the Boston Navy Yard; estimated cost, $139,000—*a*, for building complete in accordance with plans and specifications; *b*, with translucent skylights in place of Paradigm skylights as specified; *c*, for building complete with the exception of arch over 1st Ave., from Bldg. No. 104 to Bldg. No. 105; *d*, with sheet-metal frames and sash substituted for wood; *e*, alternate bid for completing work within the appropriation: Wheaton Building & Lumber Co., Putnam, Conn., *a*, $144,000; *b*, $143,700; *c*, $134,600; *d*, $151,000; *e*, $139,000. Ambrose B. Stannard, New York City, *a*, $147,276; *b*, $145,976; *c*, $136,776; *d*, $153,676. L. L. Leach & Son, Chicago, Ill., *a*, $147,463; *b*, $146,853; *c*, $130,567; *d*, $136,583. Horton & Hemenway, Providence, R. I., *a*, $177,651; *b*, $176,695; *c*, $160,595; *d*, $181,945. Penn Bridge Co., Beaver Falls, Pa., *a*, $153,869; *b*, $153,519; *c*, $144,837; *e*, $146,369, $143,719 and $142,369.

Newport, R. I.—Bids are wanted at the office of Constructing Q. M., Newport, until Jan. 7 for constructing, plumbing, electric wiring and installing hot water heating system in hospital at Ft. Greble, as advertised in The Engineering Record.

Newport, R. I.—Bids will be received at the U. S. Engrs. Office until Jan. 15 for dredging and constructing jetties in Nantucket Harbor, Mass., as advertised in The Engineering Record.

Boston, Mass.—The following bids were opened Nov. 29 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for rebuilding marine shop No. 2, Building No. 42, at the Boston Navy Yard; estimated cost, $91,000; *a*, for building complete in accordance with plans and specifications; *b*, with wooden window sash and frames used in place of sheet metal; *c*, alternate bid in case other bids exceed appropriation available: L. L. Leach & Son, Chicago, Ill., *a*, $102,000; *b*, $99,000; *c*, $90,000. Norcross Bros., Boston, *a*, $101,500; *b*, $96,566. Penn Bdge. Co., Beaver Falls, Pa., *a*, $114,889; *b*, $108,889; *c*, $104,139. Champion Iron Wks., Kenton, O., for iron work, $31,210.

Newport, R. I.—The following bids were opened Dec. 8 by Maj. Geo. W. Goethals, Corps of Engrs., U. S. A.—I, Improving harbor at Great Salt Pond, Block Island, R. I.; *a*, dredging per cu. yd.; *b*, jetty construction per ton; II, improving the harbor at Newport, R. I.; *a*, dredging per cu. yd.; *b*, removing boulders per cu. yd.; III, Repairs to breakwater per ton, Harbor of Refuge at Block Island, R. I.: John P. Randerson, Albany, N. Y., I, *a*, 34c. Chas. M. Cole, Fall River, Mass., II, *a*, 34⅞c.; II, *b*, $18. J. S. Packard Dredging Co., Providence, R. I., II, *a*, 37c.; II, *b*, $15. Chas. H. Latham, Hartford, Conn., I, *a*, 26.7c. E. S. Belden & Sons, Hartford, Conn., III, $2.17. E. S. Belden & Sons, I, *b*, $1.23.

Washington, D. C.—Bids are wanted at the Treasury Dept., Washington, until Jan. 12, for the construction (except plumbing and mechanical equipment) of the Physical Laboratory, National Bureau of Standards, as advertised in The Engineering Record.

Philadelphia, Pa.—The following bids were opened Dec. 6 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for removing material from the Delaware water front, Navy Yard, League Island, Pa.: River & Harbor Improv. Co., Camden, N. J., at 23.4 cts. per yd.; American Dredging Co., Phila., 24 cts. per yd. Estimated cost, $24,500.

Washington, D. C.—Lieut.-Col. Chas. J. Allen, Corps of Engrs., U. S. A., writes that the only bid received Dec. 3, for dredging in Rappahannock River, Milford Haven and Carters Creek, Va., was from John Miller, of Washington, at 33 cts. per cu. yd. for Rappahannock River and Milford Haven, and 28 cts. for Carters Creek.

Washington, D. C.—The following bids for dredging and furnishing riprap stone for the Anacostia River improvement were opened Nov. 26 by Lieut. Col. Chas. J. Allen, Corps of Engrs., U. S. A.:

For dredging—Sanford & Brooks Co., Baltimore, Md., in channel, 10.95 cts. per cu. yd.; in trench, 14.75 cts. per cu. yd.; total, $136,710 (awarded). Atlantic, Gulf & Pacific Co., New York, N. Y., in channel, 13.4 cts. per cu. yd.; trench, 13.4 cts. per cu. yd.; total, $165,624. Coastwise Dredging Co., Wilmington, Del., in channel, 13½ cts. per cu. yd.; in trench, 18 cts. per cu. yd.; total, $168,480. Henry Steers, Jr., New York, N. Y., in channel, 15½ cts. per cu. yd.; in trench, 20 cts. per cu. yd.; total, $193,200.

For riprap stone—Chas. G. Smith & Son, Washington, D. C., at $1.07½ per cu. yd.; total, $8,600. Brennan Constn. Co., Washington, D. C., at $1.40 per cu. yd.; total, $11,200. Martin McNamara, Washington, D. C., at $1.83 per cu. yd.; total, $14,040.

Ft. Myer, Va.—Capt. W. F. Clark, Q. M., 2d Cavalry, writes that bids for the construction of four officers' quarters (three double and one field) at this post were opened Nov. 22, and contract awarded to W. H. McCray, Atlantic Bldg., Washington, D. C., as follows: Construction proper, at $61,920; plumbing, at $6,401; heating and gas piping, at $3,878; total, $72,200.

Ft. Myer, Va.—The following bids were opened Nov. 22 by Capt. W. F. Clark, Q. M., for the construction of officers' quarters; *a*, 1 Lieutenants' Quarters; *b*, 2 Lieutenants' Quarters; *c*, Captains' Quarters; *d*, Field Officers' Quarters: Meade & Reynolds, *a*, $17,500; *b*, $35,000; *c*, $24,500; *d*, $14,000. W. H. McCray, *a*, $17,300; *b*, $34,400; *c*, $24,000; *d*, $14,375. Jas. H. Coster, *a*, $19,030; *b*, $38,060; *c*, $24,690; *d*, $16,475.

Bids, opened at the same time, for heating were as follows, for Lieutenants' Quarters, Captains' Quarters and Field Officers' Quarters, respectively: W. W. Biggs Heating & Vent. Co., $1,851, $1,311 and $771. W. H. McCuen & Co., $1,773, $1,279 and $693.

Norfolk, Va.—The following bids were opened Nov. 29 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a brick and steel storehouse for equipment at the Norfolk Navy Yard; estimated cost, $68,000: A. B. Stannard, New York City, $75,500 and $73,500; Holtclaw Bros., Hampton, Va., $86,653 and $88,499; Penn Bridge Co., Beaver Falls, $74,830 and $76,900; Congress Const. Co., Chicago, $82,943 and $83,843; Champion Iron Wks., Kenton, O., for iron work, $29,568.

Muncie, Ind.—Plans are now being prepared for the government building, to cost $80,000.

San Antonio, Tex.—Local press reports state that Brig.-Gen. Wm. Crozier, Ch. of Ordnance, of the U. S. A., has announced his intention to recommend an appropriation of $150,000 for improvements to arsenal at San Antonio.

Boise, Idaho.—The following bids were opened Nov. 29 at the Treasury Dept., Washington, D. C., for furnishing steam heating and ventilating apparatus complete in place for the U. S. Public Building at Boise; the second amount in each case is for pipe coverings: Bowers Heating Co., Milwaukee, Wis., $11,028, $1,068; Saxton & Phillips, Milwaukee, Wis., $9,933, $930; Chas. B. Kruse Heating Co., Milwaukee, Wis., $9,692, $780; P. J. Morris, Salt Lake, $11,698, $525; Hurley & Co., St. Paul, $16,722, $1,300; Kostermeyer Co., Lincoln, Neb., $11,377, $605; Idaho Hardware & Plumbing Co., Boise, $14,985, $725.

Bids opened Nov. 25 for the installation of a conduit and electric wiring system for the U. S. Public Building at Boise were as follows: Cuthbert & Black, Chicago, $3,487; Henry Newgard & Co., Chicago, $3,790; Doss Bros. Electric Co., Denver, $3,825; Salt Lake Electric Supply Co., Salt Lake, $4,883; W. J. Grey & Co., Minneapolis, $4,695; Riddle & Landon, St. Paul, $3,314.

Ft. Lawton, Wash.—Major G. S. Bingham, U. S. A., Constructing Q. M., Seattle, Wash., writes that the contract for constructing 7 buildings at this post, including construction, plumbing, gas piping and steam heating, was awarded to John H. Estes, of Tacoma, Wash., Nov. 29, for the sum of $108,990.

MISCELLANEOUS.

Boston, Mass.—Bids will be received until Dec. 16 by the Boston Transit Comn. for constructing a concrete roof for the East Boston tunnel, in State St. Howard A. Carson, Ch. Engr.

Springfield, Mass.—The City Council has passed and Mayor Ellis signed the order appropriating $225,000 to be expended under the direction of the Park Comrs. for the extension of Court Sq. to the river.

New York, N. Y.—Bids are wanted Dec. 23 for furnishing material and removing the 2 existing piers, and building a new wooden pier, with appurtenances, at the foot of E. 68th St., East River. McDougall Hawkes, Comr. of Docks, Dept. of Docks and Ferries.

New Brighton, S. I., N. Y.—Bids are wanted Dec. 19 for furnishing and delivering 12,200 tons of broken stone and screenings of trap rock of Staten Island granite, and 1,500 tons of limestone screenings, also 1,500 tons of ⅜-in. "Tomkins Cove" (or similar) limestone screenings. Geo. Cromwell, Boro. Pres., New Brighton.

Brooklyn, N. Y.—The only bid received Dec. 10 by J. Edw. Swanstrom, Boro. Pres., for 42,000 cu. yds. of dredging in Gowanus Canal and elsewhere, was from the Morris & Cummings Dredging Co., 17 State St., N. Y., at 73 cts. per cu. yd. Work to be readvertised.

Bolivar, N. Y.—The United Pipe Line Co., at its annual meeting, held recently in Wellsville, voted to increase its capital stock from $100,000 to $150,000 for the purpose of extending the line and making improvements. A. L. Shaner and Jas. B. Wakeman, of Bolivar, were elected directors.

Terre Haute, Ind.—The County Comrs. have granted the petition of the Sugar Creek Levee Asso. to issue $25,000 bonds with which to build a levee west of the city and protect 1,500 acres from overflows of Wabash River.

New Orleans, La.—Coleman, Malochée & Villeré, Engrs. of the Bd. of Comrs., Port of New Orleans, write that the contract for building a 900-ft. wharf at Julia St., has been awarded to J. H. Gardner Const. Co., of New Orleans, for $22,032.

St. Irenee, Que.—Bids will be received Dec. 26 by Fred. Gelinas, Secy. Dept. of Pub. Wks., at Ottawa, Ont., for constructing an extension to the wharf at St. Irenee.

Montreal, Que.—The Road Com. has agreed to pay two-thirds of the cost of a $21,000 tunnel or subway on Forsyth St., on the understanding that the Montreal Terminal will pay the other third.

NEW INDUSTRIAL PLANTS.

The Hughes Bros. Mfg. Co., Dallas, Tex., contemplates erecting a 5-story and basement, 80x121-ft. addition of mill construction. It has not been decided whether or not the power plant will be increased.

The Conanicut Mills, Fall River, Mass., are erecting a 2-story building which will have about 21,000 sq. ft. floor space. A power plant of about 250 H.-P. will be installed.

The Sheffield Car Co., Three Rivers, Mich., expects to erect immediately a 90x250-ft. foundry to be equipped with a 40-ft. traveling crane.

S. G. Hunter, Atlantic, Ia., will erect a 44x108-ft. foundry to be equipped with electric motors.

E. W. Church, Covington, Va., will quarry from 200 to 400 tons of limestone daily for fluxing, burn lime quite extensively, and erect brick kilns. He is in the market for brick machinery, rock drills, boilers, iron jackets and fire brick, and wants estimates and plans for 200 and 300-bu. lime kilns with iron ¼-in. thick.

Wm. P. Davis, Equitable Bldg., Atlanta, Ga., is interested in the slate business at Rockmart, Ga., and will organize a company to operate on a large scale in the near future.

The Oregon, Ill., Foundry Co. will erect a 60x170-ft. foundry and 50x80-ft. machine shop, to have four stories. The plant will be operated electrically, power being purchased from a local power company. F. G. Jones is interested.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: W. M. Buchanan, Odell, Ill., a 150-H.-P. direct-connected engine; C. C. Mengle, Jr., & Bros. Co., Louisville, Ky., a direct-connected unit; Magnus Metal Co., Chicago, a 150-H.-P. vertical and a 60-H.-P. horizontal engine.

The New York Continental Jewell Filtration Co. reports that it has closed a contract with the Maharaja of Mysore, India, through Capt. A. J. de Lotbiniere, Royal Engrs., English Army, who was sent from India to New York by his government for that purpose. The filter plant is to consist of four Jewell gravity filters, each 29 ft. in diameter, constructed of granite laid in Portland cement. There will be a masonry subsidence basin holding 400,000 Imperial gals. The capacity of the filter plant is to be 2,600,-600 U. S. gals. It will be erected early in the spring by one of the filter company's engineers, and is to be located at Bowringpet in the Kolar gold fields near Bangalore, Mysore. E. B. Weston, M. Am. Soc. C. E., consulting engineer. The company has also just received an order from Jones & Laughlins, Pittsburg, Pa., for a filter plant to be used in their South Side steel mill; and from Geo. Watkins & Co., Philadelphia, for a battery of filters to be used in their boiler service.

The Philadelphia Pneumatic Tool Co. has just completed the equipment of the new navy yard at Kiel, Germany, with Keller pneumatic tools. The company also reports an increasing trade on the Pacific coast; O. A. Berger, the company's representative in San Francisco, has just visited the home office, bringing with him some large orders from shipyards, steel works, etc., on the Pacific Coast.

The Crocker-Wheeler Co., Ampere, N. J., manufacturer of electrical machinery, has included among its shipments of engine type generators for the month of November one 400-Kw. for the Stephen Girard Bldg., Philadelphia; one 100-Kw. and one 125-Kw. for the Missouri Pacific Ry., St. Louis, Mo.; two 150-Kw. for the Penna. Malleable Co., McKees Rocks, Pa.; one 200-Kw. for J. L. Mitchell, Philadelphia; two 50-Kw. for the Liveright & Greenwald Bldg., Philadelphia; two 100-Kw. for the McClintic-Marshall Construction Co., Pottstown, Pa.; one 300-Kw. for the Grand Crossing Tack Co., Chicago; one 400-Kw. for the Lake Construction Co., Erie Co., Pa.; one 250-Kw. for the Wilmington, Del., City Elec. Co.; one 225-Kw. for the Pine Bluff, Ark., & Western Ry.; two 150-Kw., one 200-Kw. and one 75-Kw. for the Woodward & Lothrop Bldg., Washington, D. C. The company reports that its new mill building is now being occupied, enlarging the floor space by 60,000 sq. ft. and giving increased facilities for prompt deliveries on large orders.

The Cleveland Cliffs Iron Co. is about to install an electric power distribution system for operating mixers and blowers in its Gladstone, Mich., plant, and has recently purchased from the Westinghouse Electric & Mfg. Co. two 75-Kw., direct-current generators and eight 10-H.-P. direct-current motors. The Pioneer Iron Works, of Marquette, Mich., owned by the Cleveland Cliffs Co., will also be equipped with electrical apparatus for the operation of mixers and blowers, and the apparatus recently purchased from the Westinghouse Electric & Mfg. Co. for this plant includes ten 10-H.-P. direct-current motors and two 150-Kw., engine-type generators to be direct connected to two Westinghouse compound condensing engines. The company has also ordered a Baldwin-Westinghouse electric locomotive to be used for shifting cars in its yards.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Dec. 16.	Wellsville, O.	Dec. 6
Dec. 17.	Wilbur, Wash.	Dec. 6
Dec. 18.	Tottenville, N. Y.	Dec. 13
Dec. 18.	Long Island City, N. Y.	Dec. 6
Dec. 20.	Pumping engines, Louisville, Ky.	Oct. 25
	Adv., Eng. Record, Oct. 25 to Dec. 13.	
Dec. 20.	Havre, Mont.	Dec. 6
Dec. 22.	Lining tunnel, Paterson, N. J.	Dec. 13
	Adv., Eng. Record, Dec. 13.	
Dec. 22.	Marieville, Que.	Dec. 13
Dec. 24.	Chicago, Ill.	Dec. 13
Dec. 26.	Salt Lake City, Utah	Dec. 13
Dec. 26.	Searcy, Ark.	Dec. 6
Dec. 27.	Cincinnati, O.	Dec. 6
Dec. 27.	Meters, Cleveland, O.	Dec. 6
	Adv., Eng. Record, Dec. 6, 13.	
Dec. 29.	Gillett, Wis.	Nov. 15
Jan. 1.	Sacramento, Cal.	Nov. 22
Jan. 2.	Kansas City, Mo.	Dec. 6
	Adv., Eng. Record, Dec. 6, 13.	
——	Meters, Schenectady, N. Y.	Dec. 13
——	Great Notch, N. J.	Dec. 6

	SEWERAGE AND SEWAGE DISPOSAL.	
Dec. 16.	Philadelphia, Pa.	Dec. 13
Dec. 16.	Kansas City, Mo.	Dec. 13
Dec. 17.	Brooklyn, N. Y.	Dec. 6
Dec. 20.	Oakland, Cal.	Dec. 6
Dec. 22.	Canonsburg, Pa.	Dec. 13
Dec. 22.	Chillicothe, O.	Dec. 6
Dec. 22.	Norristown, Pa.	Nov. 29
Dec. 22.	Wabash, Ind.	Nov. 29
Dec. 26.	Salt Lake City, Utah	Dec. 13
Dec. 27.	(Ft. McKinley) Portland, Me.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Jan. 2.	Cincinnati, O.	Dec. 13
Jan. 3.	Pumping Station, Washington, D. C.	Nov. 15
	Adv., Eng. Record, Nov. 15, Dec. 6.	
Jan. 5.	Lawton, Okla. Ter.	Dec. 13
Jan. 7.	Fernandina, Fla.	Dec. 13
Jan. 6.	Columbus, O.	Dec. 13
	Adv., Eng. Record, Dec. 13.	
Jan. —	Walnut, Ill.	Dec. 13
Feb. 2.	New Orleans, La.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Feb. —	Dixon, Ill.	Dec. 13
——	Miami, Fla.	Dec. 6

	BRIDGES.	
Dec. 16.	Philadelphia, Pa.	Dec. 13
Dec. 16.	York, Pa.	Dec. 13
Dec. 17.	Columbia City, Ind.	Nov. 29
Dec. 17.	Chicago, Ill.	Nov. 1
Dec. 18.	Portland, Ind.	Dec. 6
Dec. 19.	Columbia City, Ind.	Dec. 6
Dec. 22.	New York, N. Y.	Dec. 13
Dec. 30.	Georgetown, Colo.	Nov. 29
Dec. 31.	Terre Haute, Ind.	Dec. 13
Jan. 1.	Rome, N. Y.	Dec. 13
Jan. 5.	Montezuma, Ia.	Dec. 6
Jan. 5.	Cumberland, Md.	Nov. 29
Jan. 6.	Stockton, Cal.	Dec. 13
Jan. 6.	Grand Junction, Colo	Dec. 13
Jan. 7.	Olivet, S. D.	Dec. 13
Jan. 7.	Colfax, Wash.	Dec. 13
Jan. 7.	Webster, S. D.	Nov. 29
Jan. —	Peoria, Ill.	Dec. 13

	PAVING AND ROADMAKING.	
Dec. 16.	New York, N. Y.	Dec. 13
Dec. 16.	Philadelphia, Pa.	Dec. 13
Dec. 16.	Somerville, N. J.	Nov. 29
Dec. 17.	Ft. Dodge, Ia.	Nov. 29
Dec. 18.	McKeesport, Pa.	Dec. 6
Dec. 19.	Cincinnati, O.	Dec. 13
Dec. 19.	Galion, O.	Nov. 29
Dec. 20.	Long Island City, N. Y.	Dec. 13
Dec. 20.	Williamsport, N. J.	Dec. 6
Dec. 22.	Cincinnati, O.	Dec. 6
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	
Dec. 24.	Brooklyn, N. Y.	Dec. 13
Dec. 26.	Salt Lake City, Utah	Dec. 13
Dec. 27.	Wellsville, O.	Dec. 13
Dec. 27.	Kalamazoo, Mich.	Dec. 6
	Adv., Eng. Record, Dec. 6, 13.	
Dec. 29.	Terre Haute, Ind.	Dec. 13
Dec. 30.	St. Augustine, Fla.	Dec. 6
Jan. 3.	Madison, Wis.	Dec. 13
Jan. 5.	Toledo, O.	Dec. 13
Jan. 6.	Cincinnati, O.	Dec. 13
Jan. 10.	Ft. Myer, Va.	Dec. 13
	Adv., Eng. Record, Dec. 13.	
——	Wichita, Kan.	Dec. 6

	POWER, GAS AND ELECTRICITY.	
Dec. 18.	Chicago, Ill.	Dec. 13
Dec. 18.	North Amherst, O.	Dec. 6
Dec. 20.	Havre, Mont.	Dec. 6
Dec. 20.	Philadelphia, Pa.	Nov. 22
Dec. 23.	Lexington, Ky.	Dec. 13
Dec. 23.	Cleveland, O.	Dec. 13
Dec. 26.	Searcy, Ark.	Dec. 6
Dec. 27.	Cincinnati, O.	Dec. 6
Jan. 3.	Abilene, Tex.	Dec. 13
Jan. 12.	Hot Springs, Ark.	Dec. 13
Jan. 15.	Rome, Ga.	Oct. 11
Jan. —	South Norwalk, Conn.	Dec. 13
Mar. 4.	Franchise, Manila, P. I.	Nov. 15

	GOVERNMENT WORK.	
Dec. 16.	Supplies, Washington, D. C.	Dec. 6
Dec. 16.	Ft. Hancock, N. J.	Nov. 29
Dec. 16.	San Francisco, Cal.	Nov. 29
Dec. 16.	Ft. Columbus, N. Y.	Nov. 29
Dec. 16.	Snagboat and barge, Montgomery, Ala.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 16.	Towboat, dredge, etc., Montgomery, Ala.	Nov. 15
	Adv., Eng. Record, Nov. 15 to Dec. 6.	
Dec. 17.	Washington, D. C.	Dec. 6
Dec. 17.	Baltimore, Md.	Nov. 22
	Adv., Eng. Record, Nov. 22 to Dec. 13.	
Dec. 17.	Mobile, Ala.	Nov. 22
Dec. 18.	Olympia Harbor, Seattle, Wash.	Nov. 29
Dec. 18.	Lake Wash. Canal, Seattle, Wash.	Nov. 29
Dec. 18.	Milwaukee, Wis.	Nov. 22
	Adv., Eng. Record, Nov. 22 to Dec. 13.	
Dec. 19.	Steam tenders, Nashville, Tenn.	Nov. 22
	Adv., Eng. Record, Nov. 22 to Dec. 13.	
Dec. 20.	Carson, Nev.	Dec. 6
Dec. 20.	Sheridan, Wyo.	Nov. 29
Dec. 20.	Charleston, S. C.	Nov. 15
Dec. 22.	Savannah, Ga.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29. Dec. 13.	
Dec. 23.	Ft. Barrancas, Fla.	Dec. 6
Dec. 23.	Garbage crematory, Ft. Getty, S. C.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Dec. 23.	(Ft. Rodman) Newport, R. I.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Dec. 23.	Mobile, Ala.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Dec. 24.	Ft. Brady, Mich.	Dec. 6
Dec. 26.	Ft. Williams, Me.	Dec. 6
Dec. 26.	Dredging, Savannah, Ga.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Dec. 27.	Portsmouth, N. H.	Nov. 29
Dec. 27.	Sewers (Ft. McKinley), Portland, Me.	Nov. 29
Dec. 28.	New Orleans, La.	Dec. 6
Dec. 29.	Mobile, Ala.	Dec. 6
	Adv., Eng. Record, Dec. 6, 13.	
Dec. 29.	Ft. Banks, Mass.	Dec. 6
Jan. 2.	Boston, Mass.	Dec. 6
Jan. 3.	Richmond, Va.	Dec. 6
	Adv., Eng. Record, Dec. 6, 13.	
Jan. 3.	Elevator, Helena, Mont.	Dec. 6
Jan. 3.	Wall, Philadelphia, Pa.	Dec. 6
Jan. 5.	Boston, Mass.	Dec. 6
Jan. 6.	St. Louis, Mo.	Dec. 6
Jan. 7.	Hospital (Ft. Greble), Newport R. I.	Dec. 13
	Adv., Eng. Record, Dec. 13.	
Jan. 8.	Mobile, Ala.	Dec. 6
Jan. 12.	Washington, D. C.	Dec. 13
	Adv., Eng. Record, Dec. 13.	
Jan. 14.	Helena, Mont.	Dec. 6
	Adv., Eng Record, Dec. 6, 13.	
Jan. 15.	Newport, R. I.	Dec. 13
	Adv., Eng. Record, Dec. 13.	
Jan. 15.	Norfolk, Neb.	Dec. 6
Jan. 15.	Machinery for dredge, Wash'ngton, D.C.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	

	BUILDINGS.	
Dec. 16.	Hospital, Green Bay, Wis.	Dec. 13
Dec. 16.	School, White Plains, N. Y.	Dec. 13
Dec. 16.	Engine house, New York, N. Y.	Dec. 6
Dec. 16.	Library, Fond du Lac, Wis.	Nov. 29
Dec. 17.	Pub. bldg., Brooklyn, N. Y.	Dec. 6
Dec. 19.	Almshouse, Scranton, Pa.	Nov. 22
	Adv., Eng. Record, Nov. 22.	
Dec. 20.	Church, Perkasie, Pa.	Dec. 13
Dec. 20.	Library, Waukesha, Wis.	Dec. 6
Dec. 20.	Schools, Sterrett, Pa.	Dec. 6
Dec. 20.	Library, Milwaukee, Wis.	Nov. 29
Dec. 20.	Y. M. C. A. Hall, Akron, O.	Nov. 29
Dec. 20.	School, Baton Rouge, La.	Nov. 29
Dec. 20.	Armory Plans, Brooklyn, N. Y.	Nov. 8
Dec. 22.	School, Salt Lake City, Utah	Dec. 13
Dec. 22.	Pub. bldg., New York, N. Y.	Dec. 13
Dec. 22.	Htg. school, Brooklyn, N. Y.	Dec. 13
Dec. 22.	School, New York, N. Y.	Dec. 13
Dec. 24.	Pub. bldg., Brooklyn, N. Y.	Dec. 13
Dec. 24.	School, Albany, N. Y.	Nov. 29
Dec. 26.	Pub. bldg., Canton, O.	Dec. 13
Dec. 27.	Pub. bldg., Canton, O.	Dec. 13
Dec. 27.	Library, Port Huron, Mich.	Nov. 29
Dec. 29.	Jail, Marion, Ind.	Dec. 6
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11
Dec. 31.	Church, Huntington, Ind.	Dec. 13
Jan. 1.	Schools, Huntington, W. Va.	Dec. 13
Jan. 7.	Jail, Morristown, Tenn.	Dec. 6
Jan. 12.	Church, Chepstow, Ont.	Dec. 13
Jan. 15.	Library, Winnipeg, Man.	Dec. 13
Jan. 15.	Library plans, Binghamton, N. Y.	Nov. 15
Jan. 23.	Jail, Grand Junction, Colo	Dec. 13
Jan. 30.	School, Geneseo, N. Y.	Dec. 13
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Feb. 1.	School, Dickinson, N. Y.	Dec. 6
Feb. 2.	City Hall, Houston, Tex.	Dec. 13

	MISCELLANEOUS.	
Dec. 15.	Street sweepers, Syracuse, N. Y.	Dec. 13
Dec. 16.	Boston, Mass.	Dec. 13
Dec. 19.	Sand, New Brighton, S. I.	Dec. 13
Dec. 19.	Garb. Disp., Kansas City, Mo.	Nov. 22
Dec. 22.	New York, N. Y.	Dec. 13
Dec. 24.	Garb. crematory, Ft. Brady, Mich.	Dec. 13
Dec. 26.	Wharf, St. Irenee, Que.	Dec. 13
Jan. 2.	El. R. R. Franchise, Vallejo, Cal.	Nov. 22
Jan. 14.	Dredging, Chicago, Ill.	Nov. 22
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
——	R. R. work, Chicago, Ill.	Dec. 6
——	Garb. disposal, Rochester, N. Y.	Dec. 6

THE ENGINEERING RECORD.

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The offices of The Engineering Record have been removed to the sixth floor of the Engineering Building, No. 114 Liberty Street, New York.

The Use of Oil Fuel.

The recent annual report of the Bureau of Steam Engineering, of which Rear Admiral George W. Melville is the chief, contains some valuable data bearing upon the relative evaporative efficiency of Texas oil and certain well known steam coals. A series of tests with each fuel was conducted in which the conditions as to rate of combustion and evaporation were varied through a wide range. The tests were made upon the same boiler, thus rendering it possible to make a fair comparison of the results. They were conducted by a board of engineers appointed by the Navy Department, and the principal data and results are given upon another page of this issue. While the oil tests were made with the idea of securing data bearing upon the use of oil as a fuel in marine service the results and conclusions drawn from the entire series should be of no little interest to those designing and operating boilers for stationary plants.

In discussing the mechanical problems involved in the use of oil fuel Admiral Melville points out that since the time inventors realized that the efficient, economical and rapid burning of liquid fuel was greatly dependent upon the success secured in atomizing the oil there was rapid improvement. It was only a few years ago, he states, that the oil was simply thrown into the furnace with an injector, and the evaporation was dependent to a great extent on the amount of incandescent surface that could be secured to ignite the fuel. There are many burners, the report states, which can atomize the oil quite satisfactorily. The heating of the oil, also the heating of the air required for combustion, must be provided for and the latter requisite should be impressed upon all contemplating the use of liquid fuel as a combustible. Until recently, Admiral Melville writes, there have been no records to show that a boiler could be forced with oil fuel to the same extent as with coal, but the experiments of the liquid fuel board have shown that this is now possible, and that the greatest evaporation per square foot of heating surface secured with coal can be greatly exceeded by an oil fuel installation of modern design where provision is made for atomizing the combustible and heating the air and oil. In one of the tests an evaporation of 16.7 pounds of water from and at 212 degrees F. per square of heating surface per hour was attained, so that the boiler operated upon a basis of about 2 square feet of heating surface per horse power instead of 12 square feet, a common standard.

Of course in stationary practice the most important question involved in the use of oil fuel, after it has been shown that mechanical objections have been overcome, is the commercial one. Oil has been used as fuel for a number of years in a spasmodic way, but it has been the experience of most plants that oil cannot compete with coal. Admiral Melville states that only at certain California ports and at ports in the Gulf of Mexico oil costs less than coal. This is attributed to the expense of transporting the oil, but it is believed that this disadvantage ought to be soon removed. It is pointed out that while oil may be put on a tank steamer at certain ports like Cape Sabine its commercial value will be determined by the cost of delivery at commercial and maritime centers. The expense of fitting up the few tank steamers conveying oil from Cape Sabine to the North Atlantic seaports has been very heavy, due to the fact that unexpected difficulties developed in making the installations. It is believed that when a large fleet of tank steamers is available and when terminal storage facilities are provided there will be a material decrease in the price of oil in the leading cities on the coast.

As regards the danger from oil fuel it is pointed out that extreme precaution will have to be taken, and the recent explosion of oil upon a ship at San Francisco, in which a number of persons were reported to have been killed, emphasized its need. However, the danger may be overcome by proper care and by experience in its use and this does not in any way detract from the value of the work done by the oil fuel board. Further experiments are contemplated by the Navy Department, and it is to be hoped that their disinterested and valuable work may be continued, for the subject is of no little importance to industrial as well as to naval engineers.

The Convention of the American Institute of Architects.

The thirty-sixth annual convention of the American Institute of Architects was held in Washington on Thursday, Friday and Saturday of last week, in the New Willard Hotel. The first session was opened with an address of welcome by Colonel John Biddle, U. S. A., engineer commissioner of the District of Columbia, and was followed by a short address by the Institute's president, Mr. Charles F. McKim. The remainder of the morning session was devoted to reports by various officers and committees. In the afternoon, following the appointment of several committees, papers were read on the "Improvement of Washington," by Messrs. Daniel H. Burnham, Frederick Law Olmsted, Jr., and Charles Moore.

It has long been realized by those competent to judge that Washington cannot be favorably compared, in point of beauty, with the capitals of the larger foreign countries. The subject of the improvement of our national capital has been strongly urged by many leading architects and the admirable work of the Institute along this line deserves acknowledgment. As a step in the right direction, it is a source of gratification to note that last Monday the House passed the Senate bill authorizing the erection of the $4,000,000 union railway station in Washington. Thursday evening the members assembled in the Congressional Library and viewed drawings and models submitted by the Park Commission, Messrs. D. H. Burnham, C. F. McKim, Augustus St. Gaudens and F. L. Olmsted, Jr. An explanation of the proposed plans for the improvement of Washington's park system was made by one of the members of the commission.

The principal feature of general interest in the Friday morning meeting was the paper by Capt. John Stephen Sewell, Corps of Engineers, U. S. A., on "The Relations of the Architect and the Engineer." Capt. Sewell, as an engineer, was closely associated with the architect in building the new government printing office, consequently his views had the weight of a personal experience. Among others, two points were particularly emphasized: the advisability of retaining a government engineer on all government buildings, rather than allowing the architect to select an outside engineer; and the desirability of having the work on government buildings entirely in the charge of a construction bureau, which could control all disbursements and secure the best possible co-operation among the architect, engineer and contractor. A paper by Mr. J. L. Smithmeyer on "The Development of Architecture" was then read by Mr. George O. Totten, Jr.

The "Development of Municipal Improvement" was the general topic considered during the afternoon session, December 12. Mr. W. B. de las Casas read a paper on "The Organization for Municipal Improvements," the particular work treated being the Boston park system, of which he has had charge as chairman of the Metropolitan Park Commission. Under the subject "The Modern City," Mr. Albert Kelsey showed in what ways foreign city work is ahead of American, and urged the need of modern ideas along original lines in our architecture. Mr. Kelsey is in charge of the park improvement work in Philadelphia. A third paper, written by Mr. Owen Fleming, the secretary of the council of improvement of London, England, was read by Mr. Glenn Brown. It dealt with the improvements put into effect in that city.

The Saturday meeting was late in opening, as the earlier part of the morning was spent in visiting the White House. Mr. McKim, to whom the work of remodeling the White House was unreservedly committed, guided the delegation, and its members declared themselves greatly pleased with the results accomplished. The morning meeting closed the balloting for the election of officers. Last year's board of officers was re-elected, as mentioned in the "personal" column of this issue, together with three elections to honorary membership. Cleveland was chosen as the place for the next convention, with St. Louis as the probable convening point for the year following. A paper by Capt. Charles D. Sigsbee on certain improvements in Washington was read by Mr. Arthur Totten. Capt. Sigsbee suggests the construction of a permanent reviewing stand on Lafayette Square in front of the White House, the stand to be made of marble and highly ornamental. The committee in charge of the subscription for the purchase of the historic Octagon house in Washington as a permanent institute headquarters reported that $17,000 was in hand. After the purchase money, $30,000, is raised, it is proposed to raise a sum of $250,000 for the establishment of a benefit fund.

The Muscoot Dam in the Croton Valley, New York.

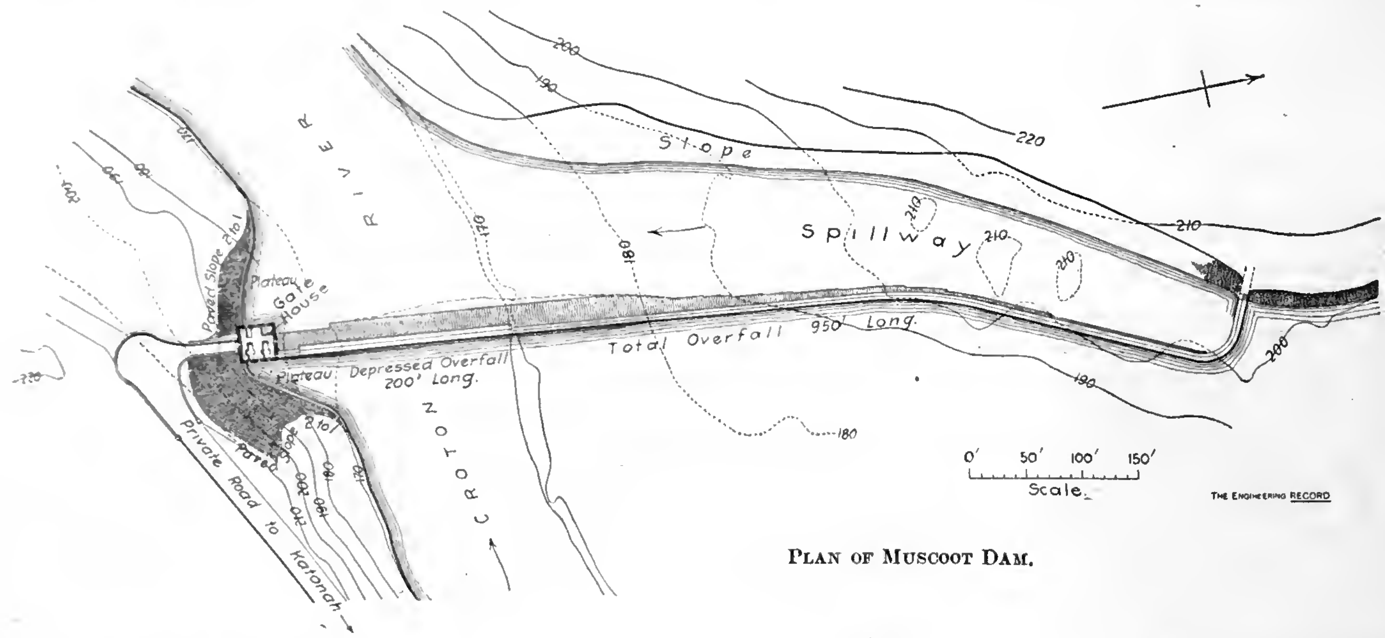
The Muscoot dam is a masonry structure now under construction in the Croton valley, being a part of the system of improvements and extensions in progress for the water-works of the city of New York. The new Croton dam (see The Engineering Record of August 16) will, when put in use, impound a body of water about 19 2/3 miles long, and the Muscoot dam will be located at about the middle of this lake, being about 5¼ miles above the old Croton dam. The lowest part of the spillway of the Muscoot dam will be 200 feet long and at the same level as the lowest part of the spillway of the new Croton dam, or 196 feet above sea level. Stop planks will be used when desired to raise the level to that of the rest of the structure, 4 feet higher, giving under these conditions a spillway 950 feet long. The Aqueduct Commissioners decided to construct the dam at this point so that when the large lake shall be drawn down below the level of the spillway crest of the new Croton dam, the bottom of some of the shallower portions toward the upper end of the lake will not be partially or wholly exposed.

For a very short section the Muscoot dam will be 60 to 70 feet high from the bottom of the foundation. From the old bed of the river to the top of the flashboards on the finished dam the height will be about 35 feet. For about 450 feet at the north end, it is only from 3 to 13 feet in total height, having been extended to a considerably greater length than was otherwise necessary in order to gain a long crest for the spillway. In fact the rock bottom in several places at the north end was higher than the crest of the dam. A channel below the dam, excavated largely in the rock, will carry the water overflowing from this end of the dam down to the main channel of the river.

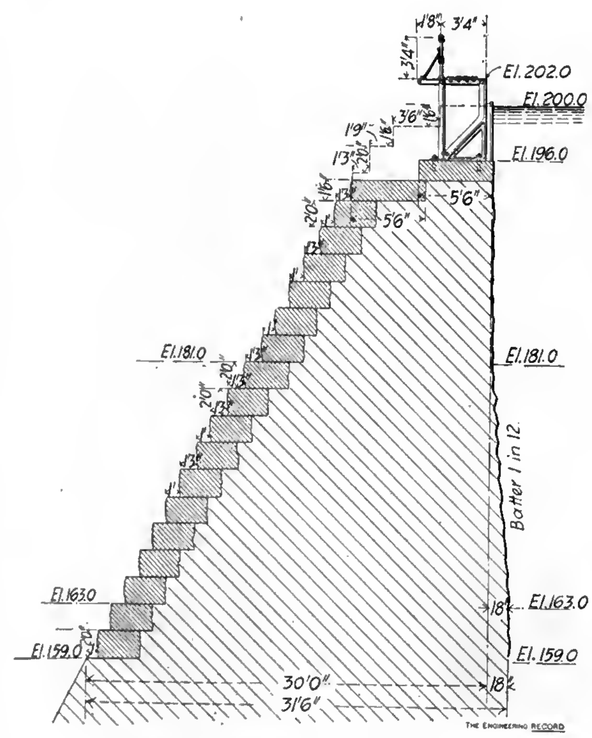
The bed rock was comparatively near the surface throughout almost the whole length of the dam. It was deepest directly below the bed of the river, there being at that point a V-shaped depression in the rock, making a deep excavation necessary for a short section. On the south bank of the river, the rock as a rule is not so near the surface.

The accompanying section shows the general character of the work. The dam is founded entirely on the bed rock. The downstream face is stepped off at the rate of about one horizontal to two vertical, and the upstream face will be vertical to 19 feet below the top, and below this to elevation 163 it will have a batter of one inch to a foot, being again vertical below that elevation. The main body of the dam and overfall, the gate chamber and retaining walls will be of rubble masonry laid in 1 to 3 Portland cement mortar. In the long spillway, however, and such other places as the engineer may designate, the masonry will be laid in 1 to 2 Rosendale cement mortar. No grouting is allowed. Stones of various sizes are used and regular coursing avoided, in order to obtain good vertical bonding as well as horizontal. In places where the masonry is thickest, a considerable proportion of large stones is used. In some cases the vertical joints, where not less than 6 inches wide, are filled with a concrete consisting of one part cement to three of small stone or gravel, this concrete being thoroughly rammed.

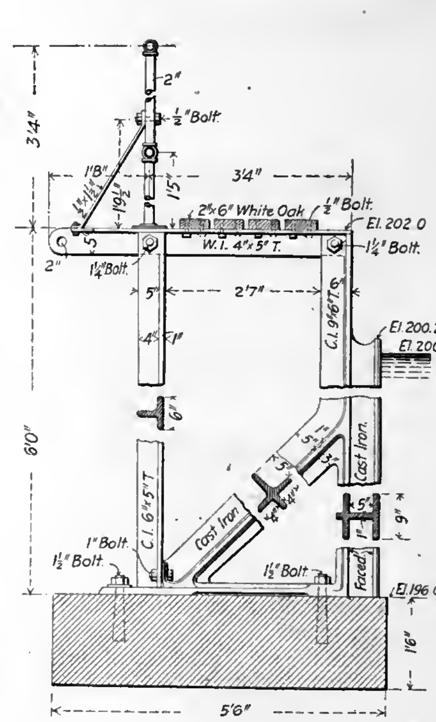
The top course of the dam is to be of dimension stone masonry. The large blocks used for the steps on the downstream face are carefully selected in order that they may be especially hard and compact, so as to withstand the shock of water and ice falling over them. Below the dam, at the depressed overfall, for 50 or 60 feet from the toe of the dam, there will be a protective apron of piling filled in with large stones measuring a cubic yard or more in volume.



PLAN OF MUSCOOT DAM.



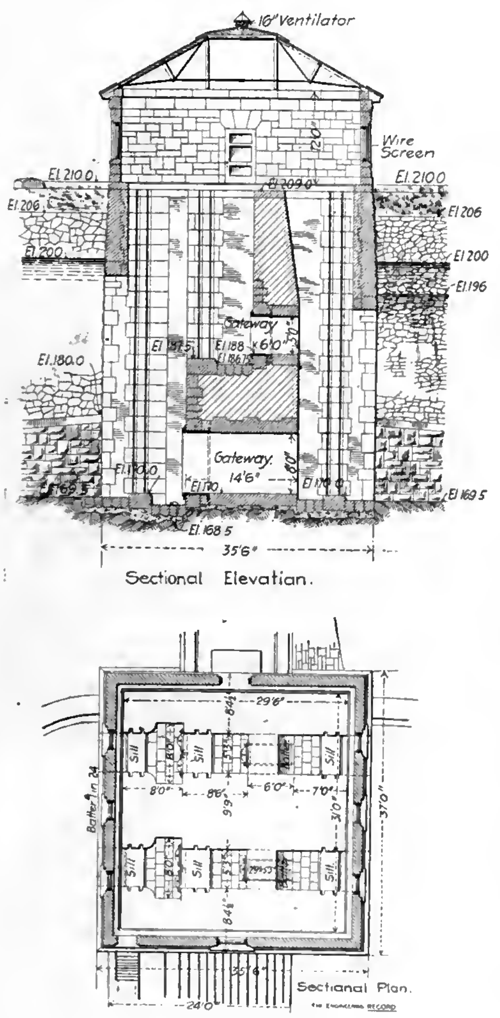
SECTION AT DEPRESSED SPILLWAY.



FLASH-BOARD STANDARD.

Along the 200 feet of depressed spillway, cast-iron frames will be secured every 8 feet to the top course of the masonry by anchor bolts, and in the grooves of these frames can be placed stop-planks or flashboards, in order to raise the water level to elevation 200. A foot bridge from which to operate these flashboards will extend from the gate house to the end of the depressed overfall. The bracket standards and the parts for supporting the foot bridge are of cast-iron; other metal parts are of steel.

At the south end of the dam, where the gate house will be located, excavation was necessary for a plateau or level area at elevation 169.5. There will be a low, submerged retaining wall at the edge of this area, and a paved slope will extend above this wall on both sides of the dam up to elevation 206. The excavation for the level area was planned to extend well into the solid rock in order to give a good foundation for the gate house. The gate house will be built entirely of masonry, with two arched openings for inlets, 5 feet 3 inches wide and extending from the plateau level to 2 feet below the surface of the full reservoir. Just beyond these inlets there is a double set of vertical grooves 5 inches wide and 6 inches deep, for stop planks, and beyond these grooves on either side of the gate house is a main gateway opening 8 feet high and 5 feet 3 inches wide, divided for two 2x8-foot sluice gates, the elevation of the bottom of the opening being 170. Above these two main gateways, at elevation 188, are two others 2 feet 9 inches wide, with single sluice gate 2x8 feet. Here there are also double sets of grooves for stop planks in front of the inlets. There will be still another series of stop planks between the ends of the gateways and the arched outlets. The outlets are 5 feet 3 inches wide and about 24 feet in height, the inside crowns of the arches being about 2 feet below the level of the depressed overfall. The floor of the gate house is at elevation 210. The three sets of stop plank grooves on either side of the gate house were provided in order to give complete control of the sluice gates. If at any time it is desired to gain access to the gates or the bottoms of the gate chambers, the planks will be put in and the space between the two parts of each



GATE CHAMBER.

set rammed full of clay. The chamber can then be pumped out.

The preliminary estimates for this work, by which the bids of the contractors were compared, included the following items: 105,000 cubic yards earth excavation, 4,000 cubic yards earth excavation in vertical trenches, 25,000 cubic yards rock excavation, 1,500 cubic yards dredging in river, 250,000 feet, B. M., of timber work placed and fastened, 7,500 linear feet of piles, 15,000 cubic yards rubble stone masonry laid in 1:2 American cement mortar, 5,000 cubic yards rubble stone masonry laid in 1:3 Portland cement mortar, 5,000 cubic yards riprap, 7,000 square feet fine hammered face dressing, and 5,000 square feet rough-pointed face dressing. Mr. W. R. Hill is chief engineer of the Aqueduct Commission, under whose supervision the work is being carried on. Mr. E. Wegmann is the division engineer, and Mr. C. E. Benedict is the assistant directly in charge of construction. The contractors are Messrs. Williams & Gerstle, of New York, and the contract price for the total work was about $209,000.

Report of Irrigation Investigations.

Abstracted from Annual Report of the Department of Agriculture.

The portion of the report of Mr. James Wilson, the Secretary of Agriculture, which deals with irrigation describes what the department has been doing during the past year and incidentally brings out many facts of general interest. Interest in these investigations, which are a part of the work of the Office of Experiment Stations, is constantly increasing and has been stimulated during the past year by the growing desire of the arid states for laws and conditions which will secure the largest and best use of the water supply, and in the humid region by the drought which prevailed throughout the middle West in 1901 and in the South during the present year. As a result, the requests for information and advice have been more numerous than ever before, and it was only through the increased appropriation made by the last congress that those in charge of the investigation have been able to comply with the demands made upon them.

Referring to the need of better irrigation laws, the secretary says that no branch of the department's irrigation work has received more cordial recognition than its studies of legal and sociological questions. A number of the arid states are cooperating with the department in these studies and two have made special appropriations to extend them. The question as to how much the water of western rivers has already been appropriated under state laws, the nature of the rights which have been acquired, the conflict which exists between riparian rights and the rights acquired under the doctrine of appropriation, are some of the problems which confront irrigators in these states. A settlement of the rights which have become vested is needed to show how much water remains for future appropriators and to relieve farmers under existing ditches from anxiety and give to a state a safe foundation for future development. To the litigation over water rights within states there has recently been added important suits over interstate rights, the one of Kansas against Colorado being the most conspicuous. The law providing for the department's investigations provides first of all for an investigation and report on the laws affecting irrigation and the rights of riparian proprietors. Under this, an investigation of interstate rights is now going on, the results of which will be watched with much interest.

The report of the secretary brings out the fact that drainage is becoming an important problem in the older irrigated districts. Two drainage surveys were carried on during the past year; one in the valley of Kings River in California, under the direction of Prof. O. V. P. Stout, and another in Colorado which was carried on by Mr. C. G. Elliott, agent and expert, under a cooperative arrangement between the state engineer's office of Colorado and the Office of Experiment Stations of the Department. The owners of lands which have become swamped by too much water will be encouraged by the results thus far secured, the secretary reporting that they show that it is not only possible to remove the surplus water and restore large areas of land to cultivation, but that the water which comes from these drains can be used for the irrigation of other lands.

The report further shows that much interest is being given to irrigation in the humid states, especially in the south where the irrigation of rice has proven exceedingly profitable, and where important experiments are being carried on to determine the value of irrigation as an aid to market gardening. The fact that the department has in its employ a number of irrigation engineers who have had wide experience in the West has resulted in a saving of large sums of money to those who were putting in pumping plants. This has been done by correcting a tendency to put in pumps of too small capacity to be of any real service.

He also calls attention to the changes in farm life and farm work which have come about through the invention of machinery and its extensive use by American farmers. The United States is the greatest manufacturer and user of farm machinery in the world, and the changes which have come about through their invention have made almost as radical a revolution in farming operations as has been wrought by the substitution of machinery for hand labor in manufacturing. Among the complex machines which the farmer has to operate to-day are combined harvesters and threshers, traction engines, automobiles, power machines for harvesting corn, for shucking the ears and shredding the stalks, and recently electric dynamos have been added to the agencies employed to do farm work. These facts, in connection with the increasing demand for more efficient labor-saving tools, the growing scarcity of farm labor, and the organization in foreign countries of institutions for the systematic study and improvement of farm machinery, make it important, in the opinion of the secretary, that we should not longer neglect this field of inquiry, and provision for carrying this out in connection with the irrigation investigations is recommended in the secretary's report. In his estimates submitted to Congress, the Secretary asks for an appropriation of $75,000 to continue the investigations in irrigation and agricultural engineering.

The San Jose Scale has been made the subject of a very searching investigation by the Division of Entomology, Department of Agriculture, the results of which are presented in the annual report of Secretary Wilson. Explorations in Japan and China have established very clearly that its original home was in the latter country. It was found in scattering numbers everywhere, just as one would expect in the native home of a pest of this sort where it is normally kept in check by natural enemies. A very interesting fact in connection with this discovery was the finding in this same region of a ladybird which preys on it naturally and seems to be the principal agent in preventing its often becoming very abundant and injurious. This ladybird (*Chilocorus similis*), a European and Asiatic species, in China feeds naturally on the San Jose scale and related forms, as also on the white peach scale, a very troublesome pest, which has recently gained foothold in our Eastern and Southern States. Several shipments of this beetle were made by Mr. Marlatt, first assistant entomologist, some from Japan and some from China. From the two surviving individuals more than 2,000 beetles and larvæ are now on scale-covered trees on the Department grounds. In addition to these, shipments of some thousand beetles have been already made to other points in the East, a number of experiment station entomologists having expressed a desire to assist in the work of propagating, distributing, and establishing this useful ladybird. This importation promises most flattering results at present. It is, however, still an experiment, and what the ultimate benefit will be can only be determined after a two or three years' test.

The Revised Plans for the Superstructure of the Blackwell's Island Bridge, New York.

The commission of engineers appointed November 3 by Mayor Low to investigate the proposed modifications of the plans for the Blackwell's Island bridge has submitted its report, giving a very clear comparison in all essential points of the original plan and that recently proposed by Commissioner Lindenthal. There is also appended a third plan, in which the commission, Messrs. William H. Burr, Henry W. Hodge, and Palmer C. Ricketts, has endeavored to combine the best features of the other two.

In brief, the original plan called for a cross-section in which there would be two middle roadways, each 20 feet wide in the clear, two double-track street car platforms 22 feet wide in the clear, one platform next to each main truss, and two cantilever sidewalks 10 feet wide outside the trusses. About 25 feet above the roadway level there were to be two single lines of elevated railway track, each centered over the posts separating the roadway and street car platforms. The total width of this plan is 120 feet.

The plan proposed by Commissioner Lindenthal called for a total width of 80 feet, with a clear space between main trusses of 44 feet. The roadway was to occupy the center of this, and there were to be two trolley tracks just inside the main trusses open also to wagon traffic, and two outside, the outside ones being supported on cantilever arms, 15 feet long. The reduction in width was to be gained by bringing the two tracks for the elevated trains together in the center of the upper deck, which was to be 15 feet clear above the lower one, and placing the two promenades, each 11 feet wide, on the upper deck, one on each side of the elevated tracks.

The plan proposed by Messrs. Burr, Hodge and Ricketts is practically a widening of that of Commissioner Lindenthal by inserting 11 feet of clear space into the center of the section, and making a complete separation between the central roadway (widened in this way to 36 feet in the clear) and the trolley tracks on each side. According to this plan there will be a clear width of 56 feet between the two main trusses and two trolley lines on the outside supported on cantilevers. The upper deck will be arranged with the two 11-foot promenades inside the main trusses and adjacent to them; and the two lines of elevated railway are to be placed as close as possible to the promenades. This plan gives a total width of 91 feet, which it is thought will be more in keeping with the piers, which were of course designed for the full width of 120 feet. The report of the commission concludes as follows:

"We further recommend that a solid floor on buckle plates be used on the lower deck between the main trusses, and that the lightest practicable continuous fireproof flooring be used on the sidewalks, the two elevated railway tracks and the spaces between the overhanging and the adjacent trolley tracks. The remaining portions of the overhanging trolley tracks should have an open fireproof floor as light as practicable. The central space between the elevated railway tracks should be entirely open to admit light and air to the roadway below. It is the opinion of the commission that this material decrease in the dead weight of the floors will fully compensate for the small increase in weight resulting from the increased separation of the trusses without increasing the cost of the structure. It is further the judgment of this commission that the capacity afforded by this plan is not beyond reasonable provision for the future requirements of the locality served by the bridge."

Loading Tests of Ransome Concrete-Steel Floor Construction.

Comparative tests of full size floor panels of different spans and construction were made by the Turner Construction Company, New York, September 23 and 24, for the Building Department of the Borough of Richmond, New York City. They were intended to demonstrate the actual relation of theory to practice in commercial construction, and to verify for the officials of the department the strength and rigidity of the Ransome system of cold twisted steel reinforcement which is being extensively used in new buildings now being erected at New Brighton for J. B. King & Company's cement and plaster mills. The Turner Construction Company is the licensed agent for the Ransome system, and is the contractor for the new buildings, the roofs of which are also to be of the same style of construction as the floor panels tested.

Four floor panels were constructed on August 20, two of 9 feet 2 inches clear span and two of 14 feet 6 inches clear span, as shown in the illustrations. The smaller span was designed for a distributed live load of 600 pounds per square foot and the larger span for roof construction with a specified distributed live load of 50 pounds per square foot. One panel of each span was constructed of gravel concrete consisting of 1 part Lehigh Portland cement, 2 parts clean, sharp sand and 4 parts clean Long Island gravel running in size from ¼ to ¾ inch diameter. The other two panels were constructed of the same proportions of cement and sand with 4 parts ¾ inch screened trap rock. These panels were constructed in duplicate to compare the strength of gravel and trap rock concrete with the same metal reinforcement. The concrete was mixed by hand with sufficient water to flush readily to the surface in tamping, and would be termed "wet" mixtures.

The cement was of very good quality and was tested by Dr. Charles F. McKenna, with the following results: Tensile strength of briquettes 7 days old, in pounds per square inch, neat, 624; 3:1 mortar, 250. Four 6-inch cubes were made from the concrete, and when 48 days old, were tested at Columbia University. One of the gravel cubes was slightly cracked across one corner. The ultimate crushing strength of the gravel concrete cubes was 2,545 pounds and 2,923 pounds per square inch, and of the trap rock concrete cubes 3,280 pounds and 3,286 pounds per square inch. The steel reinforcement consisted of square bars of mild steel twisted cold. Tension tests were made on the plain and twisted bars by Professor Woolson, of Columbia University, and gave the following results in pounds per square inch:

Size and Condition.	Elastic Limit.	Ultimate Strength.
¼ inch, plain	46,170	57,800
¼ inch, twisted	62,350	86,700
¾ inch, plain	34,840	59,200
¾ inch, twisted	56,720	85,240
⅞ inch, plain	39,700	62,100
⅞ inch, twisted	56,150	84,730

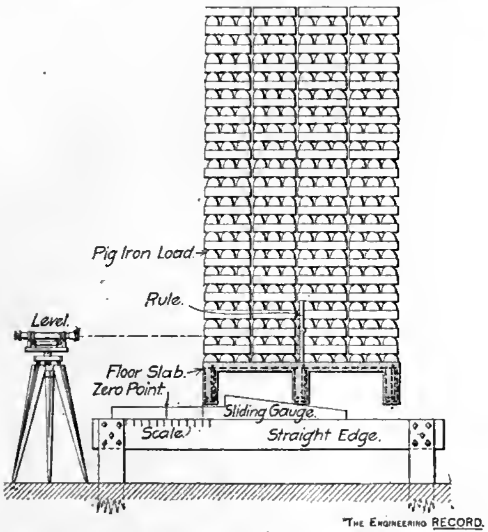
LOADING TEST SLAB.

CONSTRUCTION OF TEST SLAB.

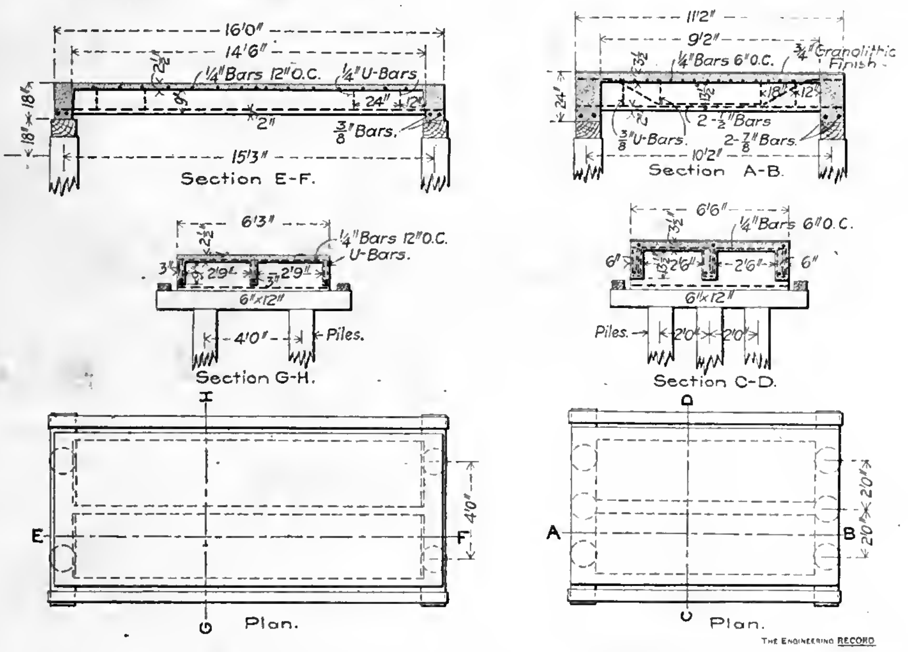
On each panel two 12x12-inch spruce timbers were laid side by side over the center beam to receive and concentrate the load on a strip 2 feet wide, across the full length of the span. The pig iron was piled centrally on these timbers, and as the height of the pile increased the pigs were carried up an inclined platform and carefully deposited on top, as shown in the view. An engineer's level was set up near the panel under test, and with it readings were taken on a rule held vertical on the middle of the center beam, in an opening left in the pig iron for that purpose. Readings were also taken on the top of the concrete over the supporting piles, and the differences of these and the center readings gave the true deflections corrected for any error due to the settlement of the piles or the compression of the timber under the heavy loads. The total displacements were also checked by readings taken on a beveled gauge which moved between a horizontal straight edge and the lower side of the center beam, as shown. A zero point was marked with the gauge touching the unloaded beam, and as the beam deflected the gauge was withdrawn to remain always just in contact with it, and the position of the zero point was read on a scale marked on the straight edge to correspond with 1/16-inch deflections of the beam. These divisions on the scale were so large that they could be accurately subdivided to read an eighth of a sixteenth.

The 9-foot 2-inch span of gravel concrete was the first section tested, and the maximum load reached was 110,218 pounds, or 4,007 pounds per square foot of panel area. This produced a center deflection of about 1/16 inch, and exhausted the supply of pig iron so that further loading of this panel was abandoned. The test demonstrated very satisfactorily the strength and rigidity of the construction, but could not be conveniently carried far enough to establish any theoretical deductions. When the load was removed the next day the beam was found in perfect condition. The corresponding span of stone concrete was not loaded.

The gravel concrete panel of 14½-foot span



MEASURING AND CHECKING CENTER DEFLECTION.



DETAILS OF LONG AND SHORT SPAN CONCRETE SLABS.

sustained a maximum load of 35,800 pounds, or 822 pounds per square foot of panel area, which produced a maximum center deflection of 1 5/16 inches. The deflections varied directly with the load, and the first sign of failure was noticed between loads of 28,652 pounds and 30,952 pounds, and consisted of fine vertical cracks at regular intervals near the center of the span. At 30,952 pounds diagonal shearing cracks appeared in the loaded beam about 2 feet from the supports. They increased in size and opened about ¼ inch at the maximum load. Cracks also occurred at the juncture of the 2½-inch floor slab with the supporting walls.

The maximum load on the 14½-foot stone-concrete panel was 32,784 pounds, or 753 pounds per square foot of panel area, producing a maximum center deflection of 1⅛ inch. The first signs of failure consisted of the fine vertical cracks occurring between loads 25,477 pounds and 28,756 pounds. Diagonal shearing cracks about 2 feet from each support began at this load and increased with the loading. This panel as well as the gravel panel was capable of carrying additional loads before absolute failure, although for all practical purposes failure had occurred. Deflection curves plotted for these two panels clearly indicate almost identical action. The strength of the gravel concrete panel ran a little higher than that of the trap rock panel. Both panels showed excellent elasticity and seemed to confirm the assumption that the theory of flexure may be applied to composite beams of the Ransome system. The failure occurred not by exceeding the ultimate strength of the steel in tension or the concrete in compression, but through shear. A careful examination was made of the twisted steel bars after the panels were unloaded and taken down, and they were apparently uninjured. They were also free from any signs of corrosion.

It was noted, however, that the adhesion between the steel and concrete was not so strong as sometimes supposed. The very large loads carried are explained in part by the ability of the floor slab to transmit a portion of the load to the outside beams. Nevertheless, the remarkable strength of this construction is attributed largely to the excellent union formed between the concrete and the grooves in the twisted bars; to the high elastic limit and ultimate strength of the steel and to its lowered ductility, permitting the two materials to act in unison. The contractors consider that the results of these tests encourage the application of the Ransome construction to a large field of heavy floor work.

The Commission of Engineers recently appointed to investigate the problems of water waste prevention and additional water supply for the city of New York have entered upon their duties and will hold a public hearing next Tuesday in connection with the subject of waste prevention. The commission is expected to make its final report by November, 1903, and to defray its expenses an appropriation of $100,000 has been made, of which $36,000 is for salaries of the commission. The Department of Water Supply, Gas and Electricity will co-operate in the studies. As previously announced, Wm. H. Burr, Rudolph Hering and John R. Freeman, Members Am. Soc. C. E., constitute this commission. Commissioner Robert G. Monroe and Mr. Nicholas S. Hill, chief engineer of the department, are active in furthering this work.

Compressive Resistance of Concrete-Steel and Hooped Concrete.

Probably no materials of construction are engrossing more of the attention of engineers in these passing days that the combination of concrete and steel. The fields of application for this compound material are continually widening and the varieties of the combination have not ceased to multiply. Among the most recent forms of union of steel with concrete for the reinforcement of the latter is the beton fretté or hooped concrete, of M. Considère. Experimental information on this subject, we are sure, will be of value to many readers. Simultaneously in "Le Génie Civil" and in the new periodical, "Beton and Eisen," published by Mr. Von Emperger, M. Considère prints under the above title the first comprehensive paper on his recent experiments on concrete-steel in compression. The high position of the author as an experimenter in the line of concrete-steel construction and the great value of these tests, which fairly bid to surpass his now famous bending tests, justify, in the opinion of The Engineering Record, an extended extract.

I. *Concrete Reinforced by Longitudinal Rods.*—The first idea which presented itself to engineers to increase the resistance of concrete in compression was to reinforce it, similarly to tension pieces, by rods laid longitudinally in the direction of the stress. For purposes of construction, to keep the rods better in place, the reinforcing rods were tied together by a network or a belt of smaller rods. Some engineers understood that these belts perform another important role, that they protect the longitudinal rods from premature flexure and retard the swelling of the concrete and, hence, its ultimate failure.

It will be seen below that by hooping or completely surrounding the concrete by steel rods a considerably higher resistance can be obtained, and it is evident that between this method, supplemented by the addition of longitudintal rods, on one side, and the method of reinforcing by longitudinal main rods tied together by belts of lighter material on the other side, there is an intermediate continuous series of methods of reinforcing. The conclusions reached by this study will enable us to foresee the effects of these complex combinations, but, before making the synthesis the influence of each element should be investigated separately. Concrete reinforced by longitudinal rods tied together by netting or belts of dimensions too small or spaced too far apart to exert noticeable influence on the resistance of the concrete will therefore be treated first.

It was admitted, up to the present time, that the different varieties of stone, mortars and concrete, when under compression, always fail by shearing along planes which are inclined to the direction of the stress. The recent experiments made in Germany by Foeppel and repeated by Mesnager at the laboratory of L'Ecole des Ponts et Chaussées have proved that this mode of failure is due to the friction exerted on the lower planes of the test specimens by the plates transmitting the pressure. And it has further been proved that by sufficiently reducing this friction by the introduction of a greased surface, the failure will take place along surfaces which will be parallel to the direction of the pressure. It is not clear how longitudinal reinforcing bars, which are parallel to the lines of rupture, could prevent the separation of the molecules and increase the resistance of the concrete, and it seems that the only effect of longitudinal reinforcing in compression members consists in adding the resistance of the steel to that of the concrete without strengthening the latter. Experience has shown that such is the case. The effects of the reinforcing bars are, however, complicated, for the reasons which follow.

As has been shown by the experiments which the author described in 1899, before the French Academy of Sciences, the tendency to shrink which concrete shows when setting in air causes in reinforced concrete inner stresses of great intensity: tension in the concrete and compression in the metal. Experiments made in 1902 at the laboratory of L'Ecole des Ponts et Chaussées, according to the programme laid out by the French commission on concrete-steel, have determined the effect due to shrinkage of large concrete-steel specimens of the most commonly employed mixture, 1,000 pounds of Portland cement to 45 cubic feet of 1-inch gravel and 22.5 cubic feet of sand, (1:3:6). Measurement of the variations in length of the reinforcing bars has shown that after three months the shrinking of the concrete had compressed the metal 6,540 pounds per square inch, in prisms 6.5 feet long of a section about 4x4 inches and reinforced near the edges by four iron wires ¼ inch in diameter. The compressive stress in the metal has reached 10,800 to 14,220 pounds per square inch in beams 13 feet long having a cross-section about 8x16 inches and reinforced near one of the smaller sides by four metal rods of ⅞-inch diameter placed 1.3 inches from the face. The latter specimens were prepared to be tested for bending.

It is superfluous to point out the importance of the above statement as to the magnitude of the interior stresses in members of the usual mixtures and dimensions similar to those met in practice. Neglecting this kind of stresses, some engineers have made grave mistakes in the interpretation of bending experiments and have established incorrect formulas and rules, especially on the subject of stresses in compression members. They have assumed that if a certain specimen has undergone a shortening, i, its reinforcing bars, which had a coefficient of elasticity, E, were compressed to a stress Ei, neglecting the addition which has to be made to the latter stress for the shrinking of the concrete, if it has set in air, and which usually exceeds it in amount. The above considerations are sufficient to compute the stresses in compression members as long as the elastic limit has not been surpassed, neither in the concrete nor in the metal; but this is only one side of the question.

Without entering into a discussion of the unit stresses which may be allowed for the various elements of concrete-steel structures, it is evident that the basis of any computation must be the knowledge of the stresses which are induced in these elements at the instant where, for the first time, there appears any danger for the one or the other of them. It is therefore important to know the stress caused by the reinforcing steel in a member in compression at the instant where it begins to fail by the crushing of the concrete, which takes place a long time before that of the steel.

A concrete of common quality can stand without crushing a reduction in length of 0.07 to 0.10 per cent. and sometimes more. Such a compression will cause a stress in the metal of 20,000 to 29,000 pounds per square inch, if the co-efficient of elasticity be 29,000,000 pounds. This stress, added to the previous stress of 7,000 to 14,000 pounds, gives a total of 27,000 to 43,000 pounds per square inch of the metal, which is equal and even superior to the elastic limit of the iron and mild steel which is usually employed. Therefore, before the crushing of the concrete, the reinforcing bars are almost always stressed up their elastic limit, unless the elastic limit of the bars be exceptionally high or the concrete exceptionally poor.

This stress cannot be appreciably surpassed because a very great decrease takes place in the value of the coefficient of elasticity of the metal as soon as the elastic limit has been exceeded, and the stresses increase, therefore, with an extreme slowness which is limited by the small deformations which the concrete can still undergo without crushing.

Hence, it may be stated that *in concrete members reinforced by longitudinal rods connected by cross pieces or ties too weak or too far apart to bind the concrete sufficiently together crosswise, the total resistance to crushing varies little from the sum of the resistances offered by the crushing strength of the concrete and the longitudinal bars when stressed up to their elastic limit. During the elastic period the metal, which has been compressed before by the shrinking tendency of the concrete, causes important stresses.*

II. *Concrete Reinforced by Transverse Rods.*—Whatever the mode of rupture of concrete in compression, the crushing of the same must be retarded by the use of reinforcing rods put in planes perpendicular to the direction of the external pressure and sufficiently near to each other. The tendency to slide along oblique planes is, indeed, resisted by reinforcing bars which cut these planes, whether parallel or perpendicular to the direction of the pressure. Rupturing along surfaces parallel to the pressure is directly opposed by transverse reinforcing.

The idea of using transverse reinforcing is not new, and, while it may be still older, it is sufficient to mention that it was experimented upon in 1892 by Koenen and Wayss. Since then Harel de la Noé has theoretically explained the advantages of transverse reinforcing and has made and inspired some very interesting applications. The transverse reinforcing may consist of a series of rods placed on diameters, all passing through the center of the section, or of a net with rectangular openings, or of circumferential rods which constitute hoops embedded in the concrete to a depth required to protect the metal from the action of atmospheric influences.

The author has not made any experiments on the first system which concentrates the metal around the center where it is the least useful. He has limited his preliminary experiments to reinforcing consisting either of circumferential hoops or of netting wires at right angles and parallel to the sides of the section. For equal weights of metal the resistance to crushing was appreciably more than twice as great for the circumferential reinforcing as for the wire netting.

Without entering into a theoretical discussion, the above result can be explained by a simple observation. If the external layers of a prism reinforced by rectangular wire nets are considered the lateral thrust outwards to which they are subjected to by the pressure at their base will in nowise be resisted by the rods parallel to these layers or faces, and nothing prevents them from separating from the central mass simultaneously with the concrete in which they are embedded. Of course, the bars at right angles to the faces considered offer a resistance to the outward thrust, but only to such extent as they adhere to the concrete. This adhesion is proportional to the area of contact, and is zero at the ends and only increases in intensity as the distance along the bars increases from the faces, but these faces are just the layers most exposed to crushing. To remedy this fault the author has first employed iron rods so connected as to support each other, and then nets of wires interwoven in a manner which promised the best results. After all these arrangements the crushing beginning at the face has gradually spread towards the center and it became apparent why, for equal weights of steel, not more than one-half of the resistance shown by the hooped concrete was obtained. It was as a result of the above experiments that all further investigations were directed to concrete reinforced by hoop-like rods.

III. *Theoretical Considerations on the Resistance of Hooped Concrete.*—The inner forces acting in solid bodies are often placed in two different classes. The name, cohesion, is generally given to the inter-molecular action, and it is known that it varies in proportion to the distances of the molecules from each other up to a certain point which is called the elastic limit. As a premise nothing is supposed to be known of the effects produced by cohesion above the elastic limit; but at the same time it is generally admitted that friction exerts an action in the interior of bodies similar to that exerted on their surface. Leaving purely academical discussions, the following method was adopted for investigation.

A certain number of prisms of concrete of different qualities and surrounded by hoops of various arrangements and sizes was prepared. Some had, also, longitudinal reinforcing rods. These prisms were submitted to increasing pressures and the shortenings produced were measured together with the loads. By a well known formula for earth thrust, the resistance was computed which would be offered by a prism of same dimensions reinforced in the same way if in place of the concrete sand without cohesion were put. The same coefficient of friction was assumed and the same percentage of swelling of cross-section to decrease of length. This was computed for each observed deformation. It is evident that the excess of the observed resistance of a concrete prism over the similar resistance of sand corresponding to the same deformation can only be attributed to the direct or indirect effects of the cohesion of the concrete. The author has named this excess the specific resistance of the concrete.

Sand, of course, cannot be reinforced by hoops but must have a continuous shell. It is easily shown that the resistance given to the sand by the shell is 2.4 times as much as could be offered by longitudinal reinforcing rods of the same weight as the shell, with the same stress. The ratio of the efficiency of the two types of reinforcing is therefore as 2.4 to 1. Sand is taken here as an example of cohesionless body.

IV. *Experimental Researches.*—The above considerations referred to bodies without cohesion; and it is important to determine whether in concrete the effects of cohesion act in addition to friction and in what way. The beginning was made by experiments to verify the agreement of the resistance of a sand cylinder in a shell with the formula for earth thrust above mentioned. This has been fully verified and the value 2.4 was checked by experiment. A first series of experiments was then made at Quimper, in 1901, on small prisms of mortar 1.6 inches in diameter hooped by a fine iron wire. The deformations have not been measured and the results obtained can, therefore, only be used to verify the resistance to crushing and to compare the same to the assumptions made above. The accompanying table shows the results obtained from some of the prisms.

The figures given in the table are significant. The iron wire employed for the hooping was drawn cold and did not have a definite elastic limit. From its curve of deformation 78,200 pounds per square inch appeared to be the proper value after passing which the stress in the metal increased too slowly for its elongation to be able to maintain the real efficiency of the reinforcing. This value of 78,200 pounds per square inch has been multiplied in the above table by the ratio of iron to concrete, giving the values in the next to last line, representing the compressive resistance which would have been offered by the metal if it were used as longitudinal reinforcing bars instead of hooping wires. The ratios obtained in the last line of the table thus give the coefficient of efficiency from the point of view of the compressive resistance of metal employed in longitudinal reinforcing or in hooping. For sand, as seen above, this ratio is 2.4 and the figures of the last line show that for mortar this ratio has not deviated far in the above experiments.

The compressive values obtained should be noted. Of the above described prisms a single one was of mortar which had had time enough to set. With a volume of metal equal to 0.034 of the total volume and without any longitudinal reinforcing it showed a resistance of 10,500 pounds per square inch of total section. It will be useful to compare the resistance of this prism with the resistance of an iron prism of the same weight. The hooped concrete had a density of 2.4, and that of iron is 7.8. To compute the pressure which an iron bar of the same weight will get per square inch of section, 10,500 must be multiplied by 3.2, the ratio of the densities of the two materials, and 33,600 pounds per square inch is thus obtained for the iron. Since not more than 36,000 to 39,000 pounds per square inch can be expected of the total area of a riveted iron section weakened by numerous holes, it may be said that a prism of an ordinary mixture reinforced by an average percentage of hoops, has shown a compressive resistance in the neighborhood of that of ordinary iron.

Weight of Cement per Cubic Yard of Sand:	675 Pounds				730 Pounds.
Age of mortar tested, days	8	14	22	23	100
Ratio of volume of iron to volume of concrete	0.02	0.03	0.04	0.02	0.034
Resistance to crushing in pounds per square inch of total section	4,870	6,540	7,360	4,930	10,500
Resistance to crushing of concrete not reinforced	569	711	853	853	2,420
Increase of resistance due to hooping	4,301	5,829	6,507	4,077	8,080
Product of ratio of iron to concrete by 78,200 pounds	1,564	2,346	3,128	1,564	2,658
Ratio of the values of the last two lines	2.7	2.5	2.1	2.6	3.0

It will be seen in what follows that the results of hooping are less advantageous for the coefficient of elasticity and, therefore, for the resistance to flexure as a column than for that of the crushing resistance. To study this question experiments had to be made on long members and their deformations measured. With the aid of M. Hennebique, 38 prisms of octagonal section of 5.9 inches diameter were made. Different reinforcing was embedded, and the concrete consisted of the usual mixture of 1,000 pounds cement to 45 cubic feet of gravel and 22.5 cubic feet of sand, in some prisms, and double the amount of cement in others. Some prisms had a length of 1.64 feet and were especially intended to test the crushing resistance; the others had a length of 4.25 feet and were used to study the elasticity and the ductility of hooped concrete, which is one of its characteristic properties and one of the most important for safety. Prisms of 11.8 inches diameter have also been prepared and they will be broken in a 1,100,000 pounds testing machine.

Each specimen teaches its lesson, but it is plainly impossible to describe all the results obtained, comprising about 1,200 observations of deformations. They have, therefore, been grouped so as to throw most light on the important points.

The first group consists of 6 prisms. Prism A was not reinforced. It crushed under a load of 1,050 pounds per square inch. Prism B was reinforced with helicoidal spirals of 5.5 inches average diameter made of cold drawn ¼-inch iron wire spaced 1.18 inches centers to centers. It crushed under a pressure of 5,120 pounds per square inch of total section. Prism C was reinforced by helicoidal spirals of 5.5 inches average diameter made of cold drawn iron wire of 0.17 inch diameter and spaced 0.59 inch centers to centers. Without crushing it stood a pressure of 5,400 pounds per square inch, which was the highest pressure supplied by the testing machine employed. Prisms D and E were armored respectively the same as B and C, and in addition they were reinforced by 8 longitudinal wires ¼ inch in diameter leaning against the inside of the spirals. They failed as columns, before crushing, under pressures of 4,550 to 4,700 pounds per square inch. Prism F had 8 longitudinal reinforcing wires 0.35 inch diameter tied together by belts of iron wire 0.17 inch diameter spaced 3.15 inches apart, that is, closer than they are usually in concrete steel constructions. It failed under a pressure of 2,420 pounds per square inch. The following phenomena were noticed without the aid of measuring devices.

V. *General Properties of Reinforced Concrete and Hooped Concrete.*—The non-reinforced prism A broke suddenly, without any signs of approaching danger. The failure of F was almost as sudden. Its breaking load did not exceed by more than 7 per cent. the load producing the first cracks. The reinforcing rods bent outwards between their cross connecting ties and the concrete crushed. Concrete in compression when not reinforced or when reinforced by longitudinal rods must be classified among the materials which break suddenly without much deformation. Quite different is the behavior of hooped concrete as will be seen.

The hooped prisms behaved at the beginning the same as the others and showed only very small deformations under small loads; but this so-called elastic period did not end with the failure of the specimen. The shortening was observed to increase rapidly and cracks appeared in the concrete covering the hoops, first fine, then more and more pronounced. Rough measurements showed that failure took place after deformations as great as 3 per cent. of the length. By comparing the percentages of the iron to the concrete with the corresponding crushing resistances the considerable superiority of hooped concrete, from this point of view, becomes evident. The table giving the results of the Quimper experiments shows this very clearly. It may be added that the results of this group of experiments have shown at once *that while concrete not reinforced or reinforced by longitudinal rods, even when tied together by ties appreciably nearer to each other than is usually the case, breaks in compression under small deformations and without any notice, hooped concrete sustains, without crushing, considerably heavier loads and only fails a long time after cracks in the faces and exaggerated deformations have called attention to the approaching danger.*

(To be continued).

The Department of Bridges of New York City has been assigned an official photographer, who will make all progress photographs of the work of the department.

The Character of Waters used in irrigation, especially in the growing of rice, is being studied by the Bureau of Chemistry, Department of Agriculture, to determine the quantity of injurious salts which these waters may contain and the quantities of this water which may be safely used upon the fields.

Large Transit Undertakings.

The two cities which have taken a leading part in the solution of metropolitan rapid transit problems have recently taken decisive steps towards additional extensive construction for improved transit facilities. By a very large majority at the recent elections, the citizens of Boston, on popular referendum, accepted the act providing for new subways which will greatly enlarge the present underground transportation system. The new subways are intended to facilitate travel into and through some of the most congested parts of the city. The design and construction of these subways will be under the charge of the Boston Transit Commission. Details of the project have not yet been fully determined.

About a year ago the Pennsylvania Railroad made public a project for tunneling beneath the North and East rivers and the boroughs of Manhattan and Queens, New York City, for the purpose of connecting its terminals in New Jersey with the Long Island railroad systems and obtaining direct entrance to the heart of New York. The work was outlined in The Engineering Record of December 14, 1901. The Rapid Transit Commission represented the city in the negotiations, but final action upon the franchise came within the province of the Board of Aldermen. After the matter had been under consideration for several months, the Board voted, 41 to 36, on December 16 to grant the franchise. Clauses providing for an 8-hour day, the prevailing rate of wages and the submission of labor disputes to arbitration, upon which many of the aldermen insisted, were steadily rejected by the railroad officials, and the franchise as granted does not contain them. The franchise is perpetual, but terms of rental are subject to readjustment at intervals of 25 years; and the franchise cannot be transferred excepting to a New York corporation, which must comply with all its provisions. The power to be used for propulsion of trains through the tunnels shall be electricity or other form of power not requiring combustion within the tunnel. Construction, it is required, shall begin within 3 months, and shall be completed, ready for operation, within 5 years. The cost of construction and real estate is roughly estimated at $50,000,000. The city may utilize the tunnels for fire and police telephone and telegraph wires, and shall have sanitary and police control of them.

An Examination for Architectural Draftsmen will be held by the Municipal Civil Service Commission of New York, January 19, 1903. Receipt of applications will close January 15. This examination will be divided into two parts: First grade, salary $750 or less per annum; third and fourth grades, salary more than $750 but not more than $1,200 per annum. For particulars address Mr. S. William Briscoe, secretary, 61 Elm Street, New York.

Fire Insurance Rates in Brooklyn have recently been increased from 20 to 30 per cent. on property in business and manufacturing sections of the borough because of inadequate water supply for fighting fires. The great number of small and old pipes in the distribution system are said to be responsible for curtailing the quantity of water and reducing the pressure at hydrants. To relieve this unfortunate condition it is proposed to lay additional large trunk mains and replace some of the oldest and smallest pipes with new mains of larger size. Brooklyn's experience may well be taken as a lesson by some other municipalities. Computation will often show that the saving in fire insurance premiums alone would pay for large extensions of water-works.

A Fire Test of Doors.

A fire test of two doors composed of deal and uralite, is described in a recent report of the British Fire Prevention Committee. Uralite is a patented product marketed by the British Uralite Company, Ltd., of London. It consists of asbestos fibers, crossed and interlaced, with which a small quantity of chalk is mixed. This mass, in the form of a pulp, is spread out into sheets, materials being added to cause the conformation of gelatinous silica. The board is then dried, and is repeatedly treated with chemicals to cause the deposition of silica within its pores. After each deposition, it is dried and heated, and resulting carbonate of soda is washed out. The doors were constructed of two thicknesses of white deal, each ⅞ inches thick, one set being vertical and the other horizontal, with one layer of soft uralite between and one layer of soft and one of hard uralite on the outside faces. One of the doors was armored by a covering of tinned sheet steel, 0.022 inch thick. The doors were approximately, 2 feet 9 inches by 6 feet 6 inches and 2¼ inches thick, and were placed in one wall of a fire brick testing chamber, 10x10 feet in area and 9 feet high. Mixed air and gas was introduced below the floor of the chamber and burned within it. The test lasted 90 minutes, during which time the maximum temperature reached was 1,780 degrees, and the average about 1,320 degrees. The doors were supported by two heavy hinges and secured by two bolts at the top and bottom. At the conclusion of the test the doors were cooled with water. The unarmored door was buckled ¾ inch outward between the bolts, and slightly less than that between the hinges. The outer thickness of uralite was not damaged, but the upper inside layers were broken away, being carried away by the application of water. The inner thickness of wood was carbonized throughout; the center layer of uralite was cracked and damaged; and the outer thickness of wood was partly carbonized. The steel-covered door was buckled ⅜ inch outward between the bolts, and slightly less between the hinges. The plates on the outside were not damaged, but those on the inside, while still in position, were badly warped toward the fire and the joints slightly opened. Upon removing one of the steel plates, it was found that the inner thickness of boarding was carbonized; the center thickness of uralite was not harmed, and the outer thickness of boarding was discolored but not much damaged.

Since the foregoing account was written, some further information has been obtained concerning uralite from a report of Consul-General Oliver J. D. Hughes, at Coburg, Germany. It is the invention of a Russian artillery officer and chemist, named Imschenetzky. The process of manufacture is akin to that employed in paper making, and commences in what is known as a "preparation building," where the crude asbestos is first of all "teased" out and freed from sand and other foreign substances. It is carefully graded and separated and passes onto edge runners, where a small portion of whiting is added to prevent grinding rather than the loosening of the fibers which is desired. From the edge runners it is conveyed by elevators to a floor above, where it is fed into a Krupp disintegrator which further loosens the fibers. It is again separated by air blasts and by sieving, and is then ready for the next stage.

In another building, the asbestos is mixed with an equal weight of whiting, if white uralite is being made; or if gray or red uralite is needed, this is replaced by carbon black or red oxide. The whiting is first reduced to a cream by beating it up with revolving paddles in a mixer. This is passed through a sieve for the removal of accidental impurities, and thence into a "hollander." The asbestos is next added, the usual charge being about 600 pounds, and then the coloring matter. The whole is worked up into an emulsion by revolving screws and beaters, for a quarter of an hour or so, and there is a further separation to remove any sand which may have hitherto escaped detection.

The uralite pulp then passes to a machine designed on much the same lines as that employed in making paper boards. The pulp is delivered over riffle boards onto an endless revolving blanket, and passing through a series of rolls is partially dried and compacted. It then passes onto a revolving drum at the end of the machine, on which some fourteen or fifteen thicknesses are deposited before the required thickness is attained. During the process of winding onto the drum, a solution of sodium silicate, with an amount of sodium carbonate insufficient to permit of the immediate deposition of the silica, is passed over the successive fibers of asbestos and serves as an adhesive.

The large sheets, as they are taken from the drum in their pliable state, are quickly cut to smaller ones, measuring 6 feet 2 inches by 3 feet 1 inch. These sheets are piled up, alternating with sheets of wire gauze or sheet iron, to a height of about 40 inches. The pile is then placed under an hydraulic press and the pressure slowly increased, until at the end of half an hour it is about 200 pounds per square inch. This is maintained for one and one-half hours, and the pile is then left to harden for 24 hours, after which the sheets are removed to go to the storing rooms. Here, they are placed vertically in racks on trucks, and pass through a series of gas-fired stoves with graduated temperatures. They are then steeped in a solution of sodium silicate, washed, left to dry, and again passed through a stove, after which they are steeped in a solution of sodium carbonate, and washed and dried as before. These subsequent operations are repeated as often as required for the final hardening of the sheets, and the entire process occupies several days. The sheets are stacked for some days and again passed through the stove, being then ready for use, though they are the better for a little seasoning. The sheets of uralite thus produced are found to be uniform in thickness, 3/32 inch being the standard.

It is stated that under test a cube 1 inch square, built up with sections, cut from standard sheets, was subjected to a pressure of 19.8 tons before it gave way. A strip 9¼ inches long, 1½ inches broad, and 7/64 inch thick, placed between supports and gradually subjected to an increasing weight placed at its center, did not break till a weight of 15 pounds had been applied.

The Sederholm Boiler.

The Sederholm boiler is a modification of a horizontal return tubular boiler, the principal change being the addition of several transverse water heating drums below the main part of the boiler with the object of increasing the heating surface per square foot of ground occupied and thus overcoming an objection that has been made to the horizontal tubular boiler as usually designed. The drums in the Sederholm boiler extend entirely across the furnace and combustion chamber and they are sufficient in number and diameter to compel the gases to pass to the rear of the setting before coming in contact with the shell above. The gases then pass forward above the drums and below the shell and backward again through the tubes in the shell. Each drum is connected at each end and in the middle to the shell above by means of water passages consisting of large pipes with flanges riveted to its ends and to the drum and shell.

In 1901 several tests of these boilers were conducted by Mr. Albert C. Wood, M. E., of Philadelphia, Pa., and the results have been printed in a recent catalogue of the Allis-Chalmers Company, of Chicago, the builders of the boiler. Two boilers were tested, each having a main shell 8 1/3 feet in diameter, 16 feet long and containing 190 3½-inch tubes. Each boiler was equipped with four furnace drums 30 inches in diameter and 12 feet 2 inches long. The tube heating surface was 2,786.6 square feet, the drum heating surface 139.2 square feet and the rear tube sheet 25.8 square feet. As the grate surface was 51 square feet the ratio of heating to grate surface was as 57.8 to 1. Lahman-Kirkwood shaking grates were used.

Three trials were made, the first with "New Kentucky" Illinois screenings, the second and third with "New River" semi-bituminous, run-of-the-mine coal. The heat value of the former coal was 12,870 B. T. U. per pound of dry coal, as determined by calorimeter, and of the New River coal, by Dulong's formula from the ultimate analysis, 14,932 B. T. U. per pound. The principal results are given in the accompanying table:

Results of Trials of Sederholm Boilers.

Date of trial	Apr. 18	Apr. 22	Apr. 19
Duration of trial, hours	11.	13.	13.6
Average steam pressure in boiler, pounds	117.6	117.6	110.6
Average draft in flue, inches	0.25	0.46	0.44
Average temperatnre waste gases, degrees F.	520.	573.	516.
Average temperature feed water, degrees F.	199.6	200.6	199.0
Kind of coal	New Kentucky	New River	New River
Moisture in coal, per cent.	5.54	1.56	2.31
Per cent. refuse in coal	10.5	7.8	6.9
Water evaporated per pound dry coal actual conditions, pounds	8.51	10.31	9.98
Equivalent water evaporated per pound dry coal from and at 212 degrees F., pounds	8.99	10.88	10.53
Equivalent water evaporated per pound combustible from and at 212 degrees F., pounds	10.05	11.80	11.31
Water evaporated from and at 212 degrees F. per square foot heating surface per hour, pounds	3.87	4.38	3.43
Dry coal burned per square foot grate per hour, pounds	24.9	23.3	18.8

Experimental Septic Tanks, with nitrifying filters, were operated in Altoona, Pa., from September 16 to November 10 to study the applicability of this method of treatment to the dilute sewage of the east end of the city. During the experiments the rate of sewage flow varied from 3,080,000 to 4,023,000 gallons per day, excepting during five brief periods of flood caused by rain. According to the report submitted to the city council by City Engineer Harvey Linton and embodying analyses by Dr. C. B. Dudley, chemist to the Pennsylvania Railroad, the results were not at all satisfactory. This unfavorable outcome of the experiments is supposed to be due to the presence in the sewage of the drainage from the gas works, there being 527 parts of free ammonia per million in this drainage, a sufficient proportion to be detected by the characteristic odor. Besides this large proportion of ammonia, the drainage from the gas works contained some cyanide, sulphides, sulpho-cyanides and tarry matter. It is possible, however, that the diluteness of the sewage is in part responsible for the poor action of the septic tank. It is proposed to prosecute the experiments, eliminating the gas house drainage from the sewage. Mr. Allen Hazen, of New York, has been retained to confer with the city engineer in the further study of the subject. The Engineering Record is indebted to Mr. Harvey Linton, city engineer, for the above.

Grouting Subaqueous Walls.

An interesting example of what can be accomplished with cement under water is found in a lock and weirs recently constructed in Egypt. The lock foundations were got in entirely by grouting, and, as it is believed that this system has never been applied to such an operation before, it may be useful to abstract the description published in "Indian Engineering."

The foundation bed was prepared by dredging. The walls were made in sections by depositing the materials inside bottomless boxes formed in place from a floating platform supported by two barges moored in position. The boxes were 29 feet long, 10 feet wide and 26 feet high. A horizontal timber frame was supported from the barges at the water surface and a second frame, weighted with old rails, hung by chains from the upper frame so as to be 13 feet below it. The sides of the box were then formed of sheet piles one foot wide, fastened together in sets of five, weighted at the bottom so as to float vertically, and shod with sheet iron in order to make a good joint with the river bed and prevent the escape of grout. The construction is shown in the accompanying illustration.

When the sides of the box had been formed, the whole interior surface was lined with sacking, overlapping at the angles and at the junction with the river bed. The sacking was kept in place and protected from being torn by the rubble, during filling, by nailing thin planks about 3 feet apart against it from water surface to bed. Divers were constantly at work during these operations. Four perforated pipes were then fixed along the axis of the box at equal distances, and the box filled with rubble and concrete metal (20 per cent.) and pebbles (15 per cent.) thrown in up to slightly above water level. Pipes without perforations were then inserted into two alternate perforated pipes, reaching nearly to the bottom of the box; on the tops of these pipes were screwed funnels, and over the funnels were fixed coarse wire sieves to catch the pieces of paper of the cement barrels and other foreign substances that might get mixed with the cement grout. In the other two pipes, floats which sank in water and floated in cement grout, were suspended, so that the rise of the grout might be watched. The object of grouting through an inner pipe without perforations was to deliver an unbroken column of grout at first at the bottom of the box, and afterwards have the grout ascend towards the surface of the sea. If grout were poured directly into the perforated pipe, each bucket of grout would have to fall through water. The inner pipes were changed over from time to time to the alternate perforated pipes, and gradually shortened as the grout rose. To lessen the danger of leaks at the bottom of the box from the pressure of too great a head of liquid grout, (which being twice as heavy as water exercises a pressure in water equal to the pressure exerted by a head of water in air), it was generally arranged that a depth of three feet should be grouted over night, and left till the next morning to set, so as to form a solid bottom to the box on which the rest of the grout would be supported.

The grouting was continued next day until the grout rose slightly above the water surface: the scum was cleared away, and stones put by hand into all the spaces where there was an excess of grout. The block was then left for the night, and next morning was found to have set hard enough for the box, in which it was formed, to be loosened and moved forward.

The second and subsequent boxes were made as three-sided boxes, the last grouted block forming the fourth side and being clasped by the side beams of the horizontal frames.

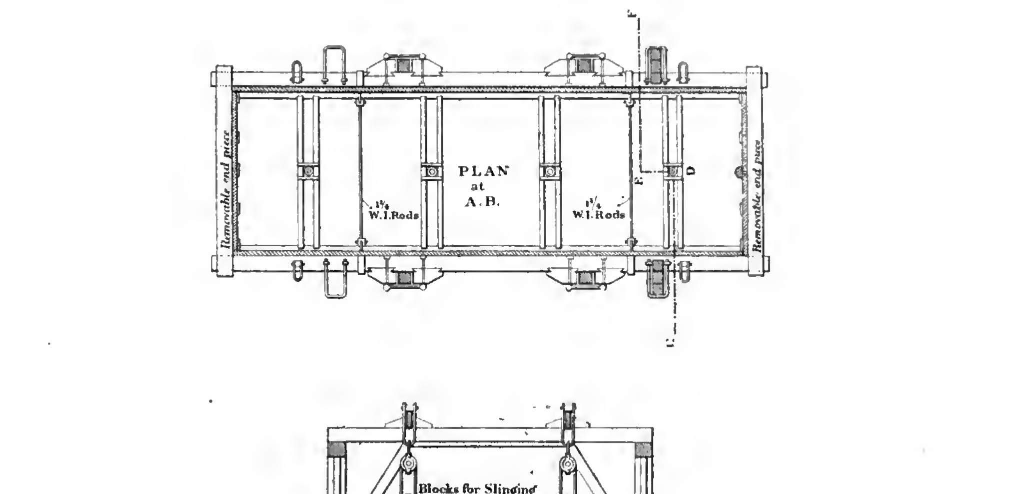
A box and its contained block took from three to four days to make, so that, when four rafts were at work, the average rate of progress was about 33 feet of core-wall or lock-wall a day. Each block contained about 210 cubic yards of masonry, and was about 29 feet long by 10 broad and 20 high.

The cement grout was mixed by hand in iron troughs by ordinary laborers. The consistency of the grout varied from thin to thick, the proportion of water depending on the judgment of the mixers. Experiments and experience on the work itself seemed to show that, whether thin or thick, the cement grout set satisfactorily and gave the desired result. Whatever the explanation, it appeared to be unnecessary to be particular about the proportion of water in the grout when used as in the work described, but it is necessary to be careful to get a cement that will behave satisfactorily under such severe conditions, and this appears from experiments made with many kinds of cement not to be difficult.

In constructing the lock, two parallel walls, bounding the lock area on either side, were formed by the system adopted for the core-wall. The rectangle of which these walls formed the sides (330 feet long by 56 feet broad between the walls) was then closed at the two ends by sheet piles supported by horizontal beams, which were kept in place by piles driven a short distance into the bed of the river and tied at their tops to the side walls already formed. A staging was then constructed across the enclosed space from wall to wall, and the perforated pipes fixed in place about 11 feet apart all over the area. Six feet depth of rubble, concrete metal and pebbles were then thrown in to form the floor foundation. At about three feet from each end a second interior cross wall of sheet piling was arranged with the lower end below the level to which the six-foot layer of rubble would come. All the sheet piling was lined on the inside with sacking to prevent the escape of grout between the joints, in the same way as in the boxes.

When the six-foot depth of floor material had been deposited, grouting commenced at one end of the lock and continued day and night for 89 hours till the other end was reached. The end walls were then filled and grouted. The enclosed space was pumped out in half a day, and the grouting was found to have formed a perfect floor without the sign of a spring in it. The rest of the lock floor and walls was built in the dry in the ordinary manner.

As the grouting was executed under water and was not continued, as in the boxes, until the grout rose above the water surface, arrangements had to be made for ascertaining to what level the grout had risen. A simple arrangement revealed this. The grout was poured into alternate pipes, and in the other pipes floats were suspended that would sink in water and float in cement grout.

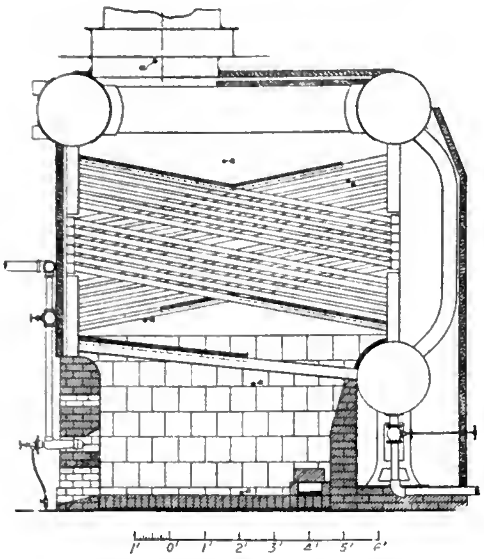


SECTION C.D.E.F.

Barges and Box for Constructing Subaqueous Walls.

Naval Tests of a Water Tube Boiler.

One of the most important series of boiler trials ever made is that reported by a board of naval officers in the recent annual report of Rear Admiral George W. Melville, Chief of the Bureau of Steam Engineering of the Navy Department. Two series of trials, one with coal and the other with oil fuel, were made on a boiler of the Hohenstein water-tube marine type built by the Oil City Boiler Works, of Oil City, Pa. The tests are of particular value because of the different conditions under which they were conducted and also because they give data bearing on the relative value of Texas oil and of two well known steam coals. The board of officers consisted of Lieut. Commander John R. Edwards, U. S. N.; Lieut. Commander Wythe M. Parker, U. S. N.; and Lieut. Commander Frank H. Bailey, U. S. N. The tests were conducted at Washington, D. C., in an air-tight steel house of dimensions corresponding to those of the fire room of the cruiser "Denver," in which boilers of the same type are to be installed. An illustration of the boiler is shown. The upper transverse drums are each 24 inches in diameter and are connected by four drums 16 inches in diameter. There are 384 2-inch tubes, 9 feet long, and 16 4-inch tubes, 7 feet long, the latter being placed over the furnace. There are also 15 5-inch down-take tubes in the rear. These are not exposed to the gases. The floor space occupied by the boiler is 9 feet wide and near 11 feet deep. The heating surface was 2,174 square feet for coal tests 15 to 20 inclusive and 2,130 square feet for coal tests 21 to 31 inclusive. The grate surface is 50.14 square feet, making the ratio of heating to grate surface 43.4 to 1 and 42.5 to 1 for the two series. The air spaces in the grate bars for the coal trials were ⅝-inch for tests 15 to 25 inclusive and ½ inch for tests 16 to 31 inclusive. The stack was 70 feet high above the grate and of 8.7 square feet sectional area.



THE HOHENSTEIN WATER-TUBE BOILER.

COAL AND OIL TESTS OF A HOHENSTEIN WATER TUBE BOILER.

					Average pressures.					Average temperature (Deg. F.).					Fuel.				
Number of trial.	Duration of trial (hours).	Kind of coal (P., Pocahontas; N. R., New River; r. m., run of mine; h. p. s., hand-picked and screened).	Oil burner used.	Height of barometer at noon.	Steam pressure by gauge.	Pressure of medium used for spraying oil (lbs. per square inch).	Fire room.	Base of stack.	Revolutions of fan blower per minute.	Air in fire room.	Medium used in spraying oil.	Chimney gases.	Feed water entering boiler.	Quality of steam.	Percentage of ashes and refuse.	Percentage of moisture in coal (*by weighing and drying sample; †by chemical analysis).	Dry coal per hour per square foot of grate (lbs.).	Oil per hour per square foot of heating surface (lbs.).	Equivalent evaporation from and at 212° F. per hour per square foot of heating surface (lbs.).
1	6	....	O. C. B. W. (air)	30.02	273.5	3.20	1.27	—0.49	327	121	(?)	704.6	120.7	0.983	....	....	...	0.83	10.5
2	4	....	"	30	273.5	4.62	2.31	— .50	423	121.5	(?)	779	103.2	.980	....	....	...	1.08	13.1
3	8	....	"	29.70	273.5	.78	0	— .35	0	106	102.5	503.6	128.5	.984	....	....	...	.36	5.18
4	3	....	"	29.94	273.5	3.37	3.25	— .41	483	108	122	854	119	.981	....	....	...	1.35	15.8
5	5	....	"	30.13	273.5	1.41	0	— .40	0	112	120	557	129	.986	....	....	...	.44	6.23
6	116	....	"	29.89	271.5	1.31	0	— .46	0	112	113.5	585	119.4	.985	....	....	...	.39	5.52
7	6	....	"	30.10	272.5	4.66	0	— .54	0	120	161	747	119.7	.995	....	....	...	.71	9.45
8	3	....	"	30.08	276	4.68	3.75	— .53	506	115	136	1,017	119.	988	....	....	...	1.55	16.7
9	6	....	Hayes (steam)	30.16	273.5	32	0	— .38	0	98	(?)	449	127	.991	....	....	...	.28	3.91
10	8	....	O. C. B. W. (steam)	30.20	273.1.	29.9	0	— .60	0	98	444.4	596	118.3	.995	....	....	...	.43	5.82
11	8	....	"	30.18	273.7	61,4	0	— .53	0	106	408.2	628	120.2	.994	....	....	...	.48	6.52
12	8	....	"	30.05	274.2	91	0	— .53	0	103	401	661	119.6	.995	....	....	...	.53	7.15
13	8	....	Reed (air and steam)	29.92	276.7.	92	0	— .45	0	99.4	375	578	121.9	.996	....	....	...	.45	6.48
14	8	....	"	29.96	277.4	89	0	— .50	0	111.5	416	645	120.8	.998	....	....	...	.54	7.60
15	8	P. r.m	....	30.02	263.9	....	0	—0.52	0	93.8	....	594	144	.980	10.24	*0.50	24.1	...	4.85
16	6	"	....	30.12	272.9	....	1.08	— .65	250	117.8	....	751	145.4	.968	10.08	* .50	34.5	...	7.05
17	4	"	....	29.86	274.6	....	2.06	— .84	335	121.7	....	1,089	145.8	.989	10.91	* .50	52.4	...	10.25
18	8	"	....	29.70	271.3	....	0	— .24	0	114	....	688	137	.990	8.66	† .79	21.3	...	5.06
19	6	"	....	30.08	272.5	....	1.06	— .41	243	139.5	....	712	129.3	.988	13.40	† .79	35.2	...	8.03
20	3½	"	....	29.95	270.5	....	2.03	— .22	375	127.3	....	1,105	116.5	.990	14.37	† .79	47.8	...	9.14
21	8	N.R., r.m.	....	30.34	273.5	....	0	— .50	0	144	....	563	131.8	.986	11.95	*3.14	19.4	...	4.53
22	6	"	....	29.95	273.5	....	1.07	— .46	243	124	....	654	126.1	.976	8.89	*3.14	31.2	...	7.11
23	4	"	....	30.25	273.5	....	2.10	— .98	375	106.5	....	688	111.8	.980	11.03	*3.14	43.4	...	9.64
24	8	P., h.p.s.	....	30.20	273.5	....	0	— .55	0	125	....	548	125.9	.988	8 44	*2.04	20.2	...	4.69
25	8	"	....	30.18	273.5	....	0	— .55	0	125.4	....	521	122.3	.987	13.48	*1.15	18.3	...	4.38
26	6	"	....	30.09	273.5	....	.99	— .55	240	105	....	580	119.7	.983	16.75	*1.59	27.4	...	6.26
27	4	"	....	30.23	273.5	....	2.10	— .77	375	86	....	717	91.4	.979	12.08	*1	52.8	...	11.77
28	6	"	....	30.13	273.5	....	...	— .59	243	77	....	766	104.6	.980	10.82	† .73	46.3	...	9.81
29	8	"	....	30.01	273.5	....	...	— .51	0	87	....	568	125	.985	12.63	† .73	22.7	...	5.40
30	4	"	....	30.28	273.5	....	...	— .64	332	64	....	800	98.4	.978	10.18	† .73	62.4	...	12.54
31	3	"	....	29.58	273.5	....	...	— .55	423	76.5	....	943	88	.974	11.92	† .73	71.7	...	14.15

COAL AND OIL TESTS OF A HOHENSTEIN WATER TUBE BOILER (Concluded).

	Economic results.						Chimney gas analysis.							Heat balance or distribution of the heating value of the fuel. In percentages of the total heating value.							Efficiency.	
Number of trial.	Feed water per lb. of oil or coal as fired (lbs.).	Equivalent evaporation from and at 212° F. per lb. of oil or dry coal (lbs.).	Lbs. of steam used in spraying oil per lb. of oil.	Steam used in spraying oil (per cent. of total steam generated).	Cubic feet of free air used in spraying oil per lb. of oil sprayed.	Equivalent evaporation from and at 212° F. per lb. of combustible (lbs.).	Carbonic acid, CO_2 (per cent.).	Oxygen, O (per cent.).	Carbonic oxide, CO (per cent.).	Nitrogen, N (per cent. by difference).	Lbs. of dry chimney gas per lb. of carbon.	Lbs. of dry chimney gas per lb. of oil.	Heat value of 1 lb. of oil or coal calculated from chemical analysis.	Heat absorbed by boiler.	Loss due to superheating steam used in spraying oil.	Loss due to moisture in coal (per cent.).	Loss due to moisture formed by the burning of hydrogen.	Loss due to heat carried away in dry chimney gases.	Loss due to incomplete combustion of carbon.	Other losses—radiation, etc.	Of boiler (per cent.).	Of boiler and furnace.
1	11.15	12.70	0.303	2.39	34.3	....	6.97	8.77	1.50	82.76	28.99	24.1	19,481	62.8	0	..	7.4	17.3	7.7	4.8	62.8	61.3
2	10 56	12.18	.474	3.89	37.4	....	6.96	9.20	1.20	82.64	30.11	25.1	19,481	60.3	0	..	7.6	20.1	6.4	5.6	60.3	58
3	12.74	14.43	.153	1.06	62.8	....	7.24	10.2	.425	82.135	32.15	26.8	19 481	71.5	0	..	6.9	13.2	2.4	6	71.5	70.7
4	10.30	11.73	337	2.88	36.7	....	7.50	10.4	.3	81.80	31.64	26.4	19,481	58.1	0	..	7.9	24.2	1.7	8.1	58.1	56.4
5	12.54	14.22	.280	1.97	70	....	7.70	10	.13	82.17	31.54	26.3	19,481	70.4	0	..	7	14.4	.7	7.5	70.4	69
6	12.36	14.12	.216	1.53	55.4	....	7.68	10.25	.06	82.01	31.91	26.6	19,481	69.9	0	..	7.1	15.5	.3	7.2	69.9	68.8
7	11.52	13.29	.090	7.45	78.3	....	10.1	6.64	,275	82.985	24	20	19,481	65.8	0	..	7.5	15.1	1.2	10.4	65.8	60.9
8	9.39	10.77	.458	4.25	36	....	7.87	9.66	.22	82.25	30.54	25.4	19,481	53.4	0	..	8.3	28.1	1.2	9	53.4	51.1
9	12.16	13.89	.701	5.77	0	....	5.5	13.05	.27	81.18	42.47	35.4	19,481	68.9	.3	..	6.9	15.4	2	6.5	68.9	64.9
10	11.65	13.47	.464	3.98	0	....	6.99	11.05	.013	81.95	35.16	29.3	19,481	66.7	.4	..	7.4	18	.1	7.4	66.7	64.1
11	11.68	13.45	.515	4.41	0	....	7.47	10.66	.086	81.78	32.64	27.2	19,481	66.7	.4	..	7.5	17.5	.5	7.4	66.7	63.8
12	11.77	13.58	.591	5.03	0	....	8.44	9.29	.014	82.26	29.29	24.4	19,481	67.3	.5	..	7.6	16.8	.1	7.7	67.3	63.9
13	12.43	14.35	1.062	8.54	81.4	....	7.70	9.85	.075	82.37	31.70	26.4	19,481	71.1	.6	..	7.4	15.4	.4	5.1	71.1	65
14	12.17	14.06	.742	6.09	78	....	8.53	9.04	.05	82.38	28.85	24	19,481	69.7	.6	..	7.5	15.7	.3	6.2	69.7	65.4
15	7.82	8.73	....	...	...	9.74	9.85	6.85	1.67	81.63	21.5	...	15,391	61	..	0.1	3.2	15.1	8.6	12	61	60
16	8.30	8.86	....	...	...	9.86	9.46	6.50	1.96	82.08	21.7	...	15,391	61.8	..	.1	3.3	19.3	10.2	5.3	61.8	60.8
17	7.55	8.48	....	...	...	9.52	12.42	4.85	1	81.73	18.7	...	15,391	59.7	..	.1	3.7	25.5	4.4	6.6	59.7	58.2
18	9.03	10.28	....	...	...	11.26	11.08	4.75	2.19	81.98	18.8	...	15,124	71.8	..	.1	3.3	15.1	9.2	.5	71.8	68.3
19	8.65	9.87	....	...	...	11.41	10.35	5.03	2.20	82.42	19.8	...	15,124	72.8	..	.1	3.2	15.9	10.4	—2.4	72.8	65.6
20	7.15	8.28	....	...	...	9.69	13.77	3.73	.93	81.57	17.2	...	15,124	62	..	.1	3.7	23.6	3.7	6.9	61.9	55
21	8.50	9.91	....	...	...	11.30	9.26	6.48	1.52	82.74	23	...	15,684	69.5	..	.3	3.5	13.1	8.1	5.5	69.6	64.4
22	8.33	9.68	....	...	...	10.66	8.87	6.94	1.59	82.60	23.6	...	15,684	65.6	...	.3	3.7	16.9	8.7	4.8	65.6	63
23	7.96	9.42	....	...	...	10.63	9.20	6.40	1.70	82.70	23.7	...	15,684	65.5	..	.3	3.8	17.8	8.9	3.7	65.4	61.3
24	8.45	9.84	....	...	...	10.76	8.89	...	...	....	...	...	15,475	67.1	..	..	3.2	...	...	...	67.1	63.3
25	8.80	10.16	....	...	...	11.77	8	...	...	....	...	...	15,475	73.4	..	..	3.2	...	...	...	73.4	65.4
26	8.38	9.70	....	...	...	11.69	7.15	...	...	....	...	...	15,475	72.9	..	..	3.3	...	...	...	73	62.4
27	8.06	9.48	....	...	...	10.79	8.64	...	...	....	...	...	15,475	67.2	..	..	3.6	...	...	...	67.2	61
28	7.75	9.00	....	...	...	10.10	8.10	...	...	....	...	...	15,475	63	..	..	3.7	...	...	...	63	57.9
29	8.82	10.11	....	...	...	11.59	7.90	11.4	.90	79.80	28.1	...	15,475	72.2	...	.1	3.4	17.7	5.9	.7	72.3	65
30	7.33	8.53	....	...	...	9.52	8.00	9	1.10	81	24.8	...	15,475	59.4	..	.1	3.7	25.1	6.4	5.3	59.4	54.9
31	7.17	8.89	....	...	...	9.53	9.70	9.1	.60	80.60	23.8	...	15,475	59.4	..	.1	3.9	28.3	3.4	4.9	59.4	54

The steel house in which the boiler was located was provided with an air lock for entrance and exit during forced draft trials and windows that could be opened during natural draft trials. A 72-inch fan discharging into the room was provided for forced draft. Coal and water were both accurately weighed. The flue temperature in the natural draft trials was taken by a mercury nitrogen pyrometer, but on the forced-draft runs so many glass bulbs were broken that a Brown quick-reading pyrometer was used, the readings of which were checked by the melting prints of zinc, aluminum and copper.

Samples of flue gas were drawn by means of an aspirator improvised from two half-gallon bottles. The sampling tube was ½ inch in diameter and extended to the center of the stack, the inner end being nearly closed and the sides perforated with small holes. Analyses were made by the Orsat apparatus.

The accompanying table gives the results of analyses of samples of each lot of coal made by the chemist in the New York navy yard:

ANALYSES OF COAL.

	A		B	C
Boilers in test, by No....	15—17	18—20	21—23	24—31
Proximate analysis—				
Fixed carbon, per cent..	73.30	75.78	72.99	76.81
Volatile matter, per cent.	17.61	19.53	21.79	19.62
Moisture, per cent......	.49	.79	.49	.73
Ash, per cent..........	8.60	3.90	4.73	2.84
Sulphur, per cent....	.48	.71	.46	.82
Ultimate analysis—				
Carbon, per cent.......	82.26	84.96	83.60	85.94
Hydrogen, per cent.....	3.89	4.07	4.85	4.45
Oxygen, per cent.......	4.12	5.46	4.87	4.50
Nitrogen, per cent......	.64	.90	1.41	1.14
Sulphur, per cent.......	.49	.71	.46	.82
Ash, per cent..........	8.60	3.90	4.81	3.15
Calorific value—				
Coal, B.T.U., per lb......	14,067	14,534	14,841	14,992
Combustible, B.T.U., lb..	15.391	15,124	15,684	15,475

A—Pocahontas coal, run of mine.
B—New River coal, run of mine.
C—Pocahontas coal, hand-picked aud screened.

The oil tests were made on the same boiler, the grates being removed. Oil was pumped from a storage tank into a weighing tank from which the oil flowed by gravity to the oil-feed tank. From this the oil was pumped to the burners, constancy of pressure being secured by an air chamber and a relief valve. An overflow pipe led from the relief valve to the feed tank. The weighing and feed tanks were fitted with gauge glasses graduated to 5 pounds by the aid of which the exact weight of oil was secured at the end of each hour. The feed water was measured at hourly intervals in the same manner. The air for atomizing the oil was supplied by a Root blower. In determining the amount of steam used by the oil burners, in some of the tests, in which steam was used for atomizing purposes, a separate boiler was used to furnish the steam.

The oil used was from the Beaumont field and was subjected to an inexpensive treatment to remove the sulphur and some of the more volatile hydrocarbons. Analyses showed the oil to be composed of 83.26 per cent. carbon, 12.41 per cent. hydrogen, 0.50 per cent. sulphur, 3.83 per cent. oxygen. The specific gravity at 60 degrees Fahrenheit was 0.926; the flash point, 216 degrees; the fire point, 240 degrees; vaporization point, 142 degrees. The loss for six hours' exposure at 212 degrees Fahr., was 21.65 per cent. The calorific value of the oil by the Dulong formula is 19,481 British thermal units per pound.

The board expresses the belief that expert engineers will be able to make important deductions from the trustworthy data that it secured. The data and results of the coal and oil tests are given in the accompanying tables. The conclusions of the board of engineers are as follows:

That oil can be burned in a very uniform manner.

That the evaporative efficiency of nearly every kind of oil per pound of combustible is probably the same. While the crude oil may be rich in hydrocarbons, it also contains sulphur, so that, after refining, the distilled oil has probably the same calorific value as the crude product.

That a marine steam generator can be forced to even as high a degree with oil as with coal.

That up to the present time no ill effects have been shown upon the boiler.

That the firemen are disposed to favor oil, and therefore no impediment will be met in this respect.

That the air requisite for combustion should be heated if possible before entering the furnace. Such action undoubtedly assists the gasification of the oil product.

That the oil should be heated so that it could be atomized more readily.

That when using steam higher pressures are undoubtedly more advantageous than lower pressures for atomizing the oil.

That under heavy forced-draft conditions, and particularly when steam is used, the board has not yet found it possible to prevent smoke from issuing from the stack, although all connected with the tests made special efforts to secure complete combustion. Particularly for naval purposes it is desirable that the smoke nuisance be eradicated in order that the presence of a war ship might not be detected from this cause. As there has been a tendency of late years to force the boilers of industrial plants, the inability to prevent the smoke nuisance under forced-draft conditions may have an important influence upon the increased use of liquid fuel.

That the consumption of liquid fuel cannot probably be forced to as great an extent with steam as the atomizing agent as when compressed air is used for this purpose. This is probably due to the fact that the air used for atomizing purposes, after entering the furnace, supplies oxygen for the combustible, while in the case of steam the rarefied vapor simply displaces air that is needed to complete combustion.

That the efficiency of oil fuel plants will be greatly dependent upon the general character of the installation of auxiliaries and fittings, and therefore the work should only be intrusted to those who have given careful study to the matter, and who have had extended experience in burning the crude product. The form of the burner will play a very small part in increasing the use of crude petroleum. The method and character of the installation will count for much, but where burners are simple in design and are constructed in accordance with scientific principles there will be very little difference in their efficiency. Consumers should principally look out that they do not purchase appliances that have been untried and have been designed by persons who have had but limited experience in operating oil devices.

The Consumption and Waste of water in Washington, D. C., measured on June 24 of this year was found to be 205 gallons per capita, the largest June measurement ever taken.

Work on the erection of the $1,120,000 suspended span of the New East River Bridge, New York, which was delayed by the tower fire on November 10, has just been commenced. The steel work has been connected to three sets of suspenders next the Brooklyn tower, and the steel traveler there is being erected. Work at the New York end is still delayed by the effects of the fire, but will soon be started, and a duplicate traveler will be erected there and work will progress simultaneously from both ends to the center of the span. The Pennsylvania Steel Company is the contractor.

Tar and Oils on Roads in France.

Tar and oils on roads have been experimented with at Champigny, near Paris, under the supervision of M. Silvain Dreyfus, Ingénieur des Ponts et Chaussées for the Department of the Seine. According to "The Surveyor" the task was undertaken at the instigation of the medical authorities, who viewed with anxiety the increasing production of dust clouds resulting from motor-car traffic. In order to arrive at some definite results, three different roads were selected—one being newly made, a second in good state and the third in bad repair. Portions of these were treated with (1) coal-tar (supplied by the Compagnie Parisienne du Gaz), (2) heavy oils (petroleum residuum), (3) shale oil, (4) Texas petroleum, and (5) "Injectoline" (a patent preservative fluid for injection into wood).

The coal-tar was heated before use. For treating small surfaces, about 20 square yards, the following appliances were used: The tar was placed in tilting cauldrons of about 15 gallons capacity, supplied with a thermometer, and placed over a small furnace, which could be quickly withdrawn, the aim being to raise the temperature to about 140 degrees Fahr., not above, as when nearing 176 degrees Fahr. the tar froths and becomes unmanageable. When ready the tar was tilted into watering cans of about 5 gallons capacity, provided with flat roses, semi-circular in form. To the roses were attached two small runners, which facilitated the work and kept the can at a regular and constant height. For large surfaces, 150 to 250 square yards, different appliances were employed. An iron barrel, of about 60 gallons capacity, was mounted on a two-wheeled trolley, and was provided with a distributor of about 1¾ yards, and pierced with holes like that of a watering cart. The furnace, also on wheels, was independent, and could be run under the barrel and instantly withdrawn, when the thermometer marked 140 degrees Fahr. Both these appliances enabled the tar to be thinly and evenly distributed, so that only slight raking is necessary. They were also used for distributing the heavy oils, which were slightly heated, to overcome their viscous condition.

It was found that tarring roads in bad condition was most inadvisable, because the tar tends to accumulate in ruts and depressions, so that it is difficult to obtain an equal distribution, and, moreover, the mending of such roads is most troublesome. Dampness facilitated the penetration of coal-tar; but it was found that this penetration was limited, and that the lower surface could not dry, and as a result marked strata were formed, and the upper crust was easily broken. For coal-tar sprinkling a dry condition of the road is imperative. Dust must also be removed before applying tar, because otherwise much hand labor is necessary in order to obtain equal distribution and a smooth surface. Dust is not so inconvenient if the lighter oils are used. Although it is not absolutely necessary to sand roads after treatment, it was found advisable to do so; because if no sand was used a tarred road had to be left for several days, and an oiled road for several hours, before being opened for traffic. In these experiments from about 1 quart to 5 pints of liquid were distributed per square yard. The experiments have, so far, proved satisfactory. M. Dreyfus remarks that the past summer was too wet to enable a reliable opinion to be formed as to the exact dust-laying capacities of the different materials. On the other hand, the rain does not appear to have produced an objectionable oily mud. Possibly this may be due to the care observed in the first application and the use of a moderate quantity. The three roads are to be kept under close observation during the winter, and if the result justifies it an extension of the work will be carried out next summer. So far, M. Dreyfus seems to give preference to the tarred roads.

The Preservation of Forests in Russia and their economic development has long occupied the attention of her statesmen, according to a recent report of the Russian Ministry of Agriculture and Domains. In 1888, a law was enacted which aimed at the preservation and maintenance of forests. All forests exercising influence on the natural conditions of the country are placed under the protection of the State. They are freed from land imposts, and the government manages them at its own expense. The department of forestry is under the Ministry of Agriculture and Domains, with a general director at the head, assisted by two vice-directors. The personnel of the department is recruited from the schools, of which there are two superior and thirty secondary, with a two years' course of instruction. Certain agricultural societies have special forest sections. Three trial establishments have been created in southeastern Russia, to determine the influence which the planting of trees on the steppes would have on the agricultural and economic conditions of the region. The tendency is not to plant in solid masses, but in straight lines, either from north to south or east to west, as the local conditions demand.

The Labor Law of Nicaragua of June 30, 1901, recently put into effect contains some rather startling provisions in the way of defining the relations between labor and capital.

First. A laborer is defined as any person, male or female, over 16 years of age not having a capital of 500 pesos (about $100).

Second. All laborers must have an employer. Anyone found unemployed will be imprisoned for twenty days and made to labor on public works while awaiting an employer. Every employer of labor must purchase a small booklet (cost, about 20 cents), in which are registered the name, age, description, general characteristics of the person, and conditions of the contract. The employer gives his employe a receipt for the book, which the latter can produce as proof of his good standing whenever arrested by the police on suspicion of being idle. When a laborer has finished his contract with one employer and desires to go to another, he must take his "book of labor" and present it to his next employer and take a receipt, the change being registered by the judge of agriculture.

Third. If a laborer desires money in advance, his employer can give it to him only as a loan without interest, to be paid by retaining one-half of the salary or wages until the debt is canceled. A laborer leaving his employer without satisfactory settlement of his debt will be imprisoned, fined, and obliged to return and work it out.

Fourth. Any person employing laborers without this "book of labor" will be fined 200 pesos (about $40).

The purposes of the law are to do away with the pernicious habit formerly in vogue of advancing wages to laborers on a contract, which made the laborer a slave until he settled his account, and to prevent idleness and viciousness, by obliging everyone without capital to be employed. Consul Donaldson in "Consular Reports" for December states that the law caused general consternation at first among all classes, but as it is being enforced everyone is becoming reconciled, and the general effect seems to be beneficial.

Heat Resistance of Building Materials.

At the recent meeting of the American Society of Mechanical Engineers a paper was presented by Mr. William Kent proposing the use of the reciprocals of the values of heat conductivity of substances in order to facilitate the comparison of different combinations of the substances. As stated in the report of the convention, he makes the coefficient of heat resistance or heat insulating power of a substance equal to unity divided by the number of British thermal units transmitted in one hour by a slab 1 square foot in area and 1 inch thick per degree Fahrenheit of difference of temperature between the two faces of the slab, both surfaces being exposed to still air. In this way the total resistance of a combination can be indicated by the addition of the several resistance coefficients. The author points out, however, that while the coefficient is thus a constant quantity for a given substance, it can only be so considered when the differences in temperature of the air on the two sides of the slab are small—say, less than 100 degrees Fahrenheit. When the temperature range is great, experiments on heat transmission indicate that the quantity of heat transmitted varies not directly as the difference in temperature but as the square of that difference.

The question of the effect of surface resistance when the surface is in contact with air or with another body, the author treats as follows: "Authorities on the subject of heat transmission generally agree that the resistance to the passage of heat through a plate consists of three separate resistances; viz., the resistances of the two surfaces and the resistance of the body of the plate, which latter is proportional to the thickness of the plate. It is probable also that the resistance of the surface differs with the nature of the body or medium with which it is in contact. Thus a very rough surface on a metal plate would be likely to transfer more heat to adjacent air than a smooth surface would, since it has a greater area in actual contact with the air, while two rough surfaces of metal touching each other would transmit from one to the other less heat than two smooth surfaces."

He has computed the figures for heat resistance of several insulating substances from the figures of conducting power given in a table published by Mr. John E. Starr, in a paper on "Insulation for Cold Storage," published in "Ice and Refrigeration" for November, 1901. Mr. Starr's figures are given in terms of the British thermal units transmitted per square foot of surface per day per degree of difference of temperature of the air adjacent to each surface. The author's figures, the coefficients of heat resistance, given in the second column of the accompanying table, are calculated by dividing Mr. Starr's figures by 24, to obtain the hourly rate, and then taking their reciprocals.

"Analyzing some of the results given in the last column of the table, we observe that, comparing Nos. 2 and 3, 1 inch added thickness of pitch increased the coefficient 0.74; comparing Nos. 4 and 5, 1½ inches of mineral wool increased the coefficient 1.11. If we assume that the 1 inch of mineral wool in No. 4 was equal in heat resistance to the additional 1½ inches added in No. 5, or 1.11 reciprocal units, and subtract this from 5.22, we get 4.11 as the resistance of two ⅞-inch boards and two sheets of paper. This would indicate that one ⅞-inch board and one sheet of paper give nearly twice as much resistance as 1 inch of mineral wool. In like manner any number of deductions may be drawn from the table, and some of them will be rather questionable, such as the comparison of No. 15 and No. 16, showing that 1 inch additional sheet cork increased the resistance given by four sheets 6.67 reciprocal units, or one-third the total resistance of No. 15. This result is extraordinary, and indicates that there must have been considerable differences of conditions during the two tests."

HEAT CONDUCTING AND RESISTING VALUES OF BUILDING MATERIALS.

Brick Wall: Thickness.	Cond.	Res.	Revised. Res.	Revised. Cond.
4-in.	0.68	1.47	1.50	0.667
8-in.	0.46	2.17	2.30	0.435
12-in.	0.32	3.03	3.10	0.323
16-in.	0.26	3.85	3.90	0.256
20-in.	0.23	4.55	4.70	0.213
24-in.	0.20	5.00	5.50	0.182
28-in.	0.174	5.75	6.30	0.159
32-in.	0.15	6.67	7.10	0.141
36-in.	0.129	7.75	7.90	0.127
40-in.	0.115	8.70	8.70	0.115

Wooden beam construction, planked over or ceiled:	Cond.	Res.
As flooring	0.083	12.05
As ceiling	0.104	9.71
Fireproof construction, floored over:		
As flooring	0.124	8.06
As ceiling	0.145	6.90
Single window	1.030	0.97
Single skylight	1.118	0.89
Double window	0.518	1.93
Double skylight	0.621	1.61
Door	0.414	2.42

The author has also calculated the coefficients of heat resistance from the heat transmission figures of various building materials, as given by Mr. Alfred R. Wolff, based on German experiments. These values are reproduced in a table herewith, the first column giving the conductance, in British thermal units per hour, and the second, the reciprocals, or heat resistances. It will be noted that there is an irregularity of the differences in the value of the resistance for each increase of 4 inches in thickness of the brick walls, which the author holds to indicate a difference in the conditions of the experiments. He finds the average difference is 0.80 and that the approximate formula for the resistance is $0.70 + 0.20\ t$, in which t is the thickness in inches. In the third and fourth columns are given the revised values of the resistance and conductance, respectively, ascertained in accordance with his formula.

The Cleveland Water Works Tunnel under Lake Erie is nearing completion, the work still to be done being the cleaning of recently finished sections and repairing of 300 feet of poor construction. Over 60 lives have been lost on the work, the last casualty being an explosion Dec. 14, which killed three men and injured others.

HEAT CONDUCTING AND RESISTING VALUES OF DIFFERENT INSULATING MATERIALS.

	Conductance.	Resistance
1. ⅝-in. oak board, 1-in. lampblack, ⅞-in. pine board (ordinary family refrigerator)	5.7	4.21
2. ⅞-in. board, 1-in. pitch, ⅞-in. board	4.89	4.91
3. ⅞-in. board, 2-in. pitch, ⅞-in. board	4.25	5.65
4. ⅞-in. board, paper, 1-in. mineral wool, paper, ⅞-in. board	4.6	5.22
5. ⅞-in. board, paper, 2½-in. mineral wool, paper, ⅞-in. board	3.62	6.63
6. ⅞-in. board, paper, 2½-in. calcined pumice, ⅞-in. board	3.38	7.10
7. Same as above, when wet	3.90	6.15
8. ⅞-in. board, paper, 3-in. sheet cork, ⅞-in. board	2.10	11.43
9. Two ⅞-in. boards, paper, solid, no air space, paper, two ⅞-in. boards	4.28	5.61
10. Two ⅞-in. boards, paper, 1 air space, paper, two ⅞-in. boards	3.71	6.47
11. Two ⅞-in. boards, paper, 1-in. hair felt, paper, two ⅞-n. boards	3.32	7.23
12. Two ⅞-in. boards, paper, 8-in. mill shavings, paper, two ⅞-in. boards	1.35	17.78
13. The same, slightly moist	1.80	13.33
14. The same, damp	2.10	11.43
15. Two ⅞-in. boards, paper, 3-in. air, 4-in. sheet cork, paper, two ⅞-in. boards	1.20	20.00
16. Same, with 5-in. sheet cork	0.90	26.67
17. Same, with 4-in. granulated cork	1.70	14.12
18. Same, with 1-in. sheet cork	3.30	7.27
19. Four double ⅞-in. boards (8 boards), with paper bet. three 8-in. air spaces	2.70	8.89
20. Four ⅞-in. boards, with three quilts of ¼-in. hair bet. papers separating boards	2.52	9.52
21. ⅞-in. bosrd, 6-in. patented silicated strawboard, finished inside with thin cement	2.48	9.68

High Pressure Steam Piping.

Abstract of a paper read by Mr. William Andrews before the Engine Builders' Association of the United States.

The art of piping for high pressure steam is of legal age. Twenty-one years ago, when Edison, at Menlo Park, brought out his electric lamp and called upon the engine builders, boiler makers and steam fitters to assist him with better apparatus, 80 pounds steam pressure per square inch on the boiler was considered good practice. It is true that higher pressures had been used on steamboats and locomotives, but the majority of stationary engines used in factories and mills were slow speed engines, piped with ordinary merchant pipe and screwed fittings, put up by any one who could use pipe tools. Soon all this was changed for the better, high speed engines were introduced, pressures were raised, fittings and valves were made much heavier and put up with some regard to expansion and contraction.

About the year 1890 high speed, compound non-condensing engines were installed in the central station of the Edison Electrical Illuminating Company, of Brooklyn. This was the first prominent installation of engines of this type and the specifications called for a steam pressure of 150 pounds. The pipe specifications called for flanged fittings and full weight special pipe, all to stand a working pressure of 150 pounds. There were no patterns for such fittings among the eastern manufacturers, and presumably, none among the western foundries. At any rate the fittings were made to order from special patterns and they are carrying steam to-day at full pressure. In this station was introduced the "double system" of piping which became a fad for a few years, but like the American buffalo, has almost become extinct.

About this time copper pipe became popular for high pressure work, probably on account of the ease with which it could be bent and formed into curves, which were just coming into fashion, but after a few years of use, having proved itself a very treacherous metal, it was discarded and now is very seldom used except for expansion bends in exhaust pipes. About 1892 wrought steel piping made in the regular way had become so reliable that it was used in making bends and steam mains, and at the present time is so generally used, that if an engineer wishes wrought iron pipe, especially in the larger sizes, he has to call for it in his specifications and then wait for it to be made. Pipes, fittings, valves, pumps, engines and all material used in a modern, first-class job, are now required to stand a working pressure of 200 pounds per square inch.

Strange to say that during the development of the electric light and railroad interest, almost the entire efforts of the engineers and owners were given to improving the engines, boilers, generators, heaters and pumps to the exclusion of the piping. So far was this carried that it was no uncommon thing for the owner, after the above mentioned articles were bought, and his attention was called to the piping, to say, "Piping! Oh, don't worry about that I will let my plumber put that up." It may not be out of place here to name the engineers, who, during the dark days of high pressure piping, always called for and insisted on the best. They were: William Lee Church, Frederick Sargeant, Charles E. Emery, J. H. Vail, E. J. Cooke and J. Van Vleck.

A modern high pressure steam job requires: First, a good design; second, good material, and third, skillful steamfitters. The first requirement can be altered to suit the conditions, but the other two, never. Up to the year 1900 the almost universal design for a piping system for power plants was to carry a pipe from each boiler into a large steam header, whose cross section was equal to the sum of all the areas of the feeding pipes. If the designing engineer wanted to be very grand, he made it larger without knowing just why. From this header, pipes were carried to the various engines, of sizes called for by the engine builder. It was quite common to place steam separators in each line leading to an engine, but fashions changed in steam piping, as well as in clothes, and with the advent of high pressure and superheated steam, sizes of pipes have been very much reduced. In the four large power houses now built in New York City, with an ultimate capacity of from 60,000 to 100,000 horse power each, the largest steam mains are not over 20 inches in diameter, and these are used more as equalizing pipes than storage reservoirs.

Some of our best plants have pipes which run from the header to the engine two sizes smaller than that called for by the engine builders. These pipes before reaching the engine are carried into a wrought iron or steel receiver, which acts also as a separator. This receiver has a cubical capacity of three times that of the high pressure cylinder, and is placed as near as possible to the cylinder. The pipe from the receiver to the cylinder is of full size called for by the engine builder. The object of this arrangement is, first, to have a full supply of steam close to the throttle, second, to provide a cushion near the engine on which the blow caused by the cut-off in the steam chest may be spent, thereby preventing vibrations from being transmitted through the piping system, and third to produce a steady and rapid flow of steam in one direction only, by having a small pipe leading into the receiver. This steam flows rapidly enough to make good the loss caused during the first quarter of the stroke. Plants fitted up in this way are successfully running where the drop in steam pressure is not greater than 4 pounds, although the engines are five hundred feet away from the boilers. This is probably the most radical departure in high pressure work up to the present time. Allowance for contraction and expansion is provided for by long bends, by using a double swing like a gas bracket on which the fittings turn on the threads of the nipple, and by producing what may be called initial tension. This can hardly be described in words, but is a rule of thumb method by which the skilled steamfitter puts a strain on the pipes when cold, so that when the pressure is put on, the expansion removes this tension and there remains no strain on the pipe, other than that due to internal pressure.

As to quality of material, in the earlier days of electric light and railroad plants, owing to the difficulty of keeping the screwed joints tight, some engineers tried flanged cast-iron pipe for steam mains, but it was heavy and clumsy and sometimes cracked on account of the unequal expansion. Then came copper and this pipe, even when reinforced with steel wire wound around it, was found to be a treacherous metal. Flanged cast steel pipe was tried, but the difficulty of obtaining this free from blow holes barred it out. At present the material used is either wrought steel or wrought iron pipe, on which the flanges are either riveted, screwed or welded. In England and on the continent they weld a light flange to the end of the pipe and face it; it is pulled together when in use by a heavy steel or cast-iron flange, which had previously been slipped over the pipe very much as copper joints are made in marine piping.

In 1880 the New York Steam Company installed about six miles of steam mains under the streets of New York for power and heating purposes. All the joints in this pipe above eight inches in diameter were made by expanding the pipe into recesses in the flanges, and then beating the ends of the pipe over the edges of the flanges. This was done by machinery, and was well done, and at the time was considered a great improvement over threading or riveting, but in five years every joint had to be taken out on acount of leaks and threaded joints were substituted. These threaded joints lasted until 1895, when all the pipes were renewed with new mains having heavy wrought steel flanges welded on the pipe. These welded flanges when turned true in the lathe make the most workmanlike and perfect steam joints in use at the present time, and their cost alone prevents their general use. Corrugated copper gaskets placed inside the bolts and well pulled up will make a joint which will last as long as the fittings. When the owner's bank account is strong enough, ground joints without any gaskets are used. This makes a first class job, but the price is all but prohibitive.

Gate valves are almost exclusively used in high pressure work, as globe valves, especially in the larger sizes, would be very clumsy, and they would also make a pocket in the pipe. If gate valves are used often enough to keep them in good order, they will remain tight many years. One of the very necessary points of a first class piping job, and one, too, which is very often overlooked, is to have extra heavy fittings on the gauge, lubricator and high pressure drip connections. A break in one of these pipes, while it may not shut the station down, would cause great inconvenience and would be a nuisance until it was fixed.

Vibrations which often accompany the installation of high speed engines in our modern buildings are many times laid to the bad foundations or the unbalanced condition of the engine. In almost all cases it is not true, the vibrations come from the bad piping and can be and, in many cases, have been removed without touching the engine or foundations. There is no excuse at the present time for having a bad piping job and yet there is a great deal of bad piping done. Should the underlying principles of good piping, namely, good design, material and workmanship, be more strictly adhered to, much less of the present piping would have to be done over a second time. The present almost universal practice of asking for competitive bids and giving the work to the lowest bidder, is responsible for this state of affairs.

The List of Atlas Sheets prepared by the co-operative survey of New York has just been increased by the issuance of seventeen new ones. Nine of them cover portions of Wayne, Seneca, Tompkins, Cayuga, Ontario, Yates and Schuyler counties, and take in portions of lakes Ontario, Seneca and Cayuga, and the whole of Montezuma Swamp. Two of the sheets cover portions of the Thousand Islands, and two cover portions of the southeastern Adirondack region. Three are in the Hudson valley in the neighborhood of Newburgh, and one covers portions of Madison and Oneida counties. Each sheet is printed on paper 16½ by 20 inches. The scale is about 1 mile to 1 inch, and differences of elevation are indicated by figures and by contour lines of 20-foot interval printed in brown. All drainage, as streams, ponds, swamps, etc., is printed in blue; all cultural features, as roads, railways, houses, and the names upon the map, are printed in black. On the reverse of each sheet is a brief explanation of the map and its uses. These sheets are sold at 5 cents each, or $2 per hundred. All communications should be addressed to The Director, United States Geological Survey, Washington, D. C.

Electric Heating and Lighting in the Carnegie Residence, New York.

The water supply and drainage of the new residence of Mr. Andrew Carnegie, on Fifth Avenue and 91st Street, New York City, were described in the issues of The Engineering Record for July 5 and August 2, 1902, and in this article it is intended to give an idea of the electrical work, with particular attention to the electric heating apparatus. The most noteworthy feature of the wiring is in the multiplicity of its circuits, whereby a very convenient switch control of all parts is afforded. The great number of lights used is remarkable in a building of this size, there being over 1,200 in all, of which more than half are on the first floor. Electric heating is used for such household purposes as laundry work, warming food or water, etc., and is not to be confused with the house heating, which is entirely separate. It may easily be said of the electric heating installation that it is one of the largest, if not the largest ever made in a private dwelling.

The lighting is on a 200-volt three-wire system and is supplied from the street service. The neutral wires, except in the mains from the street, have twice the capacity of the outer legs. This provision was made so that if at any time it should be desired to install a private lighting plant in the building using a two-wire system, the same wires may be used, the neutral then to constitute one lead and carry as much current as the two outside wires, which together will form the other lead. The heating and power circuits are on ordinary two-wire systems. The power circuits for each motor are taken individually from the main switchboard in the cellar. The mains from the street to this switchboard are 70 feet long and are of these sizes: 1,000,000, 500,000, and 1,000,000 circular mils.

The switchboard is of marble 2 inches thick supported by an angle iron frame. On the back of the board there are two bus-bars for power, three for light and four for heating. In cross-section the bars are proportioned by the rule of 1 square inch per 750 amperes of current carried. Connecting surfaces between bars and lugs allow but 500 amperes per square inch of contact. The switches include, one for the feeder to each lighting panel-board on the different floors, one for each motor feeder, and one for both the high and low-voltage circuits used in the heating. It is also provided with the usual meters and fuses.

From the switchboard in the sub-basement there are 28 feeder circuits. Each of the motors has its own pair of feeders direct from the switchboard, as have all of the heating circuits that carry more than 10 amperes. The remainder of the heating and lighting circuits are taken from fused panel boards having separate feeders for each class of work. The panel boards are of slate, seven in number, and have a switch for each feeder and branch. One board in the basement controls the cellar and basement branch circuits including 30 for light and 3 for heat taps. The first floor lighting, except that for the ceiling lights in the art gallery, is controlled from two boards in the basement, one having 59 light taps and the other 22. The gallery panel board is on the first floor and has 29 light tap circuits all controlled by two three-pole single-throw 200-ampere switches. On the second floor there is a panel controlling that floor which has 30 light and 4 heat taps. The third floor has a board with 29 light and 5 heat taps; and the fourth floor, one with 8 light and 2 heat taps.

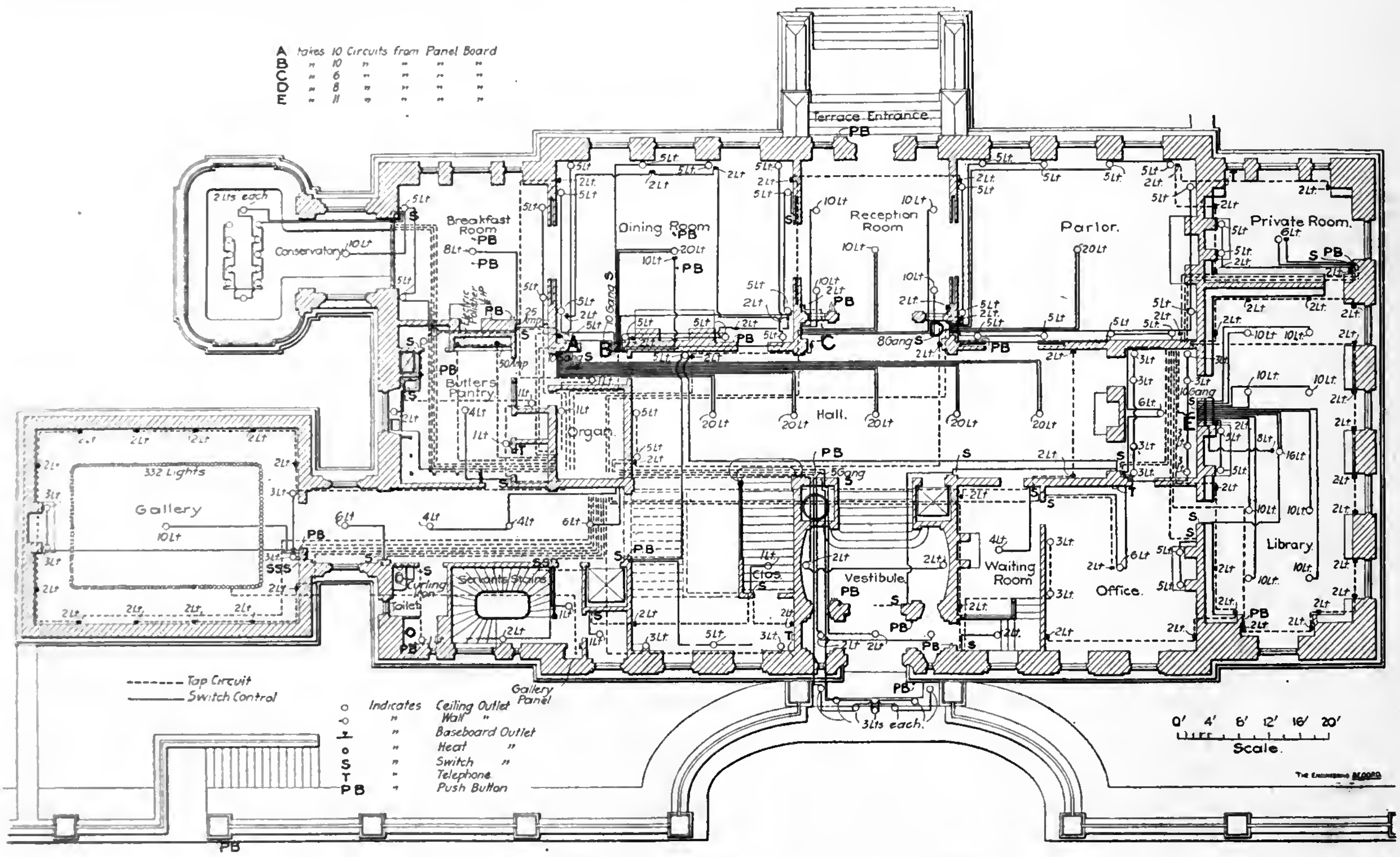
The feeders and all wiring from floor to floor are run in a wire-riser shaft located at about the center of the front of the house. All wiring is concealed and where carried in walls or ceilings is enclosed in insulated iron conduits. In most of the rooms, especially above the basement, there are two switches located near doors so that the lights may be lit or extinguished by the most convenient switch. Where desirable the lighting of one room or hall is on two or more circuits, making it possible to light the room partially or brilliantly. In such case a gang switch is usually installed to allow all of the lights to be extinguished simultaneously from one point.

A night service is provided for the halls and stairways throughout the house to burn a certain number of lights all night. A switch control for this system is afforded for each floor or it may be entirely cut off from the main switchboard. All wall switches are of the double-pole flush type and are placed four feet from the floor. There are 343 of these besides 17 carbon-break switches for the night service.

The wiring of the first floor is the most extended and is given on the accompanying plan. The localization of the lighting of the main hall and the large rooms which occur on this floor is shown in the five gangs as distinguished by the letters A, B, C, D and E. One noticeable feature to which attention has not been called thus far is the provision of many outlets in the baseboards of rooms to afford convenient extensions, to suit, for example, any desired location of a portable or desk light. In the art gallery there are two circuits entirely used for these baseboard outlets, which will enable a particular lighting to be given to any certain picture.

The other figure given is a riser diagram showing merely the run of the main distributing feeders and includes the power and heat lines as well as those for the lighting. A little idea of the extent of the wiring may be obtained when it is considered that in the feeders alone there is over a mile and a quarter of wire, which would be a small part as compared to the total length of wire if all of the branch circuits were included.

There are no steam pumps used at all in the building, and, with the exception of one Rider hot-air engine, all power is supplied by motors.

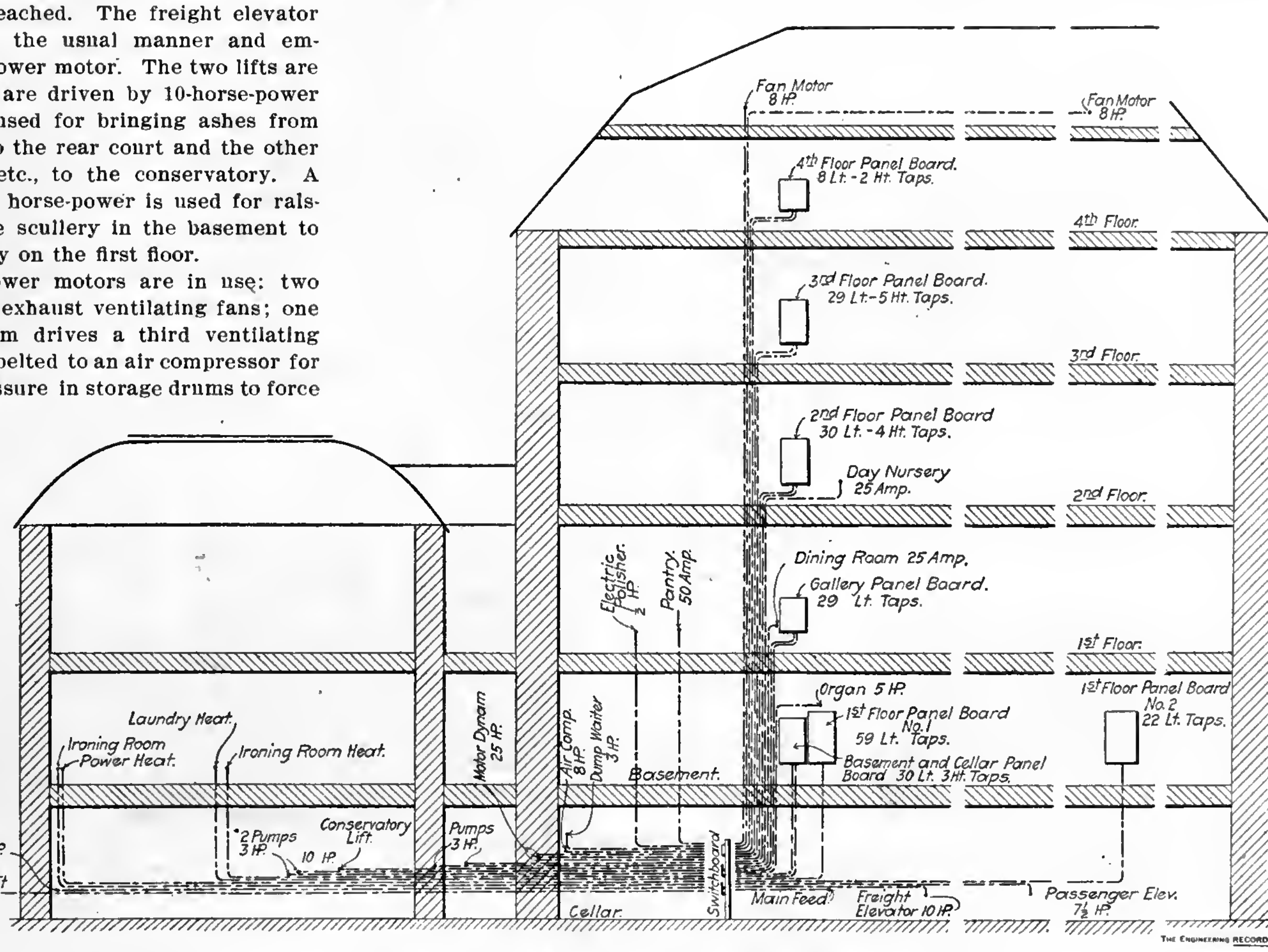


PLAN OF FIRST FLOOR WIRING, CARNEGIE RESIDENCE, NEW YORK CITY.

The largest unit consists of a 25-horse-power motor-generator used in connection with the electric heating. It is of the Western Electric Company's make and embodies a 220-volt motor direct-connected to a 20-volt dynamo which delivers a correspondingly increased current. The apparatus supplied at this reduced pressure is located in the laundry and ironing rooms, those being the only heaters that could not be run satisfactorily on the higher voltage.

The elevating machinery includes two elevators, two lifts and a dumb-waiter. The psssenger elevator is operated by a 7½-horse-power motor and has the automatic push button system of control. This is of the usual type, the person requiring its use pressing a button which causes the elevator to move to that floor and stop, if it is not already in use and the doors are all closed. After the occupant is within the car and both doors are closed, he presses the button corresponding to the floor to which he would go and the motor starts up in the required direction stopping when the indicated floor is reached. The freight elevator is operated after the usual manner and employs a 10-horse-power motor. The two lifts are of short run and are driven by 10-horse-power motors. One is used for bringing ashes from the boiler room to the rear court and the other to raise plants, etc., to the conservatory. A dumb-waiter of 3 horse-power is used for raising food from the scullery in the basement to the butler's pantry on the first floor.

Four 8-horse-power motors are in use: two in the attic drive exhaust ventilating fans; one in the boiler room drives a third ventilating fan; the fourth is belted to an air compressor for establishing a pressure in storage drums to force filtered water to the various parts of the house. The blower for the pipe organ in the chapel or music room on the first floor is located in the basement and is driven by a 5-horse-power motor. The water pumps are each direct-driven by a 3-horse-power General Electric motor. Two, of the Quimby rotary type, are for the hot and cold water house service and two centrifugal pumps are for emptying a sewage tank. The last and smallest motor is a ½-horse-power motor located in the butler's pantry and used for running a buffer for polishing silver.



RISER DIAGRAM OF ELECTRIC FEEDERS.

The electric heating apparatus was all made in special patterns to accord with the specifications furnished by the engineers and includes the following: Three flat iron heaters, one for 10 irons and two for 2 irons; three stoves, one with 2 lids and two with 1 lid; a starch boiler; a clothes boiler; a plate warmer for warming dishes; and a heated plate for keeping food hot until ready for serving. All of the apparatus is supplied on a two-wire 220-volt direct-current service, with the exception of the ten-iron heater, starch and clothes boilers and a one-lid stove, which are on the 20-volt system previously mentioned. Where movable the apparatus is provided with a marble base and is connected with the current outlets by flexible leads. The outlets are taken from panel boxes with D & W enclosed fuses in both leads or else fuses are provided in the apparatus itself.

The ten-iron heater, in the ironing room in the basement, is mounted on a fixed iron stand and occupies a floor space of 56x14 inches. The top consists of an iron frame in which a row of ten contiguous heating plates is set, each 5x7 inches in area and ½ inch thick. The size was determined on a basis of using from four to nine-pound flat irons. It has been found that 15 irons of the sizes most commonly used can easily be heated at one time when all of the ten plates are working, and that for ordinary usage a great plenty may be kept hot by the use of only 5 plates. Each plate is individually supplied with current and controlled by a two-pole snap switch placed in the front panel of the heater. With the 20-volt service used the required heat for a single plate is obtained by a current of 40 amperes, making the total maximum capacity 400 amperes and the consumption 8,000 watts. The plates heat up with remarkable rapidity and will heat a cold iron to its proper temperature in from 10 to 15 minutes according to its size. Starting with the plate cold the hand cannot be held on it for a full minute after the current is turned on. The regulation of the heat of an iron is commonly done on an ordinary range by pushing the iron to the back part of the stove when it is becoming too hot. Such regulation may be accomplished with this electric heater by turning current on but a few of the central plates and using the adjoining dead plates, which by conduction will have a decreasing intensity of heat as the distance from the live plates is increased.

The laundry adjoins the ironing room in the basement and contains the starch boiler, clothes boiler and a one-lid stove. The starch boiler is of the water-bath type and has a capacity of 5 gallons. The inner starch pan is of heavy hammered copper 15 inches in diameter and 7 inches deep. The water bath surrounding it is sufficiently larger to afford room for water in the bath and consists of a planished copper jacket with an upward recess for the heater in the bottom. The heater is insulated by a false bottom, and by its placing offers the greatest amount of heating surface possible to the water within the bath. Its construction is somewhat similar to that for the iron heater but it is divided into two separate circuits, by the use of which either full or half heat may be obtained. Full heat requires 160 amperes on 20 volts and is used while the starch is coming to a boil. After that time the half heat suffices to maintain the required degree of heat in the starch. The boiler occupies one end of an iron stand on the other end of which is placed the one-lid stove. This stove differs from the other stoves to be later described, in that it is on the 20-volt circuit and contains an irremovable heater. The heating material is divided into two circuits to give two degrees of heat. It supplies a means of heating water in small quantities or any other heating likely to be required by the laundresses.

The clothes boiler occupies an adjacent marble-top iron stand and consists of a large rectangular copper kettle with rounded corners and a cover. It is 23x33 inches overall and 24 inches deep and rests on a heating plate 20x30 inches. Attached to the lower side of the plate is the heater, in this case fitted for full and two-thirds heat, using, on 20 volts, a maximum current of 580 amperes with a maximum energy density per square inch of superficial area not to exceed 23 watts. Water is drawn cold into the boiler from a faucet close by and brought to a boil on the plate. For emptying the kettle a tap is provided near the bottom. The clothes boiler has a separate panel box with leads therefrom run in flexible coiled wire armoring finished in bright nickel. The starch boiler and one-lid stove are supplied from another panel box with similarly protected leads.

in the brush room in the basement there is a two-iron heater of the same general construction as the one for ten irons, but mounted on a marble base instead of an iron stand. It is operated on 220 volts instead of 20 and uses about 9 amperes when both plates are running. It will be used for pressing garments or other outside wearing apparel.

So much for the heating apparatus in the basement. The first floor contains but two pieces of like apparatus, both located in the butler's pantry. The first is a plate warmer and is the largest feature of this installation. It stands directly on the floor, is approximately 48 inches high, 40⅜ inches wide and 25 inches deep, and has an external casing of heavy Russia iron with two doors, latching at top and bottom and lined with the same material. The trimmings, such as hinges, latches, etc., are of nickeled and polished iron. The inner casing is of Russia iron of the same weight as the outer casing and is separated from it by an air space of 1¼ inches. The warmer contains three shelves, each the full size of the interior, framed with angle iron and covered with perforated iron. Heat is supplied by two circuits of coiled wire so wound on porcelain insulators that either circuit while running alone will give a uniform heat to the entire shelf. The insulators are mounted closely together on rigid cross bars and distributed over the entire surface, affording a strong support for the perforated sheet above them. Two degrees of heat, full and one-half, are supplied to each shelf, so that the complete interior may be subjected to six degrees of heat. Current is supplied on 220 volts with a maximum of 15 amperes, or 5 amperes to a shelf; half heat requiring but half those amounts. A double-pole flush switch controls each circuit of each shelf.

Located in a passage off from the butler's pantry, there is an electrically heated steam plate for warming food. It is in the form of a modified bain marie. The plate is 20x30 inches of heavy tinned copper and sets in a copper water bath so as to allow a space of 3 inches above water level with the water not over 2 inches deep. The heater is attached to the bottom of the water bath and insulated from it, being recessed into the bottom to give the greatest amount of surface to water contact. The heater is made in three sections with a flush switch for each, to allow of three different heats, using 6 amperes on 220 volts. A glass water level gauge, a cock for draining and a funnel for filling are fitted to the water bath, and a deep cover of heavy planished copper is provided to set over the whole to retain the warmth.

On the second floor in the nursery pantry, a two-lid stove will be used for water heating and limited cooking. The overall dimensions are 16x24 inches, and the two lids are each 8 inches in diameter. The stove is mounted on an ornamental iron stand, barffed a blue black color, with the usual marble base. Each lid has two flush switches mounted in the front panel giving independent control of each of two degrees of heat. The 220-volt pressure is used with a maximum current of 10½ amperes on both lids or 2¾ amperes on each heat. In this stove the lid and heater is a removable unit. The lower side contains lugs which engage in phosphor bronze contact clips and form the connections between the switch control and the heating medium.

The third floor heating apparatus introduces no features other than those already described. A two-iron heater precisely similar to the one in the brush room in the basement is found here in the sewing room, its purpose being, as before, to heat irons for pressing clothes. In one of the bath rooms there is a stove with one lid, but otherwise identical to the two-lid stove last mentioned. It is 16x16 inches overall, with iron stand, marble base, and switches for full and half-heat, each heat consuming 3 amperes at 220 volts. These two heaters and all of the smaller heaters except the laundry stove, are movable and may be disposed of in any convenient manner when not in use. Their connections to the outlets of the current source in the room baseboards are made by plugs on their leads.

In addition to the foregoing uses of dynamo current the residence is elaborately equipped with battery systems supplying call bells, telephones, etc. One battery of 12 cells, arranged 6 in series and 2 in multiple, operates bells and annunciators for all parts of the house. There are seven annunciators, the two largest being the one in the basement with 52 drops and the one in the butler's pantry with 24. The house has its own private telephone system with 21 instruments and 20 cells of battery for their operation, besides four telephones connected with the public service. In short the building embraces all of the now common conveniences that may be afforded by the use of electricity.

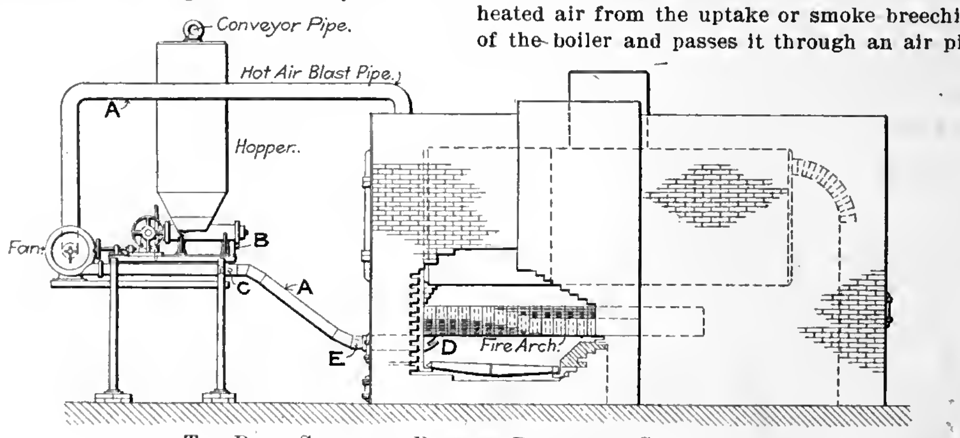
The building was erected from the plans of Messrs. Babb, Cook & Willard, of New York, and its electrical features were designed by the electrical engineers, Messrs. Clark & MacMullen, also of New York. The contractors were: For the electric heating, the Hadaway Electric Heating and Engineering Company; for the electric lighting and the switchboard, Mr. Charles L. Eidlitz.

Standard Bench Monuments in Chicago are built of granite concrete with the top of a hardened copper rod showing at the surface under an iron cover. The concrete extends 6½ feet below the surface of the ground, is 3½ feet square at the bottom, and 16 inches at the top, where it is 6 inches below the surface. An iron cover with movable lid protects the bench point. These monuments average about a mile apart each way, and according to the 1901 report of Mr. W. H. Hedges, bench and street grade engineer, about half the city has been provided with them. In running the lines of exact levels to determine the elevations of these concrete monuments, there were established at the same time 935 bench marks of the ordinary kind along these lines of levels, choosing the best points available for that purpose, viz., stone or iron door-steps, water-tables of buildings, corners of stone or cement curbs, roots of trees, tops of hydrants, etc. These ordinary benches are not reported to the city council for confirmation, and are in no way official in their character, but are simply recorded in the city bench books for the convenience of the engineers employed by the city and of any city surveyors who may wish to copy and make use of them.

The Rowe System of Burning Pulverized Coal.

In view of the increased attention that has been given during the past couple of years to the burning of pulverized coal under steam boilers, a device for this purpose, known as the Rowe feeder system, that has been perfected and put into practical operation by the C. O. Bartlet & Snow Co., of Cleveland, Ohio, will doubtless be of interest. Among the advantages of burning pulverized fuel might be mentioned practically perfect combustion and the consequent absence of smoke, a considerable saving of fuel on account of the readiness with which the air supply can be adjusted and the reduction of the ashes and refuse to a minimum. The designers of the apparatus maintain that in order to obtain perfect combustion three conditions are absolutely necessary; that the coal must be of uniform size, that it must contain the minimum amount of moisture and that the powdered coal must be burned while suspended in the air.

The system as applied to the boilers in the company's works is shown in the accompanying illustration. It is being used with the cheapest kind of bituminous slack. This is dried so that it will not contain over 2 per cent. moisture and then ground so as to pass an 80-mesh sieve, making it practically dust. The dust is stored in an iron storage hopper or tank near the boiler. A blower of sufficient size to furnish the necessary air for burning the coal draws heated air from the uptake or smoke breeching of the boiler and passes it through an air pipe A to the furnace. Coal is conveyed by a special conveyor from the bottom of the storage bin to a spout B. The speed of this conveyor controls the amount of coal used, which can be changed at a moment's notice by turning a hand wheel. From the conveyor the coal is fed directly to the air spout A. There is a nozzle C on the inside of the air spout which converges the current of air just as it strikes the coal falling from the conveyor. This insures a thorough mixture of the two and at the same time prevents clogging. The coal is blown by the current to the furnace spout, but just before entering this the mixture passes through another nozzle E which again mixes the air with the dust. The feed spout is made of cast-iron and has a semi-circular opening or mouth so as to spray the coal dust upward against an arch wall, where it is ignited and burned. This spout is covered with fire brick for protection and the current of air continually passing through it also protects it from burning out. In fact, there is nothing about the system which is not durable, an important feature in any system. There are slides or valves in the air pipe so as to admit just enough air to obtain perfect combustion. Attention is called to the fact that the application of this device to a steam boiler requires practically no change in the grates and in case of an accident coal can be fed through the furnace doors. With the apparatus it is not necessary to open the furnace doors, thus admission of cold air is prevented.



The Rowe System of Burning Pulverized Coal.

The Water Supply of King's Lynn, England.

The borough of King's Lynn has a population of about 20,000. Its old water supply, drawn from a small tributary of the Ouse River, was badly polluted and an outbreak of typhoid fever due to this cause led to the installation of a new supply in 1899, under the direction of Mr. E. J. Silcock, M. Inst. C. E. The new works, which cost about $150,000, consist of two wells about 6 feet in diameter and 100 feet deep with three horizontal headings at the bottom, a covered reservoir and nearly 7½ miles of 15-inch cast-iron mains. The whole scheme was described at length some time ago in an article by Mr. F. C. Grimley in "The Surveyor," from which the following account has been condensed:

The wells are sunk in the hard chalk about eight miles from Lynn, and are 14 feet apart center to center, 6 feet 2 inches in diameter and 100 feet deep, with a lining of concrete varying in thickness from 14 inches at the top to 6 inches at the bottom. The concrete was composed of 1 part cement to 4 parts of gravel and sand. Circular moulds 6 feet 2 inches in diameter and 3 feet deep were used for placing the concrete in position as the excavation proceeded. From the bottom of the western well two headings, 6 feet high and 4 feet wide were driven, one to the south 153 feet long and the other to the north 213 feet long. Another heading which was commenced in an easterly direction from the eastern well had only proceeded 50 feet when it was found that the quantity of water required (1,000,000 imperial gallons a day) could be procured. The east heading was, however, extended to a total length of 293 feet and a bore-hole 8 inches in diameter and 63 feet deep was put down in the east well, passing into the sand below the chalk formation.

The output of the wells was tested by continuous pumping for a fortnight, the water passing into a concrete tank where gaugings were taken at frequent intervals. The quantity of water finally obtained was 1,250,000 imperial gallons per day at the most unfavorable time of the year and after a prolonged drought. The supply since the works were put in operation has been greatly in excess of the demand, which in March, 1901, was about 650,000 gallons a day. The bottom of the wells is 32 feet above ordnance datum, and the water stands at a height of 70 to 80 feet above ordnance datum when pumping is not going on. The engine is erected over the wells. Rails are set in the side walls at a height of 10 feet, on which runs a traveling crane for the hoisting of machinery when necessary. The engine for each well is placed at one side of it, a good foundation being afforded by the chalk, which is very near the surface. Between the two engines a flight of stone steps descends to a subway lined with white glazed tiles, the bottom of which is 16 feet below the floor of the engine house. This subway communicates with both wells, and inside of each of them at this level is fixed a permanent staging. This is the lowest point to which the engineer in charge needs to go in the ordinary course of working, everything below this depth being arranged to work automatically. The subway is arched over so as to provide a shelf upon which the delivery pipes unite with the rising main.

The pumping plant is in duplicate, consisting of two sets of boilers, engines and pumps, each capable of delivering 1,000,000 imperial gallons per day through 18,730 feet of 15-inch pipe, against a head, including friction of 123 feet. The different portions of the plant are interchangeable, being so arranged that either of the boilers will supply steam to either or both engines, and each engine will drive the pumps in either well. The possibility of a breakdown is further provided against by each set of pumps, consisting of three, being worked by equidistant cranks on the same axle. One or more of them, therefore, can be withdrawn for repairs while the others remain at work, so that before a complete stoppage can occur it will be necessary for six pumps, two engines, or two boilers to fail simultaneously.

When pumping ceases the water in the wells rises rapidly to a height of about 50 feet, so that the working portions of the pumps, which are within 20 feet of the bottom of the wells, are submerged. All portions of the pumps are attached to a massive iron staging fixed in the well just above the high-water mark, so that it is not necessary to pump out the water either for fixing the machinery or in case of repairs being afterwards required. In addition, this staging forms a water-tight floor, and so effectually prevents the possibility of any oil or dirt from the machinery getting into the water in the well. The pumps are of the three-throw type. The working barrels and parts are of gun-metal, and all the large pipes which are 13 inches in diameter, are of steel plate, electrically welded and afterwards galvanized, thus securing lightness, strength and freedom from rust. At a point above the pump stage the three tubes unite into a single main, and the pipe from each well joins the rising main upon the shelf before described. The engines are of the horizontal, compound, triple-expansion type. They are designed for a working boiler pressure of 140 pounds per square inch, and have lately been arranged so as to run coupled together and work both sets of pumps. While running coupled together, the speed of the engines is from 75 to 80 strokes per minute, but when running separately the normal speed is from 112 to 120 strokes per minute.

As a result of a series of tests it was found that the engines could pump the total quantity required, but the slip of the pumps was somewhat excessive, being 7 per cent. The west engine gave an efficiency of 21.3 pounds of steam per hour per pump horse-power, and the east engine 21.5 pounds. The west boiler gave an evaporation of 10.25 pounds of steam per pound of coal and the east boiler 9.55 pounds. The length of stroke of the engines is 14 inches and the diameter of cylinders 6¼, 9¼ and 12½ inches. The pump cylinders are 12½ inches in diameter and have a stroke of 2 feet 6 inches, being geared to make one stroke to six of the engine.

The water is pumped through about 3½ miles of 15-inch cast-iron pipes to the service reservoir, which is 140x100 feet in size. The main follows the contours of the roads at a depth of about 4 feet from the surface. The top water-level of the reservoir is 139 feet above ordnance datum. The subsoil consists of boulder clay to a considerable depth. Excavations were first made to a depth of 6 feet, and on the bottom was laid a floor of concrete 18 inches thick, increasing to 3 feet 6 inches at the bases of the columns which support the roof. The floor is composed of a series of inverted arches springing from the bases of the columns, and it has, in common with the walls, a 4½ inch lining of bricks set in Portland cement. The walls are built of concrete, composed of cement 1 part, sand 2 parts and shingle 4 parts. They vary in thickness from 5 feet to 18 inches, the total height being 14 feet. Rows of 18-inch brick columns 10 feet apart center to center support the roof, which is composed of 4½-inch brick arches carried by cast-iron girders 12 feet long. These girders run the short way of the reservoir, and are tied in with 1¼-inch tie rods. The spandrels of the arches are filled with concrete, and the whole is covered with ½ inch of asphalt.

For the purpose of cleansing, the reservoir is divided into two equal parts by a brick wall 6 feet high. When the water is level with the top of this wall, there are 250,000 imperial gallons in each half, which is a quarter of the total capacity. At the north end of the division wall is fixed an electrical indicator, communicating by wire with the pumping station, so that the engineer on duty is informed of the rise or fall of the water in the reservoir. This appliance also records the variations in the height of the water upon a chart, thus giving a permanent record.

The length of the delivery main to the East Gates of Lynn is nearly 4 miles, from which point the water is distributed through the same mains which were in use before. The cost of the most important items in this work was as follows: Two engines with boilers, $15,900; wells and headings, $8,400; buildings, $17,900; pipe line, $66,200; reservoir, $25,400.

Personal and Obituary Notes.

Mr. Alphonzo Tarr has been appointed water commissioner of Gloucester, Mass.

Civil Engineer L. M. Cox, U. S. N., has been ordered to leave Guam for the United States.

Mr. Michael B. Corriden has tendered his resignation as superintendent of the Logansport, Ind., water-works.

Mr. Francis D. H. Lawlor, M. Am. Soc. C. E., has been appointed superintendent of the Burlington, Ia., water-works.

Mr. F. M. Webb is said to have resigned as mechanical engineer of the London & Northwestern Railway, England.

Mr. Edward DeV. Tompkins has been appointed assistant engineer in the Department of Bridges, New York City.

Messrs. Thomas Murray, John E. Moore and Henry Nagel were reelected city engineer, city electrician and street commissioner, respectively, at Davenport, Ia.

Messrs. Cope & Stewardson, of Philadelphia, on the basis of a competition, have been appointed architects for the municipal building for the District of Columbia.

Mr. Robert L. Warner, Boston sales manager of the Westinghouse Electric & Mfg. Co., presented a paper on electrically driven shops at a recent meeting of the New England Railroad Club, at Boston.

Mr. C. E. Fowler, president and chief engineer of the Puget Sound Bridge & Dredging Co., read a paper before the Pacific Northwest Society of Engineers at Seattle, December 6, on the corrosion of iron and steel.

Mr. T. L. Lyman, manager of the Asbestos Department of the H. W. Johns-Manville Co., New York, sailed December 20 for Havana, Cuba, where he will remain about two weeks for the benefit of his health.

Mr. J. W. Peterson has been elected president and general manager of the Electrical Equipment Co., contracting engineers, Monadnock Block, Chicago, succeeding Mr. J. Holt Gates, who has retired from the company.

Mr. H. F. J. Porter, of the Bethlehem Steel Co., delivered the founder's day address at the Clarkson School of Technology, at Potsdam, N. Y., December 1. His subject was: "Technical Education and the Higher Industrial Life."

Miles Leonard, a well-known contractor of New York State, died December 11 at his home in Binghamton, aged 52 years. He erected many of the prominent buildings in that city and was contractor for the Manhattan State Hospital at Central Islip.

Mr. Burton J. Ashley, whose retirement as chief engineer in the founding of Zion City, Ill., and resumption of private practice in Chicago was announced November 29 has established his offices in The Temple, Chicago. He reports 8,000 persons in Zion City at the end of 16 months.

Among the recent railroad appointments are the following: Mr. C. P. Chamberlain has been appointed division engineer of the Chicago Great Western Railway at Des Moines, Ia. Mr. L. G. Haas has been appointed assistant general manager of the Baltimore & Ohio Railroad succeeding Mr. Arthur Hale, who has become general superintendent of transportation, and his position as general superintendent at Pittsburg is to be filled by Mr. I. G. Rawn, general superintendent, at Cincinnati, of the Baltimore & Ohio Southwestern Railroad. Mr. R. C. St. John has been appointed assistant chief engineer of the Michigan Central Railroad with headquarters at Detroit.

At its meeting last week in New Orleans, the following committees of the American Public Health Association were announced: Purification of Public Water Supplies: George W. Fuller, New York City; Robert S. Weston, Boston, Mass.; H. W. Clark, Boston. Disposal of Industrial Wastes: Dr. G. T. Swarts, Providence, R. I.; Allen Hazen, New York City; Prof. L. P. Kinnicutt, Worcester, Mass. Purification and Disposal of Sewage: George H. Benzenburg, Milwaukee, Wis.; J. W. Alvord, Chicago, Ill.; J. P. Force, Columbus, O. Disposal of Garbage: Rudolph Hering, New York City; Elzear Pelletier, Montreal; W. C. Woodward, Washington, D. C. The bacteriological section elected the following officers at its meeting last week in New Orleans: Chairman, Dr. H. L. Russell, Madison, Wis.; vice-chairman, Dr. Veranus A. Moore, Ithaca, N. Y.; secretary, G. C. Whipple, Brooklyn, N. Y.; recorder, Dr. H. D. Pease, Albany, N. Y.

The American Institute of Architects, at its meeting in Washington last week, approved the following additions to membership and elected the following officers: Honorary members: Andrew Carnegie, Pittsburg, Pa.; Samuel A. D. Abbott, Boston, and Emil Neuchamer, Paris, France. Corresponding members: George R. Shaw, Boston; John James Burnett, Glasgow, Scotland; Banister F. Fletcher, London, Eng.; Mervin McCartney, London, Eng.; Leonard Stokes, London, Eng.; William R. French, Chicago; A. H. Bloomfield, London, Eng. Fellows: W. R. Mead, New York; G. L. Heins, New York; R. A. Cram, Boston; Elmer Grey, Milwaukee, Wis., and J. L. McGrann, St. Louis. Officers: President, Charles F. McKim; first vice-president, Frank Miles Day; second vice-president, Alfred Stone, and secretary-treasurer, Glenn Brown. Board of directors: Robert S. Peabody, William B. Mundie, Isaac C. Ditmars. Auditing committee: S. A. Treat, Wm. G. Preston.

The Removal of Garbage in Chicago was done during 1901 at a cost of $490,302, the amount removed being 1,333,920 cubic yards, giving as the cost per cubic yard about 36¾ cents. A portion of the amount removed had to be hauled from 8 to 10 miles, and the Commissioner of Public Works, Mr. F. W. Blocki, recommends the erection of garbage reduction plants along the banks of the Chicago River, so that garbage may be carried to them in scows.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 23, 24 and 36.

WATER.

Lowell, Mass.—R. J. Thomas, Supt. of Water Wks., writes that the State Legislature has passed a bill enabling this city to lay pipes and supply city water to the inhabitants of Chelmsford and Dracut. The matter is now pending action of the Lowell city government.

Weymouth, Mass.—See "Power Plants, Gas and Electricity."

New London, Conn.—The Water Comrs. have voted to secure a tract of land on Mohegan Ave. on which to build a distributing reservoir, having a capacity of 350,000 gal.

Great Barrington, Mass.—City Engr. Curtiss is said to have completed profiles of a 40-ft. dam at Goodale Brook.

Amherst, Mass.—The Amherst Water Co. has petitioned Legislature for permission to acquire certain water rights and lands in the town of Shutesburg; the Co. also desires to increase its capital stock and to issue additional bonds.

Allentown, Pa.—City Engr. J. Howard Martz writes that the proposed gravity water works system will probably cost $200,000.

Troy, N. Y.—The contract for furnishing all material (steel pipe will be used) and constructing the conduit line of Tomhannock extension of Troy water works system is stated to have been awarded by the Board of Contract & Supply to the T. A. Gillespie Co., of New York, at $259,300. For detail bids see The Engineering Record of Dec. 13.

McKees Rocks, Pa.—Local press reports state that Ch. Engr. J. A. Atwood, of the Pittsburg & Lake Erie R. R., has awarded contracts for additional improvements at McKees Rocks as follows: To Dravo Const. Co., sinking well and building a pump house for $20,000; to N. F. Trimble & Sons, contract for superstructure of new erecting and machine shop, 560x170 ft., for about $130,000. It is stated that a contract will soon be let for pumps and machinery, to cost $5,000, for the water works plant.

Gloucester City, N. J.—The City Council has passed on its second reading an ordinance for the issue of water works improvement bonds. It is proposed to reconstruct the reservoir, and install an air compressor plant at a probable cost of about $15,000.

Brooklyn, N. Y.—Bids will be received until Dec. 30 for furnishing, delivering and laying water mains in portions of several streets in the Boro. of Brooklyn. Robt. Grier Monroe, Comr. of Water, Dept. of Water Supply, Gas and Electricity, N. Y. City.

Long Island City, N. Y.—Bids will be received until Dec. 30 by Robt. Grier Monroe, Comr. of Water, Dept. of Water Supply, Gas & Electricity, N. Y. City, for furnishing, delivering and laying water mains in portion of several streets, in the Boro. of Queens.

New York, N. Y.—Bids are wanted Dec. 30 for furnishing and installing superheaters, furnaces and all appurtenances in the pumping stations at 98th and 179th Sts., Boroughs of Manhattan & Bronx. Robt. Grier Monroe, Comr. of Water, Dept. of Water Supply, Gas & Electricity.

Baltimore, Md.—The Comn., which is to select a site for the new storage reservoir provided for in the ordinance of estimates for 1903, is composed of Mayor Hayes, Water Engr. Quick and City Comptroller Smith. Said Comn. will have $350,000 with which to purchase land for the reservoir and begin work of construction.

Wilmington, Del.—A site has been purchased by the Bd. of Water Comrs. for a city water plant. The Comrs. contemplate building two basins, one to hold 100,000,000 gal. and the other from 5,000,000 to 10,000,000 gal., and a filter plant. No plans have been drawn for the plant, and it has not been decided what filter system will be used.

East Orange, N. J.—The Water Com. is taking steps relative to the execution, with the Orange Water Co., of a contract for a water supply for one year. The Water Com. of the City Council has decided to engage an engineer to work in conjunction with City Engr. W. H. V. Reimer to prepare plans and specifications for a distributing system.

Binghamton, N. Y.—Supt. of Water Wks. John Anderson is said to be in favor of the installation of water meters in this city.

Cape May, N. J.—The City Council has passed an ordinance granting to J. Pemberton Newbold, of Philadelphia, the franchise of laying mains and establishing a plant for the supplying of salt water to hotels and residences here.

Cranford, N. J.—The Union Water Co. is said to contemplate the construction of a stand pipe and pumping station at South Cranford on Rahway River, in order to supply increased demand for water in the towns along the Central between Plainfield and Elizabeth.

Salem, Va.—City Secy. John H. Palmer writes that a committee has been appointed to investigate as to the best means for a further water supply. W. B. Dillard, Chmn. of Com.

Marion, S. C.—Business men of this town are investigating a plan for the installation of a system of water works.

Fairmont, W. Va.—The City Council has decided to build a reservoir with a capacity sufficient to hold a 3 weeks' water supply for the city.

Lakewood, O.—Bids will be received by the Bd. of Trus. until Jan. 9 for laying the necessary water and sewer mains in several streets. John French, Hamlet, Clk.

New Bremen, O.—Local press reports state that bids will be received until Jan. 6 by the Village Trus. for $28,000 bonds, the proceeds to be used to construct water works and to furnish the citizens with water.

South St. Paul, Minn.—Press reports state that bids will be received until Jan. 5 for constructing a standpipe and laying water mains. Chas. W. Clark, City Recorder.

Chicago, Ill.—Contract Clk. Frank Murphy writes that the following bids were opened Dec. 11 for furnishing and delivering the following approximate quantities of cast iron water pipe: 400 pcs. of 4-in., 4,000 pcs. of 6-in., 3,000 pcs. of 8-in., and 500 pcs. of 12-in. internal diameter, I. B. Clow & Sons, Lake and Franklin Sts., per ton, $35.70; U. S. Cast Iron Pipe and Fdy. Co., Rookery Bldg., Chicago, per ton, $34.80 (awarded).

Menasha, Wis.—Mayor Geo. Banta writes that previous reports, to the effect that this city contemplates constructing water works, were incorrect.

Cedar Rapids, Ia.—According to press reports an ordinance has been passed providing for the purchase of the present water system or the construction of a new system. The question of issuing bonds will be submitted to the voters.

Shelbyville, Ind.—The Citizens' Water, Light, Power & Heat Co. will be organized, with a capital of $200,000. Harry Whitcomb and T. W. Fleming are said to be interested.

Two Harbors, Minn.—The village is reported to have voted bonds for improvements to the water and light plant.

Morgantown, W. Va.—See "Power Plants, Gas and Electricity."

Joliet, Ill.—Press reports state that the Water Comrs. have been directed to purchase an air compressor.

The contract for building a storage reservoir for the water works has been awarded to Wm. Tenney, for $9,974.

Philippi, W. Va.—Citizens, including Stewart Bowman, Jas. E. Hall and S. A. Moore, have incorporated the Philippi Water & Light Co. with $40,000 capital, to establish water works and lighting plant at Philippi.

Fostoria, O.—A report has been submitted to the City Council recommending the construction of a municipal water works plant.

Ottumwa, Ia.—An election will be held Jan. 6, at which the electors of the city will ratify or reject the contract entered into by the City Council with the U. S. Cast Iron Pipe & Fdy. Co., of Chicago, for furnishing, and with the Des Moines Bridge & Iron Wks. for laying pipe needed by the city for the new water works system For detail bids opened Dec. 1 see The Engineering Record of Dec. 6.

St. Paul, Minn.—Bids will be received until Jan. 15 by Geo. E. Pond, Ch. Q. M., St. Paul, for constructing a pumphouse and equipment, including pumps and boilers, a water tank and trestle, and the extension of mains at Ft. Snelling.

North Milwaukee, Wis.—Press reports state that water mains will be laid through the streets. The village will pay commercial rates for the water furnished by Milwaukee.

Kalamazoo, Mich.—The Grand Rapids & Indiana Ry. (S. B. Liggert, Asst. Secy., Pittsburg, Pa.,) will, it is stated, build a $12,000 pumping station at this place.

Cincinnati, O.—Ch. Engr. Bouscaren is reported to have completed designs and plans for the 3 steel coal sheds to be built for the water works, at a cost of about $100,000 each. Two of the sheds will be 132x72 ft., and the other 228x72 ft. in size.

El Reno, Okla. Ter.—Press reports state that about Jan. 1 the El Reno Water Co. will let contracts for 2 pumps of 1,000,000 gal. capacity, boiler, etc.

Owensboro, Ky.—The City Council has passed a resolution appointing Mayor Yewell and Councilmen Slaughter, Steitler and Delker a special Water & Light Com., and instructing them to employ a competent engineer to make plans and specifications for a new water works. This committee was also instructed to enter into negotiations with the Owensboro Water Works Co. with a view to buying the present water works system, provided it can be bought for an amount not to exceed $90,000. Water works bonds to the amount of $200,000 are said to have been offered for sale by City Clk. O'Bryan.

Woodville, Miss.—An election will be held to vote on the issue of $30,000 city bonds for the construction of water works and electric lights.

Terry, Okla. Ter.—Bonds to the amount of $50,000 are reported to have been voted for water works. F. F. Busch Clk.

Beaumont, Tex.—The Beaumont Irrigation Co. has filed an amendment to its charter increasing its capital stock from $150,000 to $300,000.

Memphis, Tenn.—The stockholders of the Artesian Water Co. on Dec. 8 officially accepted the proposition of the city of Memphis to buy its plant. The city is said to be paying for the plant $2,346,000 and assuming the outstanding indebtedness of the Co., estimated to be about $60,000.

Ardmore, Ind. Ter.—Bids are wanted Jan. 6 for furnishing material and doing the following work in connection with the construction of water works: Pumping machinery, fire hydrants, gate valves and valve boxes, steel water tower, 24x125 ft., laying about 12 miles of mains, and constructing a pumping station. Chester B. Davis, Engr., San Antonio, Tex. Geo. H. Bruce, City Clk.

Granger, Tex.—Press reports state that the Granger Water Co. proposes to purchase gasoline engine, pumps, etc. W. H. Kelso, Mgr.

Searcy, Ark.—It is stated that the time for receiving bids for constructing a water works and an electric light plant has been extended from Dec. 26 to Dec. 30. Owen Ford, Engr., Security Bldg., St. Louis, Mo.; Emmet Snipes, Secy. of Com.

Kansas City, Mo.—Bids will be received by the Bd. of Pub. Wks. until Dec. 29 for furnishing and erecting complete, under boilers, at Turkey Creek Pumping Station, 2 mechanical stokers, having sufficient grate area to furnish 300 H.-P., burning bituminous slack coal. Baxter Brown, Secy.

Centerville, Miss.—Bids will be received by the Bd. of Mayor and Aldermen until Jan. 7 for constructing a system of water works, according to plans and specifications prepared by C. H. Jenks, Engr., Fayette. Address, Ackland H. Jones, Centerville.

Flagstaff, Ariz.—Town Clk. L. W. Quinlan writes that on Dec. 8 it was voted to issue $10,500 supplementary water works bonds.

Sioux Falls, S. D.—The City Aud. has been directed to ask for bids designed for the purpose of commencing work on a municipal water works plant.

Alcester, S. D.—A site has been purchased by the trustees for a water works plant. A deep well will be sunk.

Denver, Colo.—Plans for the building of a 3-mile tunnel through the mountains for the purpose of irrigating 100,000 acres of arid land, near Denver, have been about completed by the Agricultural Ditch Co. and the Church Ditch Co. It is reported that there is more than $1,000,000 back of the scheme. Henry Lee, Secy., Agricultural Ditch Co.

Perry, Utah.—Articles incorporating the Three-Mile Creek Irrigation & Water Co., with Perry as the principal place of business, have been filed. Capital stock, $50,000. The directors are: Barnard White, Jas. Nielson, Richard Thorn, Alma Wright, and others.

Salt Lake City, Utah.—A. B. Lewis is said to be interested in the development of a water power in Beaver County; it is stated that the project provides for the irrigation of 4,000 acres of land and the development of 800 H. P. for mining enterprises in Beaver Co.

Corona, Cal.—At the recent annual meeting of the stockholders of the Temescal Water Co., the articles of incorporation were amended for the purpose of empowering the Co. to carry through the proposed purchase of water-bearing lands, developed water and pumping plant in the Perris Valley.

Montrose, Colo.—At a recent citizens' meeting a resolution was passed recommending to the Town Bd. the Cimarron Canal as the only practical and economical source of pure water supply for this town.

Gunnison, Colo.—Articles of incorporation have been filed by the Gunnison & Ohio Creek Canal Co. Incorporators: John A. Allen, A. E. Hyzer and A. F. Cunningham.

Ukiah, Cal.—Press reports state that local citizens propose to place a dam at the lower end of Walker Valley for the storing and conserving of water for irrigation and power purposes.

North Yakima, Wash.—Articles of incorporation of the Moses Lake Irrigation Co. have been filed here. The capitalization is $5,000. The incorporators are C. G. Wands, David Longmire, A. E. Treat and S. S. Wheeler.

Seattle, Wash.—The estimated cost of new cast-iron water mains to cover the West Queen Anne Dist,. has been placed at $53,000, and the estimated cost of a wooden water main for Stowe St. and other streets on Bigelow Hill, $10,500.

Pomona, Cal.—It is stated that bids are wanted Jan. 3 for furnishing the Del Monte Irrigation Co. 1 steel tank of 10,000 gal. capacity. W. A. Lewis, Secy.

Wessington Springs, S. D.—The sum of $2,500 has been voted for sinking an artesian well.

Alberta, N. W. Ter.—Local papers state that the Canadian Pacific Ry. (Wm. Whyte, Mgr. of the Co.'s western lines, Winnipeg, Man.) proposes to irrigate two and a half million acres of semi-arid lands lying in the district between Calgary and Medicine Hat, the water to be obtained from Bow River.

Ottawa, Ont.—In his annual report to the Water Wks. Com., City Engr. Ker recommends the construction of water mains in several streets, estimated to cost in all $36,485.

Toronto, Ont.—The by-law to provide $175,000 for a new 15,000,000 gal. pumping engine has received its first and second readings in the City Council, and will now be submitted to the ratepayers, and if approved by them will be given its third reading by next year's Council.

Montreal, Que.—Fire Chief Benoit favors the city putting in large water mains. Probable cost, $30,000 to $50,000.

SEWERAGE AND SEWAGE DISPOSAL.

Providence, R. I.—Bids will be received until Dec. 26 by Robt. E. Smith, Comr. of Pub. Wks., for 14,400 ft. of 12 and 15-in. straight pipes and 22,000 ft. of 6 and 8-in. (2-ft. lengths) straight pipes, 150 ft. 12x8-in., 3,000 ft. 12x6-in., 30 ft. 8x8-in., 300 ft. 8x6-in. branch pipes, the last two sizes to be of 2-ft. lengths, 100 pcs. of 8-in. 1/8 bends, 50 pcs. of 8-in. 1/16 bends, 100 pcs. 6-in. 1/8 bends, etc.

New Britain, Conn.—Bids are wanted Jan. 6 for the construction of Section 2 of the New Britain sewerage system consisting of a tunnel 1,048 ft. long and approaches 680 ft., including manholes, etc., as advertised in The Engineering Record.

Woonsocket, R. I.—City Engr. F. H. Mills writes that the City Government has appropriated $5,000 for an additional filter bed.

Bridgeport, Conn.—The Sewer Com. will ask for an appropriation of $12,000 for the construction of Noble Ave. sewer. E. T. Buckingham, City Clk.

Boston, Mass.—The following bids were opened Dec. 15 by the Metropolitan Water & Sewerage Bd., for Section 48 High-Level sewer, Quincy; bidders' addresses Boston, unless otherwise stated:

Bidders and addresses.	In trench and embankment. Earth excav. & refill., 135x150-in. sewer, 5,880 ft.	Br. masonry, Amer., 2,500 cu. yds.	Br. masonry, Port., 3,000 cu. yds.	Con. masonry, Port., 15,000 cu. yds.	Boulder con. mas., Port., in trench, 9,000 cu. yds.	Spruce piles, 100,000 lin. ft.	Spruce lumber in trench, 10 M ft.	Totals.
Gow & Foss	$13.50	$13.50	$15.50	$6.75	$5.50	$0.25	$40.00	$335,780
Pat. McGovern	12.90	13.00	15.00	6.50	5.00	0.21	40.00	317,252
C. H. Eglee Co	8.80	13.00	15.00	7.50	5.50	0.20	50.00	311,744
Holbrook, Cabot & Rollins	9.00	14.00	15.00	6.50	6.00	0.25	40.00	309,820
Stewart & Son Co	10.00	13.50	15.00	6.00	5.00	0.20	35.00	292,900
Met. Contracting Co	8.00	13.50	14.88	6.25	5.00	0.17	30.00	281,480
H. P. Nawn, Roxbury	10.00	12.50	14.00	5.75	4.75	0.18	40.00	279,450
Wm. H. Ellis	8.50	12.20	13.50	5.50	4.00	0.15	30.00	254,780
E. W. Everson & Co	5.30	13.25	14.50	5.50	4.50	0.16	40.00	247,189
C. G. Belden & Co., Quincy	6.00	12.50	13.00	5.50	4.00	0.17	30.00	241,330
Dennis F. O'Connell, Dorchester.	5.46	12.00	13.25	5.40	3.75	0.145	40.00	231,505

Brooklyn, N. Y.—Bids will be received until Dec. 31 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and constructing a sewer in a portion of New York Ave., and outlet sewers in portions of New York, Newkirk and Nostrand Aves., also for furnishing material and constructing small sewers in portions of several streets.

Philadelphia, Pa.—Bids will be received until Dec. 24 by the Dept. of Pub. Wks., Bureau of Surveys, for supplies for Bureau of Surveys for 1903 and main sewer. Wm. C. Haddock, Dir.

New York, N. Y.—Bids are wanted Dec. 23 for furnishing material and building an extension to outlet sewer at the foot of W. 72d St., and for furnishing material and building sewers in Broadway, between 28th and 29th Sts. Jacob A. Cantor, Boro. Pres.

Lebanon, Pa.—A correspondent writes that the question of city sewerage is being agitated.

East Syracuse, N. Y.—At a recent meeting of the Village Bd. the Sewer Comrs. presented a complete report from Geo. W. Rafter, of Rochester, upon the proposed sewer system for this village. The report favored the original route decided upon by Village Engrs. Allen & Farrington, of Syracuse, some time ago.

York, Pa.—Mayor Gibson has signed the ordinance providing for a special election to vote on the question of increasing the city's indebtedness $400,000 for the building of a sanitary sewerage system.

Richmond Hill, L. I., N. Y.—Engineer Johnson, of the Sewer Dept. of the Boro. of Queens, is said to be preparing plans for a proposed sewerage system for Richmond Hill to connect with the Jamaica disposal plant.

Reading, Pa.—The Bd. of Pub. Wks. has been asked for an appropriation of $12,000 for a settling basin to be added to the filter beds at the sewage disposal plant.

St. Petersburg, Fla.—City Engr. J. P. Titcomb writes that the City Council is considering the following bid, opened Dec. 10 for the construction of a sewerage system; the city to furnish all pipe, castings for manholes and flush tanks, which materials are now on the site of proposed work: D. M. Baker, Jacksonville, Fla., $6,689; Coates Plumbing Co., Tampa, Fla., $6,066; and W. C. Porter, of Laurel, Miss., $5,672. The detail bid of W. C. Porter was as follows: Pipe—6,025 ft. 6-in. at 25 cts., 4,420 ft. 8-in. at 30 cts., 1,970 ft. 10-in. at 35 cts., 860 ft. 12-in. at 50 cts., 325 ft. 15-in. at 60 cts., 100 ft. 16-in. C. I. pipe, $2; 25 manholes at $40, 5 flush tanks at $65. The trench is to average 6.7 ft. to be excavated in sand.

Cleveland, O.—Bids will be received by the Clk. of the Bd. of Control until Jan. 8 for constructing an intercepting sewer in a portion of Lake St. consisting of a tunnel in Marquette St., from Lake St. northerly a distance of about 675 ft. Chas. P. Salen, Dir. Dept. of Pub. Wks.

Lakewood, O.—See "Water."

South Bend, Ind.—City Engr. Alonzo J. Hammond writes that the Bd. of Pub. Wks. has directed him to prepare plans and estimates for a trunk sewer in the western portion of the city: also for a trunk sewer on the east side, both to be built in 1903.

Madison, Wis.—City Clk. O. S. Norsman writes that the following bids were opened Dec. 12 for furnishing material and constructing 2½ miles of sanitary sewers ranging in size from 6 in. to 12 in.: John Delaney, Madison, Wis., $14,800; Harding, Nelson & Johnson, Racine, Wis., $13,975. Both bids were rejected. The City Engr., John F. Icke, estimates the cost at $12,300, and the city will undertake to do the work.

Des Moines, Ia.—The City Council has passed a resolution of necessity for a sewer on Park Lane from Grand to Woodland Ave.

Indianapolis, Ind.—Petitions are being circulated for a complete system of sewerage for West Indianapolis.

The Bd. of Wks. on Dec. 15 adopted resolutions for Roosevelt Ave. sewer, estimated cost $33,300; also Hillside and Bloyd Aves. sewer, estimated cost $18,900.

Vincennes, Ind.—The contract for constructing St. Clair St. sewer is reported to have been awarded to D. W. Norton & Co., of Terre Haute, for $14,703.

Ottawa, Ill.—City Engr. Chas. F. Wilson writes that petitions are now being circulated for the construction of a sewerage system in West Ottawa.

Cincinnati, O.—The contract for constructing sewers on Price Hill, in 8th Ave., W. 8th, Wells and other streets, is reported to have been awarded to McCarthy Bros. for $16,016.

Chicago, Ill.—Bids will be received by the Bd. of Local Improv. until Dec. 26 for constructing a sewer in South 43d Court, and for completing the contract for a system of sewers in North 40th Ave., Milton Place, and Warwick Place. John A. May, Secy.

Sault Ste. Marie, Mich.—An ordinance is said to be before the Council to authorize the issue of $35,000 bonds for establishing a sewer system.

Clay Center, Kan.—Local press reports state that bids will be received by the Mayor until Jan. 16 for constructing a sewer system.

Bessemer, Ala.—City Engr. W. J. Parkes writes that the work of constructing Second Ave. Dist. storm sewers (bids for which were to have been opened Nov. 18) has been postponed until the spring. Estimated cost, $7,500.

St. Louis, Mo.—The lowest bid for the reconstruction of a part of Mill Creek sewer is reported to have been from Heman Bros. at $16.90 per ft.; appropriation, $15,000.

East Lake, Ala.—The City Council is said to be taking steps looking to the installation of a sanitary sewerage system. Probable cost, $25,000.

Knoxville, Tenn.—Local papers quote City Engr. T. J. Moreland as having stated that sewer extension, which should be made immediately, would cost about $75,000.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that on Dec. 16 the following bids were opened for the construction of sewers in Sewer Dist. No. 211, the work to include 30,000 ft. of 8 in. to 4 ft., pipe and brick sewers, with 102 manholes, 62 catch basins and 7 flush tanks: Michael Walsh (awarded), $71,170.70; W. J. & Wm. Boyd Const. Co., $72,366.24; Cotter-McDonald P. & H. Co., $77,032.73; Luther Davidson, $73,141.66. Bidders all of Kansas City.

North Yakima, Wash.—The East Sunnyside Drainage Canal Co. has been organized for the purpose of getting rid of the surplus water on the land to the east of Sunnyside, which results from too much irrigation. The officers elected for the ensuing year are: Pres., J. T. Kunz; vice-pres., I. R. Noble; secy., M. D. Clarke; treas., J. A. Rush.

Long Beach, Cal.—The City Trus. have called an election for Dec. 30 to decide the question of issuing $35,000 bonds for sewer construction. The main sewer to be 18 in. and run through the city east and west on Second St., with a separate tank and outfall to the ocean.

Ballard, Wash.—The proposition to issue bonds to the amount of $20,000 for sewers, is reported to have carried at the recent election.

Colorado Springs, Colo.—Local press reports state that work will be started without delay on the construction of the proposed Cripple Creek drainage tunnel; said tunnel to start on Cripple Creek at the mouth of Arequa gulch and to be extended for a distance of 5,000 ft. eastward. Estimated cost about $100,000. F. F. Costello, Sherwood Aldrich and Sam. Bernard are on the Com. from Colorado Springs.

Ft. Assinniboine, Mont.—See "Government Work."

San Francisco, Cal.—The City Engineer has just completed plans and specifications for a sewer to be constructed in Harrison St. at an estimated cost of $4,200. The Bd. of Pub. Wks. has determined to construct other sewers on streets and avenues adjacent to the above, cost of which will be approximately $40,000; and plans for same have just been ordered.

Toronto, Ont.—Bids are wanted Dec. 23 for constructing tile sewers in portions of several streets. O. A. Howland (Mayor), Chmn. Bd. of Control.

Toronto, Ont.—The City Council has decided to adopt the recommendation of the City Engr. that a system of sewage disposal east of Woodbine Ave. be constructed as a local improvement at an estimated cost of $45,000.

BRIDGES.

Camden, N. J.—Local press reports state that bids will probably be received by the Bridge Com. for constructing a steel draw bridge, 125 ft. span, stone abutments and pier, across Cooper Creek at Baird Ave. Appropriation, $20,000.

Elizabeth, N. J.—It is stated that the Union Co. Bd of Freeholders has decided to construct a Melan bridge at Prince St.

Baltimore, Md.—Press reports state that the B. & O. and the Pennsylvania Railroads contemplate abandoning their bridges across Susquehanna River, and are considering the construction of one, to be used in common, about half way between the two.

York, Pa.—Local press reports state that $44,000 has been appropriated for the building of the Richland Ave. bridge.

Depew, N. Y.—Press reports state that the officials of the N. Y. C. & H. R. R. R. have awarded a contract to the Boston Bridge Co. for the building of 10 standard signal bridges on the Western Division of the road.

Perry, N. Y.—The Bd. of Superv. has passed a resolution authorizing this town to borrow $7,000, and to issue bonds therefor, for the building of an iron bridge across Silver Lake.

Franklin, Pa.—E. K. Smiley, Clk. of the Co. Comrs., writes that the contract for constructing a steel bridge (substructure and superstructure) over Allegheny River at Scrubgrass, has been awarded to Penn Bridge Co., Beaver Falls, Pa., for $79,900.

Allegheny, Pa.—G. C. Langenheim, Supt. Bureau Eng. & Surveys, writes that the following bids were opened Dec. 11 for work on the bridge to cross Woods Run Valley at Shady Ave.:

Masonry Piers and Abutments—Cronin & O'Herron, Pittsburg, $19,850; Grady C. Coda & Co., Pittsburg, $18,065; Barton & Miller, Allegheny, $16,779; Keeling & Ridge Co., Pittsburg, $15,725.

Superstructure—King Bridge Co., Cleveland, O., $90,500; Penn Bridge Co., Beaver Falls, Pa., $90,000; W. Va. Bridge & Const. Co., Wheeling, W. Va., $88,400; Ft. Pitt Bridge Wks., Pittsburg, $88,150; American Bridge Co., Pittsburg, $87,475.

Paving Roadway and Sidewalks—Sicilian Asp. Paving Co., New York, N. Y., $9,275; Penna. Asp. Paving. Co., Pittsburg, $7,525; Atlas Const. Co., Pittsburg, $7,175; Wadsworth Stone & Paving Co., Pittsburg, $6,143. Contract has not yet been awarded.

New York, N. Y.—J. C. Rodgers has secured the contract for constructing the tower foundation in the Boro. of Manhattan of the Manhattan Bridge (No. 3) over the East River, between the Boroughs of Manhattan and Brooklyn, for $482,726.

Washington, D. C.—A bill has passed the House authorizing the Great Falls & Old Dominion R. R. Co. to construct a single electric railway track across Aqueduct bridge. A deposit of $25,000 is to be made by the Railroad Co., with which the District Comrs. will reconstruct the superstructure of said bridge to make it suitable for the track.

Scranton, Pa.—Bids will be received until Jan. 12 by John E. Roche, Dir. Dept. of Pub. Wks., for constructing a viaduct along Lackawanna Ave. from 7th Ave. to 9th Ave., across and over the tracks of the Delaware, Lackawanna & Western R. R.

Danville, Ill.—W. S. Dawley, Ch. Engr. of the Chicago & Eastern Illinois R. R., and W. S. Danes, Supt. of Bridges & Bldgs. of the Wabash R. R., are reported to have decided to remove the wooden bridge at Seminary St. and to replace it with an iron structure.

Uhrichsville, O.—Press reports state that the officials of the Pittsburg, Cincinnati, Chicago & St. Louis Ry. contemplate building a bridge in this city at what is known as "52 cut."

Lockland, O.—The citizens of Lockland and Reading are anticipating the building of a bridge across the canal at Benson St.

Moline, Ill.—The building of a high bridge from Moline to Gilbertown is under consideration.

Youngstown, O.—Preliminary steps are being taken for the issuance of bonds for the building of the Mill Creek bridge.

Hazleton, Ind.—The citizens of Hazleton are about to petition the Co. Comrs. of Knox and Gibson Counties to bond for the construction of a bridge in this town.

Freeport, Ill.—The construction of a bridge across Pecatonica River, near Scioto Mills, is being considered.

Carlyle, Ill.—Press reports state that plans and bids are wanted by Chas. Wilton, Town Clk., for 2 iron bridges, 200 ft. long, to be built next spring.

Huntington, Ind.—It is stated that bids will be received Dec. 30 for constructing a truss bridge, 20 ft. wide, on stone or concrete foundation, near Huntington. Herman Taylor, Co. Surv.

Enon, O.—The Co. Comrs. have decided to erect an iron bridge across Mad River, near Enon, at a cost of between $5,000 and $8,000.

San Antonio, Tex.—The matter of building a viaduct at Nueva St. is under consideration.

Castroville, Tex.—The Commissioners' Court at Hondo has selected the plan of S. A. Oliver, of Houston, for the bridge to be built across Medina River, this city, consisting of 1 252 ft. steel span and 2 100 ft. spans, on 2 stone abutments and 2 stone piers, estimated to cost $12,500.

Mammouth Springs, Ark.—The Kansas City Bridge Co., Kansas City, Mo., is reported to have secured the contract to construct a 350 ft. steel bridge in this city for $6,476.

Spokane, Wash.—See "Electric Railways."

Sacramento, Cal.—The Bd. of Superv. has accepted plans and specifications prepared by Co. Surv. J. C. Boyd for a bridge to be built at Millers Ferry, across San Joaquin River, between Sacramento and San Joaquin Counties. Estimated cost, $20,000.

Bowbell, N. D.—Local press reports state that the Co. Auditor will ask bids for constructing bridges across Mouse River, as soon as plans and specifications have been received.

Colorado Springs, Colo.—The officials of the Santa Fe R. R., according to local press reports, have made an offer to the city to construct a steel bridge, 60 ft. wide, at Costilla St.

Sioux Falls, S. D.—The Co. Comrs. have ordered the building of a 150 ft. span steel bridge in Split Rock Township, a 130 ft. span steel bridge in Brandon Township, and a 70 ft. steel bridge across Beaver Creek, in Valley Springs.

Tacoma, Wash.—It is stated that bids will be received Jan. 12 for constructing a 350 ft. plate girder or truss bridge, on concrete foundation, across a gulch in this city. Estimated cost, $4,600. Norton L. Taylor, City Engr.

San Diego, Cal.—The Chamber of Commerce is reported to have recommended the building of a steel bridge across San Diego River.

MacLeod, N. W. Ter.—A. L. Sifton, Comr. of Pub. Wks., N. W. Ter., is reported to be desirous of securing bids for supplying material for building a bridge at MacLeod, to cost $20,000, and also one at Lethbridge, to cost $40,000.

Portland, Ore.—The building of a suspension bridge across Willamette River is under consideration.

Thornhill, Ont.—The Canada Foundry Co. is reported to have secured the contract for constructing a bridge across the east branch of Don River, this city, for $6,602.

PAVING AND ROADMAKING.

Hartford, Conn.—Geo. Nevers, Clk. Bd. of Street Comrs., writes that the contract for furnishing and laying the concrete base and sheet asphalt wearing surface of about 5,605 sq. yds. on Pearl St., has been awarded to the Southern New England Paving Co., Hartford, at $2.70 with 10-year guarantee, $6.60 per cu. yd. for concrete in excess of 4 ins., total about $16,000.

Pittsburg, Pa.—Representative citizens and business men have formed an organization to be known as the Road Drivers' Asso. of Pittsburg; O. H. Allerton, Pres.; Wm. McFarland, Secy., and F. B. Haas, Treas. Plans submitted by Engr. Brown for Beechwood boulevard have been adopted; they provide for a course 5,000 ft. long and 80 ft. wide, to consist of 8 ins. of broken stone, 3 ins. of cinder and 6 ins. of sand. Probable cost, $70,000 to $90,000.

Corinth, N. Y.—The Saratoga Co. Bd. of Superv., Ballston Spa, has voted authorizing a survey for 4 additional miles of road in Corinth.

Brooklyn, N. Y.—Pub. Wks. Comr. Redfield is said to be preparing to purchase a road stone-breaking machine and other implements necessary for the repair of roads in suburban districts.

Baltimore, Md.—The contract for paving Northwest St. has been awarded to Daniel Sullivan; for detail bid see The Engineering Record of Dec. 13.

Philadelphia, Pa.—The Bd. of Surveyors on Dec. 15 gave their tentative approval to the ordinance introduced at the last meeting of Common Council to place on the city plan an avenue 300 ft. wide, extending from Broad and Cayuga Sts. northeasterly for 8 miles; estimated cost, $2,500,000.

Buffalo, N. Y.—Bids will be received by the Dept. of Pub. Wks. until Dec. 27 for repaving portions of Fillmore and Lafayette Aves. Francis G. Ward, Comr. Pub. Wks.

New York, N. Y.—Bids are wanted Dec. 23 for regulating and repaving with asphalt on present pavement relaid as foundation a portion of 23d St. Estimated quantities: 14,220 sq. yds. of asphalt pavement, including binder course; 11,560 sq. yds. of old pavement, to be relaid as foundation or in approaches, etc.; 360 cu. yds. of concrete, 6,200 lin. ft. of new bluestone curb, furnished and set, etc., for regulating and repaving with asphalt on present pavement relaid as foundation a portion of Houston and Varick Sts., requiring 2,320 sq. yds. of asphalt, including binder course; for regulating and repaving with asphalt block on a concrete foundation Lexington Ave., from 95th to 96th Sts. Jacob A. Cantor, Boro. Pres.

Schenectady, N. Y.—City Engr. C. W. Truman writes that contracts for paving (bids opened Dec. 9) have been awarded to the Schenectady Contracting Co., of Schenectady, as follows—*a*, asphalt paving per sq. yd.; *b*, curbing; *c*, total: Lincoln Ave.: *a*, $2.10; *b*, 85 cts.; *c*, $12,500. Seward Place, *a*, $2.20; *b*, 85 cts.; *c*, $11,855. South Ave., *a*, $2.20; *b*, 85 cts.; *c*, $3,655.

New York, N. Y.—Plans have been completed for the extension of Riverside Drive, from the Manhattan viaduct at 135th St. to the Boulevard Lafayette at 156th St.; these plans provide for a carriage road 60 ft. wide, a bridle path 20 ft. wide, 2 broad walks and grass plats between the road and walks 5 ft. wide. Total estimated cost, including viaducts, bridges, etc., $2,700,000.

Waynesburg, Pa.—Boro. Engr. Geo. D. Jenkins writes that on Jan. 6 this Boro. will vote on the issue of $40,000 bonds for further street improvements.

Waterloo, N. Y.—The Seneca Co. Bd. of Superv. on Dec. 12 adopted a resolution recommending the construction of 35 miles of State road in the towns of Seneca Falls, Fayette, Varick, Romulus, Ovid and Lodi.

Philadelphia, Pa.—Bids were opened Dec. 16 by Dir. Haddock, of the Dept. of Pub. Wks., for work, material and supplies for 1903. The principal items were estimates for work to be done on the highways of the city. Bids received for the maintenance of unpaved and macadamized public highways, small bridges, drains and steps for next year are reported to have been as follows for the entire city: Geo. A. Vare, $114,000; D. J. McNichol, $132,000; J. R. Stanley, $123,000; David MacMahon, $129,000. Bids for general repairs to footways and repaving: Vulcanite Paving Co., $2.49 with asphalt where concrete binder has to be removed, and $2.34 where binder is not disturbed. Geo. T. Murray is stated to have bid $2.50 per sq. yd. for granolithic pavement. Pennsylvania Asphalt Co., to pave with asphalt where binder has to be renewed, $2.60 a sq. yd.

New York, N. Y.—Bids were opened Dec. 12 by McDougall Hawkes, Comr. Docks, for paving with asphalt the new-made land between 18th and 21st Sts., East River, and with granite between piers old 20 and new 16, East River, as follows, the bid of the Barber Co. being admitted under protest because of claim that sufficient security was not given before bidding was closed: Class I (per sq. yd.), Uvalde Asph. Pavg. Co., $3.05; Continental Asph. Pavg. Co., $2.90; Barber Asph. Pavg. Co., $2.85. Class II, 18,059 sq. yds., Sicilian Asph. Pavg. Co., $3.47; Uvalde, $2.75; Continental, $2.39; Barber, $2.20.

Allegheny, Pa.—Bids will be received until Dec. 23 for regrading, repaving, curbing and paving on portions of numerous streets. D. K. Fulton, Dir. Dept. Pub. Wks.

Savannah, Ga.—The City Council has before it ordinances for paving with brick Henry, East Broad and Habersham Sts., in all about 35,000 sq. yds.; work to be started next month.

Portsmouth, Va.—The City Council has granted the Finance Com. permission to ask for bids for $50,000 paving and grading bonds, the passage of which is now pending in the Legislature.

Cleveland, O.—Bids are wanted Dec. 23 for grading, draining, curbing and paving with brick on portions of numerous streets; also until Jan. 6 for similar work on portions of several other streets. Chas. P. Salen, Dir. Pub. Wks.

Marshalltown, Ia.—City Engr. Wm. Bremner writes that the City Council has taken preliminary steps toward the paving of nearly ½ mile of streets with brick; also about 4,500 ft. of asphalt paving.

Belleville, Ill.—City Engr. Louis Grauer writes that this city is preparing to pave 5 blocks on South Race St. with brick, also to pave 6 blocks on 1st St.; the work to be started in the spring as soon as the weather will permit.

Akron, O.—Bids will be received by the Bd. of City Comrs. until Dec. 27 for improving a portion of Rose Ave., by grading, curbing, and guttering with concrete, paving with brick, laying cement sidewalks, and constructing a sanitary sewer. Chas. H. Isbell, Clk.

Burlington, Ia.—City Engr. Emmet Steece writes that bids will be asked about Feb. 1 for 20,000 sq. yds. of brick paving in this city.

Bay City, Mich.—The County Road Comrs. are said to contemplate the purchase of a road roller and a stone crusher to use in the construction of county roads.

Janesville, Wis.—City Engr. C. V. Kerch writes that the City Council has ordered plans prepared for the improvement of Milwaukee Ave.

Ludington, Mich.—This city has voted to issue $20,000 bonds for street improvements.

Crookston, Minn.—The Common Council has approved the contract of the city with the Barber Asphalt Paving Co. for the paving of the principal business streets. The contract is said to call for an expenditure of about $60,000.

Faribault, Minn.—The Council is reported to have decided to pave the streets in the business section of the city next season.

Bloomfield, Ind.—Amos Musselman and Chas. O. Morgan, of Newberry, Ind., are reported to have received the contract for constructing Stockton Township gravel roads; total length, 15 miles. Estimated cost, $48,646.

Traverse City, Mich.—The Council Com. on Streets and Walks has ordered plans, specifications and estimates prepared for paving 6th St. with brick or asphalt. Blomshield & McCloy, of Bay City, are the engineers.

Normal, Ill.—J. G. Melluish, of Bloomington, Ill., writes that he is to report on asphalt pavement 30 ft. wide, with combined cement 6-in. curb and 18-in. gutter, to be laid on Fell Ave., Normal. Length of improvement, 6,500 ft. Estimated cost, exclusive of street car right of way, $40,221. The ordinance provides for 6-in. water mains and 24, 12 and 10-in. pipe sewers to be laid on Fell Ave.

St. Louis, Mo.—Bids will be received by the Bd. of Pub. Improv. until Dec. 30 for grading, curbing, improving, and paving with bituminous macadam on portions of several streets. Hiram Phillips, Pres.

Birmingham, Ala.—City Engr. Julian Kendrick writes that an ordinance has been introduced for the construction of 18,000 sq. yds. of bituminous macadam pavement.

Brookfield, Mo.—According to press reports steps are being taken toward paving Main St.

Louisville, Ky.—The lowest bid received for paving a portion of Peterson Ave. and the square at the intersection of 28th St. and Garland Ave. is reported to have been from Geo. W. Gosnell at $1.38 per sq. yd. for brick, total about $4,900.

Wichita, Kan.—The contract for repairing approximately 70,000 sq. yds. of asphalt pavement has been awarded at $1.10 per sq. yd.

Guthrie, Okla. Ter.—The contract for brick paving (bids opened Dec. 11) is reported to have been awarded to E. N. Ford, of Kansas City, Mo., at his bid of $1.88 per sq. yd.; total, $76,942.

St. Joseph, Mo.—Petitions have been issued for brick and macadam paving on several streets.

Ft. Smith, Ark.—A correspondent writes that this city is in the market for 100,000 paving brick, and more will be wanted soon.

Ogden, Utah.—City Engr. A. F. Parker writes that the Council has directed him to prepare plans and specifications and call for bids, for 2 blocks of paving on Washington Ave.

Denver, Colo.—The contract for sidewalk construction in Dist. No. 8 is reported to have been awarded to J. Fred Roberts at 82 cts. for new 5-ft., 2½-in. stone; total, $18,706.

San Francisco, Cal.—The Bd. of Wks. has awarded the contract for paving the roadway of Mission St. with bitumen, to the Union Paving Co., for $9,681.

Salt Lake City, Utah.—The Council has adopted a resolution instructing the City Engr. to prepare an estimate of the cost of paving Brigham St.

San Diego, Cal.—The directors of the Chamber of Commerce are said to recommend the purchase of a steam roller and oil plant for improving the streets.

Oakland, Cal.—The City Engineer has been requested to make an estimate of the cost of improving a portion of 5th St. Probable cost, $30,000.

POWER PLANTS, GAS AND ELECTRICITY.

Holyoke, Mass.—Municipal lighting bonds amounting to $720,000 have been sold. The lighting plants of the Holyoke Water Power Co. were transferred to the city Dec. 15. W. H. Snow will be Acting Mgr.

Weymouth, Mass.—The Weymouth Light & Power Co. is stated to have petitioned the Gas & Electric Light Comrs. for authority to increase its capital from $50,000 to $100,000, and to increase its bonded indebtedness from $50,000 to $85,000. The company proposes installing a new engine and machinery and purchase the property of the Weymouth Water Co.

Sellersville, Pa.—An ordinance has passed first reading granting to Morris A. Clymer, of Sellersville, a franchise for an electric light plant.

Richfield Springs, N. Y.—It is stated that the Otsego Light & Power Co., recently incorporated at Albany to furnish light and power to all of the villages on the route of the O., C. & R. S. R. R. in Herkimer and Otsego Counties, has petitioned the Bd. of Trus. for a franchise in this village.

Rochester, N. Y.—Jas. Craig Havemeyer, of New York, is stated to have purchased the plant of the Central Light & Power Co. The plant will probably be improved.

Brook Haven, L. I., N. Y.—The Town Bd. is stated to have granted a franchise to the Brook Haven Gas Co. Thos. G. Carlin, Pres., Brooklyn.

Dunkirk, N. Y.—The Bd. of Water Comrs. on Dec. 11 authorized the Electric Light Com., consisting of Messrs. Cummings, Weller and Carney, to ask for bids for the purchase of a new 350-Kw. alternating generator and engine and boiler to operate same.

Cooperstown, N. Y.—Bids will be received by the Bd. of Village Trus. until Dec. 26 for lighting the streets and Village Hall. The Bd. is to contract for 1 year, with the privilege of extending the time to 5 years. Address Village President.

Geneva, N. Y.—A press report states that the General Electric Co. is planning to install a plant at East Geneva, to furnish electricity for lighting and power purposes in Geneva, Waterloo, Seneca and Auburn.

Oneonta, N. Y.—The Otsego Light, Heat & Power Co., of Oneonta, has been incorporated, with a capital of $100,000, to operate in Oneonta, Laurens, Hartwick, Exeter, Otsego, Milford, Warren, German Flats, Richfield, Cooperstown, Richfield Springs, Mohawk and Herkimer. Directors: Edw. C. White and Herbert F. Jennings, of Mt. Vernon, and Chas. V. D. Peck, of Brooklyn.

Denton, Md.—The Citizens' Light & Fuel Co., of Caroline County, has been incorporated, with a capital of $20,000, by Wm. H. Deweese, Albert G. Towers, J. Kemp Stevens, and others.

Savannah, Ga.—The Savannah Electric Co. is stated to have secured the contract for lighting the city for a period of 5 years.

Manchester, O.—Bids are wanted Dec. 27 for $7,000 electric light bonds. S. N. Greenler, Clk.

St. Paul, Minn.—The Cleveland Vapor Light Co. is stated to have secured the contract for incandescent gasoline street lights for 1903, at $23.96 per lamp per year.

Winona, Minn.—City Engr. G. P. Coleman writes that the City Council has accepted plans and specifications for erecting a municipal electric light plant. Bids will be opened on Jan. 5, as advertised in The Engineering Record. Bids will also be opened at the same time for $40,000 bonds.

Ft. Wayne, Ind.—S. M. Foster, W. J. Vesey, and others are stated to have petitioned the Bd. of Pub. Wks. for a franchise for a heating and lighting plant for the purpose of supplying buildings with steam or hot water heat from a central plant.

Vincennes, Ind.—See "Electric Railways."

Fostoria, O.—It is stated that the Fostoria Home Htg. & Lighting Co. will soon commence the construction of an electric light plant. J. S. and J. W. Barber, of Columbus, are reported interested.

Morgantown, W. Va.—The plant of the Union Gas & Water Co., which controls all the gas and water business of the town, is stated to have been sold to S. B. Elkins and G. C. Sturgiss. The consideration was about $500,000 and about $200,000 will be expended at once on improvements.

Red Jacket, Mich.—John Burder is stated to have secured a 30-year heating and lighting franchise.

Effingham, Ill.—Press reports state that bids will be received Jan. 1 for constructing a modern electric light plant. J. B. Walker, Pres.

Two Harbors, Minn.—See "Water."

Milwaukee, Wis.—The Council has passed an ordinance providing for the issue of $150,000 bonds for a municipal lighting plant.

The Northwestern Heat, Light & Power Co., of Milwaukee, has been incorporated, with a capital of $25,000, to supply light, heat and power in this county. Incorporators: Fred, Max and L. Nohl, all of Milwaukee.

Phillipi, W. Va.—See "Water."

Excelsior Springs, Mo.—Henry J. Arnold is stated to have petitioned the Council for a franchise for an electric light plant.

Springfield, Mo.—The Electric Light Co. is reported reorganized. The new company is composed of F. W. Little of Peoria, Ill., and Mason, Lewis & Co., of Chicago. It is stated that about $50,000 will be expended in improvements.

Watauga, Tenn.—The Watauga Electric Co. is reported incorporated, with a capital of $50,000, by A. M. Young, F. A. Stratton, and others.

Woodville, Miss.—See "Water."

Palestine, Tex.—The City Council is stated to have granted R. V. Gray, of Texarkana, a franchise for an electric light plant, a gas plant and an electric railway.

Covington, Ky.—The Union Light, Heat & Power Co. is stated to have secured the contract for furnishing arc lights at $75 per lamp per year.

Searcy, Ark.—See "Water."

Ardmore, Ind. Ter.—The Ardmore Electric Light & Power Co., of Guthrie, has been incorporated, with a capital of $40,000. Incorporators: A. Renmelli, St. Louis, Mo.; H. E. Foster, Ardmore, Ind. Ter.; Henry Braun, Guthrie, Okla. Ter., and others.

Brownsville, Tex.—F. L. Houston, of San Antonio, is reported interested in the construction of an electric light plant.

Eugene, Ore.—The Co. Comrs. are stated to have granted the Booth-Kelly Co. a franchise to erect poles and string wires for the transmission of electric power from Springfield to Eugene.

San Francisco, Cal.—The Humboldt Light & Power Co., of San Francisco, has been incorporated; capital, $100,000. Directors: C. P. Doe, E. Woodin, and others.

Seattle, Wash.—The following bids are stated to have been opened by the Bd. of Pub. Wks. Dec. 6 for lighting the city for one year: Seattle Electric Co. for enclosed arc lamps (66 amp. 78 volts), $66 each per year, and for 30 c. p. incandescent lights, $15 each per year; Seattle Gas & Electric Co. for furnishing any number of street lamps on the line of existing mains and care for the same at $2 a month per lamp.

Bridgewater, S. D.—W. E. Roosecrans is reported interested in the construction of an electric light plant.

Folsom City, Cal.—Brainard F. Smith, Clk. State Bd. of Prison Directors of Cal., writes that the following bids were opened Nov. 22 for furnishing the State prison at Folsom City with an electric light plant: General Electric Co., on 75-Kw. generators, etc., $6,775; Westinghouse Electric & Mfg. Co., on 75-Kw. generators, etc., $7,600; Stanley Electric Mfg. Co., care John Martin & Co., agents, San Francisco, 65-Kw. generators, etc., $6,615; also 90-Kw. generators, $7,490 (awarded).

Great Falls, Mont.—City Engr. C. W. Swearingen writes that a franchise for a gas plant has been asked by St. Paul parties. This city has no gas plant at present.

Ft. Morgan, Colo.—Messrs. Handy & Hale have petioned the Town Bd. for a franchise for an electric light plant.

Harrison, Idaho.—The Harrison Electric Light Co., Ltd., has been incorporated, with a capital of $10,000. Directors: L. J. Kimmel, H. O. Thompson and W. O. Wheeler, all of Harrison.

Logan, Utah.—The Hercules Power Co. is stated to have secured the contract for furnishing the city with 169 32-c. p. lights, at $219.10 per month.

Santa Clara, Cal.—The California Light & Fuel Co. is stated to have secured the contract for constructing a Lowe crude oil gas-making plant for the city, with a capacity of 3,000 ft. per hour; the plant will cost $33,000.

Salt Lake City, Utah.—See "Water."

Owen Sound, Ont.—The citizens are stated to have voted to acquire the gas and electric light plants, at a cost of $75,000.

Guayaquil, Ecuador.—Bids will be received until Feb. 12 by the Secy. of the Municipal Council of Guayaquil for lighting the city by gas or electricity. At least 1,400 gas or electric lights of 15.4 c. p and 50 80 c. p. arc lamps will be needed.

ELECTRIC RAILWAYS.

Concord, N. H.—The City Council on Dec. 13 granted locations to the Concord, Dover & Rochester St. Ry. Co. Wallace D. Lovell, of Boston, Mass., Pres. Union Electric Co. of Dover, N. H., is reported interested.

Worcester, Mass.—The Worcester & Northern St. Ry. Co. is about to be organized, with a capital of $150,000, to build and operate a street railway from the terminus of the Worcester & Holden St. Ry. at Jefferson, through Princeton, to the center of Westminster, where it will join the Fitchburg, Westminster & Gardner Street Ry. Incorporators: Stephen Salisbury, of Westminster; Henry W. Warren, of Holden; Dr. C. E. Parker, of Princeton, and others.

Providence, R. I.—The Senate has passed the bill incorporating the Providence & Burrillville St. Ry. Co. It will construct a line in North Providence, Smithfield, North Smithfield, and Burrillville. Edgar K. Ray, of Woonsocket, is one of the incorporators.

Bristol, Conn.—Engineers under W. A. Sperry, of New Haven, are reported to have begun work on the new trolley line from Bristol to Terryville. The line is to be owned and operated by the Bristol Tramway Co., and will cost about $80,000.

Fiskdale, Mass.—The Worcester & Southbridge Ry. Co. is reported to be considering the extension of its line 12 miles from Fiskdale through East Brimfield, Brimfield to Palmer, there to connect with the line to Springfield. W. H. Culver, Ch. Engr., Worcester.

Hartford, Conn.—The Hartford & Middletown Ry. Co. and the New Haven & Middletown Ry. Co. have been incorporated, with a capital of $3,000,000, to construct electric railways—one from Hartford to Middletown, the other from Middletown to New Haven. Incorporators: Chas. E. Perkins, Hartford; Frank D. Haines, Middletown; S. H. Wagner, New Haven, and others.

New York, N. Y.—The Bd. of Aldermen on Dec. 16 passed the ordinance granting the Pennsylvania R. R. Co. the right to tunnel under Hudson River to the Boro. of Manhattan, to the projected terminal of the company below 34th St. between 7th and 9th Aves., then eastward under East River to the Boro. of Queens, to connect with the Long Island R. R. system recently acquired by the Pennsylvania Co. The company proposes to spend $50,000,000 on the improvement. W. H. Brown, Ch. Engr., Philadelphia, Pa.

The Bd. of Aldermen also passed on Dec. 16 the franchise giving the New York & New Jersey R. R. Co. the privilege of landing its Hudson River tunnel at West St. This franchise is for a tunnel from New Jersey for a trolley line, the tunnel to strike Manhattan at the foot of Morton St. and to run up to Greenwich St. The plan of the company is to continue and complete the partly constructed tunnel under North River, work on which is now being prosecuted on the Jersey side.

The State R. R. Comn. is stated to have authorized the Union Ry. Co. of New York to use the overhead trolley system in extensions of its lines on several streets in the Bronx Boro.

Pleasantville, N. J.—The Atlantic City & Suburban Ry. Co. is stated to have secured a right of way in Pleasantville and Absecon.

Boyertown, Pa.—The Town Council has granted right of way to Trappe & Limerick St. Ry. Co.; this is the connecting link needed by the United Power & Transpt. Co., for continuous line from Reading to Philadelphia. J. A. Rigg, Pres., Reading.

Northeast, Md.—The Town Comrs. are stated to have granted a franchise to the Cherry Hill, Elkton & Chesapeake City Electric Ry. Co.

Elkton, Md.—The Elkton, Newark & Eastern Shore R. R. Co. is reported organized, with Joshua Clayton Pres., and Albert Constable, Jr., Secy. The company proposes constructing a trolley line between Elkton and Delaware City, by way of Newark, to connect with the Wilmington & Delaware City line now in operation. It also proposes extending its line down to the Eastern Shore of Md. The Vandegrift Construction Co. will probably be the contractors.

Hyattsville, Md.—The contract for erecting a power house for the Washington, Baltimore & Annapolis Electric Ry. Co. is stated to have been awarded to the Cleveland Construction Co. of Akron, O. The building, fully equipped with machinery, will cost about $300,000. The company is also reported to be taking estimates for a building to contain car sheds and machine shops at Annapolis; it will be of concrete construction, 180x60 ft., and cost about $25,000. Jas. Christy, Jr., Vice-Pres., Washington, D. C.

Newark, Del.—The Newark, Elkton & Eastern Shore Electric Ry. Co. is reported organized, with Joshua Clayton, Pres., and Albert Constable, Jr., Secy. The company proposes constructing a trolley road from Newark, Del., via Elkton, Chesapeake City and on down the eastern shore of Maryland.

Portsmouth, O.—S. P. Baird, Engr. in Charge, writes in regard to the construction of a new power house for the Portsmouth St. Ry. & Electric Light Co., that contracts for the electrical machinery and steam turbines have been let, but contracts for boilers, condensers, and buildings are still to be let. Cost, $150,000.

Lorain, O.—The Lorain & Western Electric Co. has been incorporated, to construct a trolley line between Cleveland and Lorain, a distance of 20 miles. Incorporators: Rev. A. B. Stuher, Geo. L. Cooley, Frank R. Lander, and others.

Cincinnati, O.—The Cincinnati, Dayton & Ft. Wayne R. R. Co., of Dayton, has been incorporated, with a capital of $1,000,000 to construct an electric railway from Cincinnati to Ft. Wayne, Ind., and to Toledo.

Hartford City, Ind.—The Co. Comrs. are stated to have granted a franchise to the Oil Belt Traction Co.

Vincennes, Ind.—The Western Indiana Traction Co. of Vincennes, has been incorporated, with a capital of $100,000, to construct interurban railways in Vanderburgh, Posey, Gibson, Knox, Sullivan and Vigo Counties. The company also has the power to furnish electric light and power. Directors: Edgar H. DeWolf, Chas. W. Benham, Saml. W. Williams, and others, all of Vincennes.

South Bend, Ind.—The Indiana Ry. Co. (Electric) is preparing to extend its tracks to Notre Dame, and have the line in operation in 1903. Jas. McM. Smith, Vice-Pres. and Gen. Mgr., South Bend.

Boone, Ia.—L. W. Reynolds is reported interested in the construction of an electric railway from Boone to Webster City and Fraser, a distance of about 65 miles.

Detroit, Mich.—The Detroit, Monroe & Toledo Short line has been incorporated, with a capital of $3,000,000. The Black-Mulkey Electric Ry. connecting Monroe and Toledo has been taken over and will be extended to Detroit. Of the capital, $1,000,000 is set apart for improvements. Stockholders: C. A. Black and J. M. Mulkey, Detroit; Arthur Hill, Saginaw; Matthew Slush, Mt. Clemens, and others.

Youngstown, O.—The City Council is stated to have granted a franchise to the Lake Erie, Youngstown & Southern R. R. Co.

Ripon, Wis.—The City Council is stated to have passed an ordinance granting the Madison & Northwestern R. R. Co. a franchise to construct, maintain and operate an electric railway line in Ripon.

Virginia, Minn.—The City Council is stated to have granted a franchise to the Missabe Electric Ry. Co.

Greenville, Miss.—It is stated that the Delta Light & Power Co. proposes constructing an electric railway 3½ miles long.

Beaumont, Tex.—The City Council is stated to have granted a franchise to the Beaumont, Port Neches & Port Arthur Electric Ry. Co.

Palestine, Tex.—See "Power Plants, Gas and Electricity."

Marion, Ala.—The City Council is stated to have granted the Marion Light & Power Co. a franchise to construct an electric railway.

Little Rock, Ark.—Local press reports state that the Little Rock Traction & Electric Co. will construct a new power plant, at a cost of $500,000.

Lincoln, Neb.—The Lincoln Traction Co. is stated to have decided to construct a large addition to its power plant. J. H. Humpe, Mgr., Lincoln.

Oregon City, Ore.—The City Council is stated to have granted a franchise to the Oregon City & Suburban Ry. Co.

Spokane, Wash.—Local press reports state that the Washington Water Power Co. is considering the extension of the Sprague Ave. line to connect with its Union Park spur, the construction of a new line from Ross Park west on Indiana Ave., and the construction of a double track steel bridge across Spokane River at Post St. D. L. Huntington, Mgr., Spokane.

Grass Valley, Cal.—The Bay Counties Power Co. is stated to have completed a survey for an electric line from Grass Valley to Colfax.

Oroville, Cal.—It is stated that bids are wanted Jan. 8 for the purchase of a franchise to construct and operate an electric railway over certain roads in Butte Co., as applied for by Fred. M. Clough. H. T. Batchelder, Co. Clk.

Seattle, Wash.—The Seattle & Everett Interurban Ry. Co. has been incorporated, with a capital of $1,500,000, to construct an electric railway between Seattle and Everett, a distance of 33 miles. Incorporators: M. D. Haynes, Jas. E. McMurray, and others.

Ottawa, Ont.—E. J. Walsh is reported to have commenced surveying for an electric railway for the Ottawa, Brockville & St. Lawrence Ry. It will be 55 miles in length.

RAILROADS.

Attleboro, Mass.—Plans for abolishing the grade crossings of the N. Y., N. H. & H. R. R. in Attleboro are reported as being under consideration. If the plans are accepted, it is stated that the Attleboro branch road of the Union Traction Co., which is now Probable cost of work is $400,000. C. M. Ingersoll, Jr., Ch. Engr., New Haven, Conn.

Williamstown, Mass.—The Hoosac Valley St. Ry. Co. is stated to have petitioned the State R. R. Comrs. for the abolishment of certain grade crossings in Williamstown, Adams and North Adams. W. T. Nary, Mgr., North Adams.

Washington, D. C.—See "Business Buildings."

Greenwich, N. Y.—The Battenkill R. R. Co., of Greenwich, has been incorporated, with a capital of $75,000, to operate a steam railroad 7 miles long from Greenwich to Schuylerville. Directors: G. F. Blandy and C. P. Noyes, of N. Y. City, and I. C. Blandy, of Greenwich.

Huntdale, N. C.—It is stated that the J. M. Brick Lumber Co. will construct 13 miles of railroad from Huntdale to a point in Yancy County, N. C.

Momence, Ill.—The Illinois, Iowa & Minnesota Ry. Co. has been incorporated, with principal offices in Chicago and a capital of $100,000. The new road is to be constructed from Momence through the counties of Kankakee, Will, Grundy, Kendall, Kane, De Kalb, Ogle, Winnebago, Stephenson, and Jo Daviess, terminating at East Dubuque, Ill.

Kenosha, Wis.—The Chicago, Waukegan & Elgin Ry. Co. is reported to be considering the construction of a steam railroad from Foxlake, Ill., to Kenosha. W. T. Arthur, Pres., Council Bluffs, Ia.

Elnora, Ind.—It is stated that the Southern Indiana R. R. Co. will extend its line from Elnora to Evansville, a distance of about 70 miles. J. W. Thompson, Gen. Supt., Terre Haute.

Cincinnati, O.—H. M. Strong, Hotel Sterling, Cincinnati, is desirous of securing bids for constructing 17 miles of double track railroad construction, from 23 to 40 miles from Cincinnati; most of it is very heavy work; portions of it have considerable loose rock. Approximately 2,500,000 yds. of material to be excavated. Transportation on outfit free from St. Louis, Chicago, Cleveland and other intermediate points; 60-lb. rails and frogs free. The work can now be inspected, and further information will be given by Mr. Strong.

Ravenna, O.—Drake & Stratton, of Philadelphia, Pa., are stated to have secured the contract for changing the line of the Cleveland & Pittsburg division of the Pennsylvania Lines West, between Ravenna and Hudson; cost reported to be about $650,000.

Grayson Springs, Ky.—The Illinois Central R. R. Co. is reported to have in contemplation the extension of its line from Grayson Springs Station, 20 miles southwest to Peonia, Ky. W. J. Harahan, Ch. Engr., Chicago, Ill.

Oliver Springs, Tenn.—The Callahan Construction Co. is stated to have secured the contract for the construction of the Oliver Springs branch of the Knoxville, LaFollette & Jellico R. R. (R. Montfort, Ch. Engr., Louisville, Ky.). The cost is reported to be about $200,000.

Haileyville, Ind. Ter.—The Choctaw-Rock Island R. R. Co. is stated to have decided to construct a line from Haileyville to Dallas, Tex., a distance of 100 miles. W. E. Dauchy, Ch. Engr., Chicago, Ill.

Vicksburg, Miss.—Press despatches state that the Natchez & Gulf R. R. survey (final) has been completed. The counties traversed are Adams, Franklin, Amite, Marion, Pearl River, Hancock, and Harrison.

Columbia, Miss.—A preliminary survey is stated to have been completed for a new line for the Gulf & Ship Island R. R. Co. from Mendenhall to Columbia, a distance of 50 miles. W. W. Vail, Ch. Engr., Gulfport, Miss.

Crockett, Tex.—P. A. McCarthy, of Kennard, Tex., Ch. Engr. of the Eastern Texas R. R. Co., is stated to have completed the preliminary survey for an extension of the line from Kennard to Crockett, a distance of 31 miles.

Granger, Tex.—The Granger, Georgetown, Austin & San Antonio Ry. Co., recently chartered to construct a railroad from Granger, via Georgetown to Austin, about 50 miles, will be operated by the Mo., Kan. & Tex. Ry. (S. B. Fisher, Ch. Engr., St. Louis, Mo.); it has been partially graded by the former Georgetown & Granger Ry. Co.; remainder of line will be located at once and contracts let for construction. C. B. Jones, Granger, Vice-Pres. and Secy.; A. A. Allen, of St. Louis, Mo., Pres.; T. S. Miller, of Dallas, Atty. Capital stock, $50,000.

Biloxi, Miss.—The Biloxi, Waynesboro & Cahawba Valley R. R. Co. is reported incorporated to build a railroad from Biloxi to a point on Tombigee River in Alabama.

Lewistown, Mont.—The City Council is stated to have granted a franchise to the Montana R. R. Co. Robt. Rantoul, Gen. Mgr., Helena.

Los Angeles, Cal.—The Los Angeles, Ocean Park & Santa Monica R. R. Co. has been incorporated, with a capital of $1,000,000, to construct a line about 15 miles in length. Directors: W. S. Hook, Abbott Kinney, and others.

PUBLIC BUILDINGS.

Worcester, Mass.—The Fin. Com. of City Council has voted to recommend a loan of $300,000 to enlarge and equip the City Hospital.

Melrose, Mass.—Bids will be received by John Larrabee, Mayor, until Dec. 27 for erecting a public library.

Kingston, N. Y.—The Church Construction Co. (F. A. Palen, Pres., Kingston) is stated to have secured the contract for erecting the Carnegie Library, for $29,171.

Camden, N. J.—Local press reports state that architects will submit to the Co. Bldg. Com., Dec. 31, plans and specifications for the proposed new county buildings in Camden.

Washington, D. C.—The plans of Cope & Stewardson, 320 Walnut St., Philadelphia, Pa., have been accepted for the new municipal building to be erected on 14th, D and E Sts., N. W., to cost $900,000.

Pittsburg, Pa.—It is stated that the Sisters of Divine Providence will erect a school, convent and chapel on Lincoln and Verona Aves., to cost in all $60,000.

The Congregation of Holy Rosary R. C. Church is reported to have plans prepared for an edifice to be erected on Lincoln and Lemington Aves., to cost $30,000.

Henry Shenk, 900 Lewis Blk., is stated to have received the contract for erecting a shelter house in Schenley Park, for $25,000.

Philadelphia, Pa.—The Select Council has passed an ordinance providing for the purchase of Macalester Farm, as the site for the Municipal Hospital.

Camden, N. J.—Chas. W. Bolton & Co., Witherspoon Bldg., Philadelphia, Pa., are stated to have been selected to prepare plans for a $30,000 church and Sunday school for the State St. M. E. Church, to be erected at 6th and State Sts.

Columbus, O.—At the meeting of the Ohio Comrs. of the St. Louis Exposition, Dec. 9, it was decided to request plans from Ohio Architects for a building to be erected at St. Louis, Mo. Plans to be submitted by Mar. 1st. Wm. F. Burdell, Pres., Columbus.

Marquette, Mich.—Patton & Miller, 153 La Salle St., Chicago, Ill., are stated to have been selected to prepare plans for the Peter White Library to be erected on Front and Ridge Sts.

Albert Lea, Minn.—The Library Bd. has adopted the plans of Shick & Roth, of La Crosse, Wis., for a 1-story stone and brick library, to cost $12,000.

Chicago, Ill.—E. Stanford Hall, 153 La Salle St., is stated to be preparing plans for an edifice to be erected at Wrightwood and N. Spaulding Aves. for the Norwegian Baptist Congregation, to cost about $25,000.

Monmouth, Ill.—The Warren Co. Comrs. are reported to have decided to build a $30,000 almshouse.

Calumet, Mich.—It is stated that St. Joseph's Church, which was recently destroyed by fire, will be rebuilt, at a cost of $40,000.

Decorah, Ia.—The plans of F. W. Kinney, of Minneapolis, Minn., are stated to have been accepted for the Winneshiek County Court House, to cost about $75,000.

Duluth, Minn.—It is stated that the French Catholics will erect a church and school at 23d Ave. W. and Michigan St. Zachary Lacasse will superintend the work, which is estimated to cost $90,000.

Lorain, O.—Patton & Miller, of Chicago, Ill., are stated to have been selected to prepare plans for a Carnegie Library, to cost about $30,000.

Hickman, Ky.—Bids will be received until Jan. 14 by the Fiscal Court of Fulton Co., for erecting a court house according to plans prepared by Frank P. Milburn, Columbia, S. C. S. D. Luten, Clk.

Los Angeles, Cal.—Murphy & McLennan, 119½ S. Spring St., are stated to have secured the contract for erecting (exclusive of plumbing and interior finish) the Chamber of Commerce Bldg. on B'wny and 2d St., for $125,000. It will be 6 stories high, and measure 132x185 ft.

San Bernardino, Cal.—F. P. Burnham and Wm. Bliesner are stated to have prepared plans for a Carnegie Library, to cost $20,000.

Victoria, B. C.—It is stated that bids will be received until Dec. 30 for installing hot-air heating apparatus in the drill sheds at Kamloops and Nelson. Wm. Henderson, Clk. of Wks.

BUSINESS BUILDINGS.

Laconia, N. H.—A correspondent writes that the Masonic Temple, which was destroyed by fire Dec. 5, will probably be rebuilt. Cost of building, $80,000.

Worcester, Mass.—The Chase Bldg., 44 Front St., is reported to have been destroyed by fire Dec. 11.

Boston, Mass.—It is stated that a $60,000 warehouse is to be built on the Boston Wharf Co.'s land on Congress and Stillings Sts. It will be 5 stories high, 121x83 ft.

Buffalo, N. Y.—It is stated that a parish house is to be erected for the Trinity Episcopal Church, to cost about $50,000. Rev. C. J. Davis, Rector.

Washington, D. C.—The House of Representatives on Dec. 15 passed the Senate bill providing for the erection of a union railroad station in Washington, to cost $4,000,000. The station is to be north of the present site of the B. & O. station, at Delaware and Massachusetts Aves., and in front of it is to be a large plaza park. The Pennsylvania R. R., by the terms of the bill, is to remove its tracks from the Mall and reach the site of the proposed station through a tunnel to run between the Capitol and the Library Building. The government is to pay the Pennsylvania R. R. $1,500,000, and the B. & O. R. R. $500,000, in addition to providing for the plaza park.

McKees Rocks, Pa.—See "Water."

Atlanta, Ga.—It is stated that a 14-story building, to cost $300,000, will be erected on the site of the Norcross Bldg. destroyed by fire on Dec. 9. Capt. J. W. English is reported interested.

Chicago, Ill.—It is stated that plans are being prepared for an express and freight building for the Lake Shore R. R. (H. A. Ziesel, Div. Supt., Chicago) and the Rock Island R. R. (C. H. Hobbell, Div. Supt., Chicago). The building will be 2 stories high, and cost $75,000.

The Iroquois Theater Co. has secured a permit for the erection of a 2-story theater at 79 to 83 Randolph St.; cost estimated at $300,000.

Flint, Mich.—Clark & Munger, Bay City, Mich., have prepared plans and specifications for a 3-story store and office bldg., 110x80 ft., to be erected in this city, for the Supreme Div. Knights of the Loyal Guard; bids for the erection of which will be received until Jan. 20. The work will include press brick, structural iron and steel, electric passenger elevator and 2 freight elevators, steam heating, electric wiring and plumbing.

Elwood, Ind.—Geo. H. Johnson, of St. Louis Mo., is reported interested in the erection of a hotel at Elwood.

St. Marys, O.—Bids are wanted Jan. 2 for erecting a brick building on Wharf St. John M. Koenig, Gen. Mgr., Front and Spring Sts.

Cleveland, O.—The Brooks Co., Stationers, is stated to have decided to erect a 7-story building at 122 Superior St., at a cost of $60,000. Architects, F. S. Barnum & Co., New England Bldg.

Mobile, Ala.—It is rumored that the New York Life Insurance Co. has purchased St. Johns property, N. E. St. Francis and Royal Sts., and contemplates erecting an 8-story building.

Birmingham, Ala.—John Griffith & Son, 135 Adams St., Chicago, Ill., are stated to have secured the contract for erecting a 12-story office building on 2d Ave. and 20th St. for about $500,000.

Spokane, Wash.—L. I. Rand, Rookery Bldg., is the architect for a 3-story brick building, 130x90 ft., to be erected for S. Heath of Spokane.

It is stated that the Ridpath Hotel was destroyed by fire Dec. 12.

Seattle, Wash.—Hamm & Schmitz, of the Butler Hotel, are reported interested in the erection of a 9-story hotel at 2d Ave. and Cherry St., to cost $500,000.

Fresno, Cal.—The Knights of Pythias are reported to be considering the erection of a $50,000 society building. C. E. Church, Pres.

Helena, Mont.—The contract for erecting the union station for the Northern Pacific and the Great Northern Railroads, at Helena, is stated to have been awarded to Geo. S. Deeks & Co., of St. Paul, Minn.; cost reported to be about $50,000.

San Francisco, Cal.—Wm. Koenig, 120 Sutter St., is stated to have prepared plans for an apartment hotel to be erected on Bush St. and Burritt Pl., for Harry N. Stetson, to cost about $125,000.

Quebec, Que.—It is stated that the Victoria Hotel was destroyed by fire Dec. 14.

DWELLINGS.

Montclair, N. J.—It is stated that a dwelling will be erected on N. Mountain and Watchung Aves. for Adlai E. Stevenson, at a cost of $180,000.

Pittsburg, Pa.—A. F. Link is stated to have prepared plans for a brick veneered building on Locust St. for D. H. Crisman, to cost $24,000.

It is stated that John McSorley will erect a 4-story brick apartment house on Center and Craig Sts., at a cost of $65,000.

SCHOOLS.

Brockton, Mass.—The Council on Dec. 11 passed an ordinance appropriating $180,000 for a high school.

Brooklyn, N. Y.—Bids are wanted Dec. 24 for erecting School No. 144, Boro. of Brooklyn. C. B. J. Snyder, Supt. of School Bldgs., N. Y. City.

Bids will be received until Dec. 29, by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for erecting School No. 145, and until Dec. 30 for erecting Schools Nos. 91 and 119, also on the same date for sanitary work in School No. 138, all in the Boro. of Brooklyn.

Jersey City, N. J.—The School Bd. on Dec. 12 is stated to have authorized the Supervising Archt. to prepare preliminary plans for a high school.

New York, N. Y.—Bids are wanted Dec. 29 for erecting School No. 106. C. B. J. Snyder, Supt. of School Bldgs.

Long Island City, N. Y.—Bids are wanted Dec. 29 for installing a ventilating and heating apparatus in School No. 51, and until Dec. 30 for installing electric light wiring and electric bell system in the same school, Boro. of Queens. C. B. J. Snyder, Supt. of School Bldgs., N. Y. City.

Ft. Wadsworth, N. Y.—Bids will be received until Dec. 30 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for erecting School No. 34, at Ft. Wadsworth, Boro. of Richmond.

Buffalo, N. Y.—The following are the lowest bids opened by the Bd. of Pub. Wks., Dec. 12, for a school in District 13: Masonry, Niederpruem, Gibbs & Schaaf Co., $20,467; carpentry, Herman Houseman, $10,757; plumbing and gas-fitting, Barnd & Geiger, $3,572; roofing and metal work, F. H. Menge, $4,481; and ventilating and heating, Jos. Bronold, $9,481.

Philadelphia, Pa.—The contract for erecting a 20-room school at Morris St. and Moyamensing Ave. is stated to have been awarded to S. Gourley, Jr., 1808 Gratz St., for $93,787.

Monessen, Pa.—The School Bd. is stated to have decided to erect a $50,000 school in the spring.

New York, N. Y.—The following bids were opened Dec. 15 by C. B. J. Snyder, Supt. of School Bldgs., Dept. of Educ., for the general construction of school 183, Boro. of Manhattan—*a*, to complete Sept. 1, 1903; *b*, to complete Jan. 1, 1904: Patrick Sullivan, *a*, $186,000; *b*, $178,780. Richard L. Walsh, *a*, $192,000; *b*, $191,053. Thos. B. Leahy, *b*, $161,936. John H. Goetschius, *b*, $166,000. P. J. Walsh, 503 5th Ave., *a*, $156,000 (awarded). Thos. Cockerill & Son, *a*, $164,500; *b*, $164,500. Wm. & Thos. Lamb, *b*, $165,111. Chas. H. Peckworth, *b*, $155,622.

Bids opened at the same time for the general construction of school 81, Boro. of Queens—*a*, to complete Sept. 1, 1903; *b*, to complete Jan. 1, 1904: P. J. Walsh, *b*, $229,500. Myron C. Rush, 327 Franklin Ave., Brooklyn, *b*, $213,333 (awarded). Thos. Cockerill & Son, *a*, $244,500; *b*, $244,500. Wm. P. McGarry, *a*, $231,971; *b*, $224,883. John H. Goetschius, *b*, $220,900. Peter Cleary, *b*, $219,445. Wm. & Thos. Lamb, *b*, $213,921. Chas. H. Peckworth, *b*, $222,787. John Auer & Sons, *a*, $232,500; *b*, $225,000. Geo. Hildebrand, *b*, $223,981.

Bids opened at the same time for installing electric light wiring and fixtures—*a*, Girls' Technical High School; *b*, school 72, Boro. of Manhattan: Peet, McAnerney & Powers, *a*, $3,506; *b*, $3,611. C. E. Hewitt & Co., *a*, $5,441; *b*, $5,178. T. Frederick Jackson, *a*, $2,262; *b*, $2,715. Commercial Const. Co., *a*, $2,903; *b*, $3,243. Griffin & Co., *a*, $2,384. Frederick Pearce, *a*, $2,385; *b*, $2,655.

No bids were received Dec. 15 for electric elevators in the Morris High School, Boro. of Bronx, and new bids will be asked.

Columbus, O.—Bids will be received until Jan. 12 by Lucien Livingston, Clk. Bd. of Educ. of Marion Township for furnishing material and erecting a 4-room school in the 2d Dist., Marion Township.

Seymour, Wis.—The School Bd. is stated to have accepted plans of H. A. Foeller, of Green Bay, for a school to cost about $18,000.

Canton, Ill.—The plans of Wm. Wolf, of Galesburg, Ill., are stated to have been accepted for a school to be erected here to cost $40,000

Cleveland, O.—Bids will be received by the Bd. of Educ. until Jan. 6 for $250,000 bonds. Starr Cadwallader, School Dir.

Chicago, Ill.—Jos. Molitor, Jr., 153 La Salle St., is stated to have prepared plans for a 3-story parochial school to be erected at Paulina and W. 18th Sts., for St. Vitus R. C. Church, to cost $20,000.

Toledo, O.—It is stated that the St. Louis Catholic Society will erect a $50,000 school. Rev. John Harks, Rector.

St. Henry, O.—Bids are wanted Dec. 30 for erecting a school. Dr. J. A. Schirock, Clk.

Racine, Wis.—The Council is reported to have adopted plans for a $30,000 addition to Garfield School.

Beaumont, Tex.—Competitive plans will be received until Jan. 15 by the Bd. of Trus. of the Pub. School for a first class 2 or 3 story and basement high school to be erected on a block of ground, 300 ft. square; said building to be constructed of brick, with stone, granite or terra cotta trimmings, to have a slate roof, and cost not to exceed $65,000. B. E. Pettus, Supt.

Sedalia, Mo.—The citizens are stated to have voted to issue $40,000 bonds to erect a school, to replace the Broadway School.

STREET CLEANING AND GARBAGE DISPOSAL.

Jersey City, N. J.—Mayor Fagan has approved the street cleaning contract for 1903 as awarded to Henry Byrne.

Rochester, N. Y.—Bids opened Dec. 12 by the Bd. of Contract & Supply for the collection of garbage for next year were as follows: Chas. W. Hartung, $25,300; Thos. Holahan, $30,000; M. W. Conway, $31,500.

Trenton, N. J.—The American Underwriting Co. has made two offers to Mayor Katzenbach to provide this city with an efficient system of garbage collection and disposal. The first proposition is to dispose of the city's garbage in an odorless and sanitary manner at the uniform rate of $1.30 a net ton. This does not include night soil, which will be collected and disposed of at $2.25 a cu. yd. There will be no expense to the city for a plant and a franchise for not less than 10 years is asked for.

The second plan offers to collect and dispose of all garbage, except night soil, at the rate of $1.75 a net ton, and night soil at $2.25 per cu. yd.

Toledo, O.—Local press reports state that a waste utilization company, with a capital stock of $200,000, owned and controlled by Toledo capital, is one of the possibilities for Toledo in the near future, providing a long term franchise can be secured from the City Council.

GOVERNMENT WORK.

Boston, Mass.—Bids are wanted at the U. S. Engineer Office until Jan. 22 for dredging in Boston Harbor, as advertised in The Engineering Record.

A. Schubert, Ch. Clk., writes that all bids opened Dec. 2 at the U. S. Engineer office for dredging in Chelsea Creek and Malden River, Mass., have been rejected.

Newport, R. I.—Bids will be received until Jan. 7 for 3 double sets of officers' quarters to be built at the U. S. Naval Training Station, Newport. W. S. Cowles, Acting Ch. Bureau of Navigation, Navy Dept., Washington, D. C.

Plattsburg, N. Y.—Bids will be received until Jan. 9 by the Quartermaster, Plattsburg Barracks, for roof and basement drainage, at the Barracks.

Annapolis, Md.—Bids will be received until Dec. 30 at the Bureau of Navigation, Navy Dept., Washington, D. C., for foundations for an Officers' Mess Bldg., at the U. S. Naval Academy, Annapolis. Ernest Flagg, Archt., 35 Wall St., N. Y. City. W. S. Cowles, Acting Ch. of Bureau.

Ft. Terry, N. Y.—Bids are wanted Dec. 31 for constructing gun shed and machine shop, addition to ordnance storehouse, at this post. Address, S. Y. Britt, Q. M.

New York, N. Y.—The Bd. of Comrs. of Quarantine, New York, on Dec. 11 opened the following bids for repairs to sea wall and docks at the upper Quarantine Station, Hoffman's Island, New York: Ellery Colby, Owego, N. Y., $56,850; Snare & Triest, 39 Cortlandt St., $65,525; P. Sanford Ross, N. Y. City, $76,025.

Major W. L. Marshall, Corps of Engrs. U. S. A., writes that the contract for furnishing material and building an embankment southwest of Governors Island, New York Harbor, has been awarded to the N. Y. Filling Co., 259 Washington St., Jersey City, for $125,000.

Wilmington, Del.—The following bids were opened Dec. 15 by Col. Jared A. Smith, Corps of Engrs., U. S. A., for the construction of jetty at mouth of Mispillion River—*a*, price per cord for brush; *b*, price per cu. yd. for stone; *c*, Board and room for inspector: The Coast Jetty Co., New York City, *a*, $4.00; *b*, $3.30; *c*, $1.00. Smith & Hodge, New York City, *a*, $3.25; *b*, $3.75; *c*, 75 cts. Benjamin T. Collins, Milford, Del., *a*, $5.94; *b*, $3.98; *c*, $1.00. Wilson M. Vinyard, Milford, Del., *a*, $3.27; *b*, $4.47; *c*, $1.00. T. H. Lyons, Brookland, D. C., *a*, $4.98; *b*, $3.48; *c*, $1.00.

Washington, D. C.—The House Com. on Pub. Bldgs. & Grounds has reported favorably upon the bill appropriating $7,000,000 for the purchase of a site, and for the erection of a Conrt of Justice Building, for the accommodation of the Supreme Court of the U. S., the Dept. of Justice, National Law Library, and International tribunals. The Com. also reported the bill, which has passed the Senate, carrying $2,500,000 for the construction of a new Dept. of Agriculture Bldg., but cut the limit of cost to $1,500,000.

New York, N. Y.—Bids will be received until Jan. 10 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a steel and concrete foot bridge, about 60 ft. long and 11 ft. 4 in. wide, at the Navy Yard, New York.

Philadelphia, Pa.—Bids will be received by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Jan. 17 for constructing a brick and steel extension of building No. 14, Navy Yard, League Island, Pa. Appropriation, $12,500. Bids will also be received by Mordecai T. Endicott until Feb. 7 (readvertisement) for furnishing material and constructing a concrete and stone dry dock at the Navy Yard, League Island, Pa.

Baltimore, Md.—Col. Peter C. Hains writes that the contract for dredging in Curtis Bay, Md. (bids opened Dec. 17), has been awarded to Sanford & Brooks Co., Baltimore, at 11¾ cts. per cu. yd.; total, $176,631. Estimated cost, $196,000.

Ft. Screven, Tybee Island, Ga.—Bids will be received until Jan. 5 by Sylvanus G. Orr, Q. M., for constructing a 60,000-gal. steel tank on 61 ft. 9-in. trestle at this post.

Charleston, S. C.—The following bids are reported to have been opened Dec. 6 by Capt. Jas. C. Sanford, Corps of Engrs., U. S. A., Charleston, for the construction of 2 dredges for the ports of Jacksonville and Pensacola; bids were invited for the building of *a*, two large dredges; *b*, two small dredges, and the dredges separately: Jas. Reilly Repair & Supply Co., New York, place of delivery, Greenport, N. Y.—*a*, $300,000, in 12 and 14 months; 1 large dredge, $157,673, in 12 months; *b*, $282,070, in 11 and 13 months; 1 small dredge, $145,651, in 11 months. Great Lakes Engineering Wks., Detroit, Mich.—*a*, $323,000, in 12 and 13 months; 1 large dredge, $164,000; *b*, $284,000, in 11 and 12 months; 1 small dredge, $143,000. Susquehanna Boat Wks., Havre de Grace, Md.—*a*, $365,000, in 15 months; 1 large dredge, $183,000, in 12 months; *b*, $335,000, in 15 months; 1 small dredge, $168,000, in 12 months. The Bucyrus Co., of South Milwaukee, Wis., place of delivery, Richmond, Va.—*b*, $338,500, in 12 months; 1 small dredge, $169,250, in 12 months. Geo. A. Gilchrist, Belfast, Me., place of delivery, Portland or Bath—*a*, $300,000, in 15 months; 1 small dredge, $151,000, in 12 months.

Charleston, S. C.—Bids are wanted Jan. 17 for constructing a pile and timber wharf, with appurtenances, at the Navy Yard, Charleston. Appropriation, $33,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Detroit, Mich.—Capt. Lansing H. Beach, Corps of Engineers, U. S. A., writes that the following bids were opened Dec. 12 for dredging—*a*, Cheboygan Harbor, Mich.; *b*, Rouge River, Mich.; *c*, Saginaw River in Bay County; *d*, Saginaw River in Saginaw County; *e*, Saginaw River Bar at mouth; *f*, Clinton River, Mich.; *g*, Monroe Harbor, Mich.: Edward Bros., S. Ste. Marie, Mich., *a*, 24 cts. Detroit Dredging Co., Detroit, Mich., *b*, 12 cts.; *f*, 14 cts. G. H. Breymann & Bros., Toledo, O., *b*, 11 cts.; *c*, 16 cts.; *d*, 21 cts.; *e*, 20 cts.; *g*, 25 cts. Rogers & O'Brien, Buffalo, N. Y., *c*, 33 cts.; *d*, 34 cts.; *e*, 26 cts.; Jas. Davidson, Bay City, Mich., *c*, 20 cts.; *d*, 20 cts.; *e*, 45 cts.

Wheeling, W. Va.—The following bids were opened Dec. 12 by Capt. W. E. Craighill, Corps of Engineers, U. S. A., for furnishing navigation pass trestles for Dam No. 5, Kanawha River; trestles complete 45,000 lbs.; Chas. Hegewald Co., New Albany, Ind., 6.999c. per lb., $3,149 total; Ellicott Machine Co., Baltimore, Md., 8.45c., $3,802; New Jersey Fdy. & Machine Co., New York, 8.47c., $3,811; Gorham D. Williams, Charleston, W. Va., 7.2c., $3,240; the Gallipolis Fdy. & Machine Co., Gallipolis, O., 7.5c., $3,375; B. Wallis & Co., Baltimore, Md., 6½c., $2,925.

Duluth, Minn.—The following bids were opened Dec. 15 by Capt. D. D. Gaillard, Corps of Engrs., U. S. A., for 65,000 bbls. of Portland cement; amount proposed to be expended for this work, $115,050—*a*, per bbl., if delivered in bbls.; *b*, per bbl., if delivered in sacks, 4 sacks to a bbl.; *c*, for return of empty sacks, each; *d*, total for bbls.; *e*, total for sacks (net): Martins Creek Portland Cement Co., Easton, Pa., *a*, $2.20; *b*, $2.35; *c*, 10 cts.; *d*, $143,000; *e*, $126,750. Illinois Steel Co., Chicago, Ill., *b*, $2.17; *c*, 10 cts.; *e*, $115,050. The Northwestern Lime Co., St. Paul, Minn. (Atlas brand), *a*, $2.22½; *b*, $2.32½; *c*, 10 cts.; *d*, $144,625; *e*, $125,125. The Kelley Island Lime & Transport Co., Cleveland, O. (Lehigh brand), *a*, $2.41; *b*, $2.55; *c*, 10 cts.; *d*, $156,650; *e*, $139,750. The Alpena Portland Cement Co., Alpena, Mich., *a*, $2.35; *b*, $2.45; *c*, 10 cts.; *d*, $152,750; *e*, $133,250.

Superior, Wis.—Bids are wanted Jan. 14 for furnishing and driving 819 bearing piles for new Wisconsin entrance piers, Superior. Address Capt. D. D. Gaillard, Corps Engrs., U. S. A., Duluth, Minn.

Duluth, Minn.—Bids are wanted at the U. S. Engineer Office until Jan. 15 for building pier extension and additional superstructure at Grand Marais, Mich., as advertised in The Engineering Record.

Mobile, Ala.—Bids are wanted Jan. 12 for furnishing material and constructing Oyster Bayou light station, La. Lieut. Col. A. N. Damrell, Corps Engrs., U. S. A., Mobile.

New Orleans, La.—Bids are wanted Jan. 10 for a temporary water system and electric lighting plant at the Naval Station, New Orleans. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Riley, Kan.—Capt. G. O. Cress, Q. M., writes that all bids opened Nov. 25 for the construction of 2 double sets of Non-Com. Staff Quarters have been rejected.

Memphis, Tenn.—Bids are wanted at the U. S. Engineer Office until Jan. 14 for the construction of steel hull towboat and furnishing outfit for same, for use in 3d Dist., Improving Mississippi River, as advertised in The Engineering Record.

Jackson, Miss.—Bids are wanted Jan. 2 for completing the approaches, etc., at the U. S. Post Office and Court House, at Jackson. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

South McAlester, Ind. Ter.—Press reports state that the Dept. of Justice is receiving bids for building 4 stone and brick federal jails, fitted with steel cells, bath rooms, heating and lighting apparatus, etc., in the territory, at South McAlester, Vinita, Muskogee and Ardmore. The 4, it is stated, are to cost $100,000, inclusive of the sites, and to be completed within 10 months from date of contract.

Chattanooga, Tenn.—The Secy. of the Treasury has recommended to be set aside $350,000 for improvements upon the Tennessee River. This makes a total of $550,000 that will be immediately available for the work upon Colbert and Bee Tree shoals canal.

Ft. Assinniboine, Mont.—Post Q. M. McDonald, of the 3d U. S. Cavalry, at Ft. Assinniboine, is reported to have received plans from the War Dept. for a sewer system for the Post, 4 new 2-story brick barrack buildings and a hot water heating plant for the officers' quarters. Amount allowed, $75,000.

Hot Springs, S. D.—The Bd. of Managers of the National Home for Disabled Vol. Soldiers has approved preliminary plans prepared by Thos. R. Kimball, of Omaha, Neb., for the sanitarium at Hot Springs and a resolution has been adopted asking Congress to appropriate $200,000 in addition to the $250,000 already appropriated for the completion of the sanitarium.

Denver, Colo.—The Flour City Ornamental Iron Wks. are reported to have received the contract for the ornamental iron for the U. S. Mint at Denver, for $31,000.

Ft. Meade, S. D.—The lowest bids for plumbing and heating in the new double barracks at Ft. Meade are stated to have been from J. P. Adamson, of St. Paul, at $6,970 for plumbing, and from Saxton & Philips, of Minneapolis, at $5,490 for steam heating.

Ft. Townsend, Wash.—Bids will be received by the Quartermaster until Jan. 6 for construction, including plumbing, electric wiring and heating several buildings at this post.

Ft. Lincoln, N. D.—The contract for constructing new buildings at this fort has been awarded to P. M. Hennessy, of Minneapolis, as follows: Captain's quarters, $20,817; lieutenant's quarters, $13,182; barrack building, $28,067; guard house, $11,350; bakery, $4,603; hospital steward's quarters, $4,166.

Los Angeles, Cal.—Bids will be received until Jan. 15 (readvertisement) for completing jetty at San Diego Harbor, Cal. Capt. Edgar Jadwin, Corps Engrs., U. S. A.

Chemawa, Ore.—Bids are wanted Jan. 15 for furnishing material and constructing a brick dormitory with plumbing, steam heat and electric light at the Salem School, Chemawa. W. A. Jones, Comr. of Indian Affairs, Dept. of the Interior, Washington, D. C.

Portland, Ore.—Bids will be received until Jan. 9 for erecting Brown's Point Light Station, Wash. Capt. W. C. Langfitt, Corps Engrs., U. S. A., Engr. 13th Light House Dist., Portland.

Haines, Alaska.—Bids will be received until Dec. 31 for constructing a wharf, approach, warehouse, etc., at the new Army Post on Portage Cove, Haines. Address Capt. W. P. Richardson, Constructing Q. M., Skagway, Alaska.

Cavite, P. I.—Bids will be received by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Mar. 14 for constructing a steel floating dry dock for the naval station at Cavite.

MISCELLANEOUS.

Providence, R. I.—Bids are wanted Dec. 23 for furnishing and delivering on the City Dock the cement needed by the city for its sewer, water, highway and bridge departments during the year of 1903, not to exceed 5,000 bbls. of Portland cement and 7,000 bbls. of natural cement. Robt. E. Smith, Comr. Pub. Wks.

The City Council has passed a resolution appropriating $5,000 for the improvement and development of Slater Memorial Park.

Boston, Mass.—Bids will be received until Jan. 1 by the Boston Transit Comn. for constructing a portion of the East Boston tunnel at the head of State St., and for making alterations in the Old State House. Howard A. Carson, Ch. Engr.

New York, N. Y.—Bids are wanted Dec. 23 for furnishing material and removing the 2 existing piers, and building a new wooden pier, with appurtenances, at ft. of E. 86th St., East River (not 68th St., as previously stated). McDougall Hawkes, Comr. of Docks.

Medina, N. Y.—A. L. Swett, Pres., writes that the A. L. Swett Iron Wks. propose to construct a dam near this village. Probable cost, $200,000. Engr. in Charge, W. A. Brackenridge.

Jersey City, N. J.—The Pennsylvania R. R. has been granted permission by the building inspector to erect a new pier at the foot of Grand St., a steel superstructure, covered with corrugated galvanized iron, to cost $45,000

Camden, N. J.—The New York Shipbuilding Co. is said to have under consideration the building of a $2,000,000 floating dry dock at its plant in Camden.

Brooklyn, N. Y.—Bids are wanted Dec. 24 for furnishing and erecting wrought iron picket fence along shore road and iron gates in New Lots and Linton Parks, for furnishing and delivering 6,600 cu. yds. of Hudson River road gravel in parks and parkways as required, for furnishing and delivering 6,000 cu. yds. of crushed trap rock and 3,000 cu. yds. of trap rock screenings on parkways, all in the Boro. of Brooklyn, for furnishing and delivering 7,550 cu. yds. of blue limestone and 6,700 cu. yds. of blue limestone screenings on parks and parkways in the Boros. of Brooklyn and Queens. Wm. R. Willcox, Chmn. Park Comrs., N. Y. City.

Bids are wanted Dec. 24 (readvertisement) for furnishing material and dredging Gowanus Canal, Wallabout Canal, East River, ft. of Division Ave. and Newtown Creek, ft. of Metropolitan Ave. Engineer's estimate of the quantity of material to be dredged is as follows (cu. yds., scow measurement): Gowanus Canal, 25,000; Wallabout Canal, 11,000; East River, 4,000; and Newtown Creek, 2,000. J. Edw. Swanstrom, Boro. Pres.

Savannah, Ga.—Local press reports state that the dry dock which the Savannah Dry Dock & Shipbuilding Co. proposes to build here will cost about $600,000.

Cleveland, O.—Press reports state that plans have been completed to enlarge the dock of the American Shipbuilding Co. at Cleveland, which is now 320 ft. long and 50 ft. wide, and make it 520 ft. long and 60 ft. wide.

Cincinnati, O.—The State Bd. of Pub. Wks., Columbus, on Dec. 9 opened bids for the contract of continuing the work of building retaining walls in the canal in and near Cincinnati, for which $61,000 has been appropriated by the Legislature. The lowest bid, which was from F. H. Kirchner & Co., of Cincinnati, is said to have been as follows: With water in canal, 30 cts. for excavation masonry, $5.50 and $7.50 for No. 1 and No. 2; concrete foundation, $3; concrete wall, $7.50, and slightly lower with water drained from canal.

Sandy Cove, N. S.—Bids are wanted Jan. 2 for constructing a public breakwater at Sandy Cove. C. E. W. Dodwell, Res. Engr., Halifax, N. S.; Fred. Gelinas, Secy., Dept. of Pub. Wks., Ottawa, Ont.

NEW INDUSTRIAL PLANTS.

The Mix & Riddell Hardware Mfg. Co., Stamford, Conn., will erect a 205x40-ft. factory, with a 100x40-ft. ell, both having three stories. The power plant will include 200 H.-P. in boilers and a 125-H.-P. engine.

The Nairn Linoleum Co., Kearney, N. J., will build a $50,000 addition to its works. Chas. P. Baldwin, 22 Clinton St., Newark, N. J., Archt.

The Portsmouth, O., Street Railway & Electric Light Co. will erect a new power house, to cost $150,000. Contracts for the electrical machinery and steam turbines have been let. Boilers, condensers and buildings are still to be contracted for. S. P. Baird, Engr. in Charge.

The Pacific Smelting Co., First National Bank Bldg., Bakersfield, Cal., will erect a 100-ton smelter, to be increased later to 500 tons. Oil fuel will be used.

The Reade Machinery Co., 410 American Trust Bldg., Cleveland, O., will erect a machine shop to be about 100x200 ft., and expects to go into the business of building light locomotives and repairing and rebuilding locomotives, railway and contractors' equipment, power plants and heavy machinery, in addition to the building of heavy punches and shears.

The Mesta Machine Co., Lewis Block, Pittsburg, has bought about 10 acres adjoining its present plant, which it expects to double. Plans have not yet been prepared.

J. E. Lonergan & Co., 211-213 Race St., Philadelphia, brass founders and finishers, have plans and estimates (which they regard as excessive) for a 5-story, 220x45½-ft. building. If it is decided to go on with the building, an engine of about 100 H.-P., 150 H.-P. in boilers, an electric light plant and electric motors will be required.

Alfred Wilson, Motley, Minn., is in the market for second-hand woodworking machinery. Power plant has been bought.

Pitts Bros., Hazlehurst, Miss., will install a 20-ton ice plant to be ready April 1.

The Ore Reduction & Smelting Co. of St. Louis, 309 Equitable Bldg., St. Louis, will erect an ore reduction plant in the vicinity of St. Louis, but the location has not been positively decided.

The Colorado Foundry Co., Pueblo, Col., has been organized with a capital of $25,000 for manufacturing gray and malleable iron castings. The 50x150-ft. foundry building is erected, and there will be machine shops of the same size, equipped with electric motors driven from long distance power. Hot-air furnaces of a new type, designed by the company's engineers, will be used in the foundry. O. P. Sells is interested.

The Bloch Brothers' Tobacco Co., Wheeling, W. Va., expects to erect an 8-story, 100x150-ft. building. The power plant will consist of two 150-H.-P. boilers and a 150-H.-P. gas engine and generator. Electrical transmission of power will be used.

The Manitoba Cement Co., Winnipeg, Man., has been incorporated with a capital of $1,000,000, and proposes to erect a plant to have a daily capacity of 1,000 bbls. The buildings will be fireproof, constructed of brick, cement and steel, and the plant will be electrically driven, direct current being used. The officers of the company are: Pres., Justus Chancellor; Vice-Pres., Wm. Whyte; Treas., Wm. Blackwood; Secy. & Mgr., J. A. Hunter.

The J. H. Horne & Sons Co., Lawrence, Mass., maker of paper mill machinery, contemplates erecting a 100x70-ft. addition to its foundry.

The Washington Pipe & Foundry Co., Tacoma, Wash., has purchased the plant of the Soderberg Pipe Co., and is remodeling it and installing new machinery for manufacturing pipe. The company is also about to install a foundry for making hydrants, gate valves and water-works fittings. A pipe factory is being erected at Spokane. The power is electrical.

BUSINESS NOTES.

The Ward-Corby Co., a branch of the Ward-Mackey Co., which operates large bakeries in Pittsburg, is erecting new bread and cracker bakeries in Chicago and Providence, each of which is to be supplied with 150-H.-P. boilers by the Pittsburg Gage & Supply Co. This company is also supplying the Pittsburg Tool & Drop Forge Co., Cheswick, Pa., with a 150-H.-P. water-tube boiler and the Windsor Hotel, Wheeling, W. Va., with a 65-H.-P. water-tube boiler.

The Wm. B. Scaife & Sons Co., Pittsburg, reports the following among recent orders for Scaife and We-Fu-Go water softening and purifying plants: Salem Iron Co., Leetonia, O., 2,500 H.-P.; Rochester & Pittsburg Coal & Iron Co., Dubois, Pa., 2,500 H.-P.; Toledo, O., Furnace Co., 4,000 H.-P.; Edward E. Rieck Co., Pittsburg, Pa., 500 H.-P.

The Ball Engine Co., Erie, Pa., reports the following among recent engine sales: McPherson, Kan., Water & Electric Works, 125 H.-P.; United States Coal Co., Dillonville, O., two 300 H.-P.

The Western Electric Co. reports gratifying results from its constant potential alternating arc lamps, which operate on the repulsion principle.

The American Blower Co., of Detroit, Mich., is building heating apparatus for the Iron City Sanitary Mfg. Co., Zelienople, Pa.; Enterprise Mfg. Co., Columbiana, O.; B. F. Lee Co., Braddock, Pa.; Monongahela, Pa., Forge & Furnace Co.; New York Glucose Co., Edgewater, N. J., and the Michigan Malleable Iron Co., Detroit.

The Otis Elevator Company's recent contracts include the following: Ten hydraulic passenger elevators for the extension of the Manhattan Life Insurance Company's building, 64-70 Broadway; eight hydraulic passenger and two hydraulic freight elevators for the Barclay Bldg., Broadway and Duane St., and four hydraulic passenger elevators for the store of Frederick Loeser & Co., Brooklyn.

Descriptive catalogues for filing, reference, and specification purposes are asked for by George Welsby Scott, consulting engineer, 758 The Rookery, Chicago, Ill.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Dec. 22.	Lining tunnel, Paterson, N. J.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	
Dec. 22.	Marieville, Que.	Dec. 13
Dec. 24.	Chicago, Ill.	Dec. 13
Dec. 26.	Salt Lake City, Utah	Dec. 13
Dec. 27.	Cincinnati, O.	Dec. 6
Dec. 27.	Meters, Cleveland, O.	Dec. 6
	Adv., Eng. Record, Dec. 6 to 20.	
Dec. 29.	Kansas City, Mo.	Dec. 20
Dec. 29.	Gillett, Wis.	Nov. 15
Dec. 30.	Brooklyn, N. Y.	Dec. 20
Dec. 30.	New York, N. Y.	Dec. 20
Dec. 30.	Long Island City, N. Y.	Dec. 20
Dec. 30.	Searcy, Ark.	Dec. 20
Jan. 1.	El Reno, Okla. Ter.	Dec. 20
Jan. 1.	Sacramento, Cal.	Nov. 22
Jan. 2.	Kansas City, Mo.	Dec. 6
	Adv., Eng. Record, Dec. 6 to 20.	
Jan. 3.	Pomona, Cal.	Dec. 20
Jan. 5.	South St. Paul, Minn.	Dec. 20
Jan. 6.	Ardmore, Ind. Ter.	Dec. 20
Jan. 7.	Centerville, Miss.	Dec. 20
Jan. 9.	Lakewood, O.	Dec. 20
Jan. 15.	St. Paul, Minn.	Dec. 20
———	Meters, Schenectady, N. Y.	Dec. 13

	SEWERAGE AND SEWAGE DISPOSAL.	
Dec. 23.	New York, N. Y.	Dec. 20
Dec. 23.	Toronto, Ont.	Dec. 20
Dec. 24.	Philadelphia, Pa.	Dec. 20
Dec. 26.	Providence, R. I.	Dec. 20
Dec. 26.	Chicago, Ill.	Dec. 20
Dec. 26.	Salt Lake City, Utah	Dec. 13
Dec. 27.	(Ft. McKinley) Portland, Me.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 20.	
Dec. 31.	Brooklyn, N. Y.	Dec. 20
Jan. 2.	Cincinnati, O.	Dec. 13
Jan. 3.	Pumping Station, Washington, D. C.	Nov. 15
	Adv., Eng. Record, Nov. 15, Dec. 6.	
Jan. 5.	Lawton, Okla. Ter.	Dec. 13
Jan. 7.	Fernandina, Fla.	Dec. 13
Jan. 6.	New Britain, Conn.	Dec. 20
	Adv. Eng. Record, Dec. 20.	
Jan. 6.	Columbus, O.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	
Jan. 8.	Cleveland, O.	Dec. 20
Jan. 9.	Lakewood, O.	Dec. 20
Jan. 16.	Clay Center, Kan.	Dec. 20
Jan. —	Walnut, Ill.	Dec. 13
Feb. 2.	New Orleans, La.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 20.	
Feb. —	Dixon, Ill.	Dec. 13

	BRIDGES.	
Dec. 30.	Huntington, Ind.	Dec. 20
Dec. 30.	Georgetown, Colo.	Nov. 29
Dec. 31.	Terre Haute, Ind.	Dec. 13
Jan. 1.	Rome, N. Y.	Dec. 13
Jan. 5.	Montezuma, Ia.	Dec. 6
Jan. 5.	Cumberland, Md.	Nov. 29
Jan. 6.	Stockton, Cal.	Dec. 13
Jan. 6.	Grand Junction, Colo.	Dec. 13
Jan. 7.	Olivet, S. D.	Dec. 13
Jan. 7.	Colfax, Wash.	Dec. 13
Jan. 7.	Webster, S. D.	Nov. 29
Jan. 12.	Scranton, Pa.	Dec. 20
Jan. 12.	Tacoma, Wash.	Dec. 20
Jan. —	Peoria, Ill.	Dec. 13

	PAVING AND ROADMAKING.	
Dec. 22.	Portsmouth, Va.	Oct. 18
	Adv., Eng. Record, Oct. 18, 25.	
Dec. 23.	New York, N. Y.	Dec. 20
Dec. 23.	Cleveland, O.	Dec. 20
Dec. 23.	Allegheny, Pa.	Dec. 20
Dec. 24.	Brooklyn, N. Y.	Dec. 13
Dec. 26.	Salt Lake City, Utah	Dec. 13
Dec. 27.	Buffalo, N. Y.	Dec. 20
Dec. 27.	Akron, O.	Dec. 20
Dec. 27.	Wellsville, O.	Dec. 13
Dec. 27.	Kalamazoo, Mich.	Dec. 6
	Adv., Eng. Record, Dec. 6 to 20.	
Dec. 29.	Terre Haute, Ind.	Dec. 13
Dec. 30.	St. Louis, Mo.	Dec. 20
Dec. 30.	St. Augustine, Fla.	Dec. 6
Jan. 3.	Madison, Wis.	Dec. 13
Jan. 5.	Toledo, O.	Dec. 13
Jan. 6.	Cleveland, O.	Dec. 20
Jan. 6.	Cincinnati, O.	Dec. 13
Jan. 10.	Ft. Myer, Va.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	

	POWER, GAS AND ELECTRICITY.	
Dec. 23.	Lexington, Ky.	Dec. 13
Dec. 23.	Cleveland, O.	Dec. 13
Dec. 26.	Cooperstown, N. Y.	Dec. 20
Dec. 27.	Cincinnati, O.	Dec. 6
Dec. 30.	Searcy, Ark.	Dec. 20
Jan. 1.	Effingham, Ill.	Dec. 20
Jan. 3.	Abilene, Tex.	Dec. 13
Jan. 5.	Winona, Minn.	Dec. 20
	Adv. Eng. Record, Dec. 20.	
Jan. 12.	Hot Springs, Ark.	Dec. 13
Jan. 15.	Rome, Ga.	Oct. 11
Jan. —	South Norwalk, Conn.	Dec. 13
Feb. 12.	Guayaquil, Ecuador	Dec. 20
Mar. 4.	Franchise, Manila, P. I.	Nov. 15

	GOVERNMENT WORK.	
Dec. 22.	Savannah, Ga.	Nov. 22
	Adv., Eng. Record, Nov. 22, 29, Dec. 20.	
Dec. 23.	Ft. Barrancas, Fla.	Dec. 6
Dec. 23.	Garbage crematory, Ft. Getty, S. C.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 20.	
Dec. 23.	(Ft. Rodman) Newport, R. I.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 20.	
Dec. 23.	Mobile, Ala.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 20.	
Dec. 24.	Ft. Brady, Mich.	Dec. 6
Dec. 26.	Ft. Williams, Me.	Dec. 6
Dec. 26.	Dredging, Savannah, Ga.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 20.	
Dec. 27.	Portsmouth, N. H.	Nov. 29
Dec. 27.	Sewers (Ft. McKinley), Portland, Me.	Nov. 29
Dec. 28.	New Orleans, La.	Dec. 6
Dec. 29.	Mobile, Ala.	Dec. 6
	Adv., Eng. Record, Dec. 6 to 20.	
Dec. 29.	Ft. Banks, Mass.	Dec. 6
Dec. 30.	Annapolis, Md.	Dec. 20
Dec. 31.	Haines, Alaska	Dec. 20
Dec. 31.	Ft. Terry, N. Y.	Dec. 20
Jan. 2.	Jackson, Miss.	Dec. 20
Jan. 2.	Boston, Mass.	Dec. 6
Jan. 3.	Richmond, Va.	Dec. 6
	Adv., Eng. Record, Dec. 6 to 20.	
Jan. 3.	Elevator, Helena, Mont.	Dec. 6
Jan. 3.	Wall, Philadelphia, Pa.	Dec. 6
Jan. 5.	Ft. Screven, Tybee Is., Ga.	Dec. 20
Jan. 5.	Boston, Mass.	Dec. 6
Jan. 6.	Ft. Townsend, Wash.	Dec. 20
Jan. 6.	St. Louis, Mo.	Dec. 6
Jan. 7.	Newport, R. I.	Dec. 20
Jan. 7.	Hospital (Ft. Greble), Newport R. I.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	
Jan. 8.	Mobile, Ala.	Dec. 6
Jan. 9.	Plattsburg Barracks, N. Y.	Dec. 20
Jan. 9.	Portland, Ore.	Dec. 20
Jan. 10.	New Orleans, La.	Dec. 20
Jan. 10.	New York, N. Y.	Dec. 20
Jan. 12.	Mobile, Ala.	Dec. 20
Jan. 12.	Washington, D. C.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	
Jan. 13.	Superior, Wis.	Dec. 20
Jan. 14.	Steel towboat, Memphis, Tenn.	Dec. 20
	Adv. Eng. Record, Dec. 20.	
Jan. 14.	Helena, Mont.	Dec. 6
	Adv., Eng Record, Dec. 6, 13.	
Jan. 15.	Los Angeles, Cal.	Dec. 20
Jan. 15.	Chemawa, Ore.	Dec. 20
Jan. 15.	Newport, R. I.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	
Jan. 15.	Norfolk, Neb.	Dec. 6
Jan. 15.	Machinery for dredge, Wash'ngton, D.C.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13.	
Jan. 17.	Charleston, S. C.	Dec. 20
Jan. 17.	Bldg., Philadelphia, Pa.	Dec. 20
Jan. 20.	Duluth, Minn.	Dec. 20
	Adv. Eng. Record, Dec. 20.	
Jan. 22.	Dredging, Boston, Mass.	Dec. 20
	Adv. Eng. Record, Dec. 20.	
Feb. 7.	Dry dock, Philadelphia, Pa.	Dec. 20
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20

	BUILDINGS.	
Dec. 24.	School, Brooklyn, N. Y.	Dec. 20
Dec. 24.	Pub. bldg., Brooklyn, N. Y.	Dec. 13
Dec. 24.	School, Albany, N. Y.	Nov. 29
Dec. 26.	Pub. bldg., Canton, O.	Dec. 13
Dec. 27.	Library, Melrose, Mass.	Dec. 20
Dec. 27.	Pub. bldg., Canton, O.	Dec. 13
Dec. 27.	Library, Port Huron, Mich.	Nov. 29
Dec. 29.	School, New York, N. Y.	Dec. 20
Dec. 29.	School, Brooklyn, N. Y.	Dec. 20
Dec. 29.	Htg. school, Long Island City, N. Y.	Dec. 20
Dec. 29.	Jail, Marion, Ind.	Dec. 6
Dec. 30.	School, St. Henry, O.	Dec. 20
Dec. 30.	School, Ft. Wadsworth, N. Y.	Dec. 20
Dec. 30.	School, Brooklyn, N. Y.	Dec. 20
Dec. 30.	Wiring school, Long Is. City, N. Y.	Dec. 20
Dec. 30.	Htg. pub. bldg., Victoria, B. C.	Dec. 20
Dec. 30.	Mason temple plans, Washington, D.C.	Oct. 11
Dec. 31.	Pub. bldg. plans, Camden, N. J.	Dec. 20
Dec. 31.	Church, Huntington, Ind.	Dec. 13
Jan. 1.	Schools, Huntington, W. Va.	Dec. 13
Jan. 2.	Bus. bldg., St. Marys, O.	Dec. 20
Jan. 7.	Jail, Morristown, Tenn.	Dec. 6
Jan. 12.	School, Columbus, O.	Dec. 20
Jan. 12.	Church, Chepstow, Ont.	Dec. 13
Jan. 14.	Court House, Hichman, Ky.	Dec. 20
Jan. 15.	School plans, Beaumont, Tex.	Dec. 20
Jan. 15.	Library, Winnipeg, Man.	Dec. 13
Jan. 15.	Library plans, Binghamton, N. Y.	Nov. 15
Jan. 20.	Bus. bldg, Flint, Mich.	Dec. 20
Jan. 23.	Jail, Grand Junction, Colo.	Dec. 13
Jan. 30.	School, Geneseo, N. Y.	Dec. 13
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Feb. 1.	School, Dickinson, N. Y.	Dec. 6
Feb. 2.	City Hall, Houston, Tex.	Dec. 13
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20

	MISCELLANEOUS.	
Dec. 23.	Piers, New York, N. Y.	Dec. 20
Dec. 23.	Cement, Providence, R. I.	Dec. 20
Dec. 24.	Dredging, Brooklyn, N. Y.	Dec. 20
Dec. 24.	Sand, Brooklyn, N. Y.	Dec. 20
Dec. 24.	Garb. crematory, Ft. Brady, Mich.	Dec. 13
Dec. 26.	Wharf, St. Irenee, Que.	Dec. 13
Jan. 1.	Boston, Mass.	Dec. 20
Jan. 2.	Breakwater, Sandy Cove, N. S.	Dec. 20
Jan. 2.	El. R. R. Franchise, Vallejo, Cal.	Nov. 22
Jan. 8.	El. ry. franchise, Oroville, Cal.	Dec. 20
Jan. 14.	Dredging, Chicago, Ill.	Nov. 22
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
———	R. R. work, Cincinnati, O.	Dec. 20

THE ENGINEERING RECORD.

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The Lake Ontario Route for the Barge Canal.

The agitation for the improvement of the Erie Canal has passed through many stages until it is proposed to make the new prism seventy-five feet wide on the bottom with water deep enough to float a barge one hundred and fifty feet long, twenty-five feet wide and drawing ten feet, which means a depth of water of twelve feet. While there are strong advocates of a ship canal between Buffalo and tide-water at New York City, it is generally conceded that the most judicious plan of improvement is that which contemplates the barge canal, the barges to have a carrying capacity of about one thousand tons. The dimensions of the prism have been reached after no little consideration and much argument. The settlement of questions relating to the size of the prism, however, does not mean the solution of the problem.

The Erie Canal is a true canal from Buffalo to Troy. While it parallels Lake Ontario it lies wholly within the land of the State. It was originally intended not only for the transportation of merchandise from Buffalo to the Hudson River, but also for such shipment of freight as might be demanded by the development of the cities and towns along its line. Its influence on the growth of these cities and towns and the development of land values from one extremity of it to the other is so clear that no doubt whatever attaches to that feature of its history. If a portion of its line, from Olcott, for instance, to Oswego, a distance of one hundred and twelve miles, had been laid in Lake Ontario, ignoring for the moment the effect of storms, it is absolutely certain that the interior development of the State would have been long deferred, and the general prosperity seriously checked. No such installment of the canal could, of course, have been considered for a moment when the canal enterprise first took effective shape.

The conditions bearing upon the improvement of the canal are obviously vastly different at the present time from those attending the original construction, yet it is well to give careful consideration to the proposed Lake Ontario route from the same points of view that would have been taken in the earlier construction. The proposition to run the line of the improved or barge canal from Troy to Oswego, then through Lake Ontario to Olcott or even to some point in Niagara River has been thoroughly canvassed by every engineer and every competent body of men who have had before them the problem of determining the best route. During 1900, when routes and other features of the improved waterway were being so carefully studied by the State engineer and by the consulting engineers and the advisory board, this line received serious attention and its advantages and disadvantages were fully recognized. Obviously it saves considerable cost of construction inasmuch as for a distance of about one hundred and twelve miles the open water of Lake Ontario is available. This is so attractive a feature that Governor Odell has given it his approval, and is apparently prepared to use his official influence for its adoption. Its attractiveness, however, is not without an accompaniment of material disadvantage even as a canal route aside from any other consideration. The waters of Lake Ontario are not always smooth. It is a lake of many storms and of sufficient roughness to endanger the safety of small vessels. It is true that it is not the Atlantic Ocean, but it is equally true that for a considerable portion of the open season it could not be navigated by such barges as could be used to advantage on an improved canal whose line would lie approximately along the present Erie Canal route. If barges are to be constructed of sufficient strength to make lake navigation safe their cost will be greatly enhanced and the dead weight of the boats will be so increased as to trench seriously upon their carrying capacity. In other words, the cost of construction will be greatly augmented and their carrying capacity decreased. Both of these elements will add materially to the cost of transportation. Again, barges will necessarily be towed in fleets of probably four or five. Under such circumstances, being without their own power, they must keep in protected harbors during storms. All these disadvantages would be heavy handicaps, and would make the transportation both costly and intermittent. The project of the improved waterway, whatever its route may be, must be submitted to the citizens of the State for their approval or disapproval in the election prescribed by the State Constitution. This feature of the subject is political and not engineering, and yet it is a feature of gravity, and one that must not be ignored. From Syracuse to Lockport the cities and towns otherwise benefited by location upon the improved waterway would be entirely avoided by the lake route, receiving practically no benefit from the enlarged canal. It does not require a very astute politician to determine in advance what sort of an expression would be given by the people thus affected. It may be stated with considerable reason that the main object of the canal would be the transportation of through freight, yet it is a fact now as it was eighty years ago that the interior cities and towns and the country adjoining the line will be materially benefited by the construction of the barge canal in consequence of local transportation facilities as well as the indirect advantageous effects of a current of traffic passing to and fro through their midst. While the State would be saved the sum perhaps of $20,000,000 in construction, in the eyes of the people immediately affected at least, it would lose far more by depriving so large a portion of its industrious population of the benefits of the improved canal.

Even this, however, is not all, as was clearly recognized by the advisory board of engineers acting during the year 1900, when the whole subject was receiving such careful investigation. If canal traffic between Buffalo and the Hudson River requires the construction of boats for its accommodation sufficiently seaworthy to navigate the waters of Lake Ontario there is little or no reason why they should not carry grain and other freights intended for ocean steamships directly from Buffalo to Montreal or to Quebec. Our Canadian neighbors are alert enough to discover and appreciate the advantages of such shipment along by far the shortest line between the Great Lakes and the ports of Great Britain and Europe. The construction of the barge canal therefore on the Lake Ontario route would be a direct and material encouragement toward the shipping of through freights from the Great Lakes down the St. Lawrence to Atlantic steamers, taking cargo at Montreal and Quebec. This would mean the diversion of a large amount of ocean shipments from New York City, which is already suffering at least considerable relative diminution of that traffic. The saving of $20,000,000 expenditure to the State of New York is certainly a material item, and one that should not be hastily overlooked, but it is by no means impossible that if the avoidance of that expenditure is both to increase the cost of canal transportation between Buffalo and tide-water and decrease the capacity of the barge canal, as well as encourage the diversion of ocean shipments from the port of New York to Canadian ports, the expenditure of a far larger sum to produce opposite results would be the highest degree of economy for the State.

Limited Franchises.

That the reasonable control of valuable franchises dealing with at least one line of public service is being gained by one of our leading cities will be evident after reading the brief article printed elsewhere in this issue on Boston's underground railways. The contract entered into by the city, acting through the Boston Transit Commission, and the elevated railway company can hardly be considered an experiment, for it is not the first agreement of such nature made by the same parties. It is, rather, an evidence that the contract previously made for the use of the existing subways, which has now been in force for several years, is proving satisfactory to the citizens and is not intolerable to the railway corporation. By the method pursued, the city does not merely build its subways and tunnels and retain the ownership of them, which facts in themselves have certain distinct advantages, but it receives an annual income of 4½ per cent. on its investment, has some measure of control of the structure during use, and can, at the end of twenty-five years, readjust the terms of the lease or become possessed of the equipment and operate the system. In this way municipal control is made effective by actual municipal ownership and potential municipal operation. Such advantageous arrangements in connection with public utilities are possible largely because of an unusually intelligent and public-spirited interest in public affairs among a large proportion of the citizens. A wise and successful solution of public as well as of private problems can be attained only through painstaking and intelligent study by capable men. These duties now frequently fall to engineers acting as city engineers, members of public works commissions or as engineers to such commissions and departments, and require not alone good technical efficiency and wide experience, but in a high degree, a broad-minded view and strong grasp of facts relating to men and affairs. That the value of engineering training and experience in fitting men for such service is being recognized is made plain by recent appointments in more than one large city.

A New Dam and Storage Reservoir at Amsterdam, N. Y.

The Glenwild reservoir, completed during the past summer, forms a part of the water-works of the city of Amsterdam, N. Y. It is located on Steele Creek, about two miles above the Hans conduit diverting dam, from which the water passes to the city. The area of the watershed of Steele Creek above Glenwild reservoir is 4.54 square miles. The entire watershed of the creek is without human habitation. It is all a forest of second growth spruce and hemlock, with beech, birch, maple and poplar trees, and will probably always remain uninhabited, as the soil is a glacial drift of sand and boulders, and totally unfit for cultivation.

An old mill pond formed by a low timber dam formerly occupied the site of the reservoir, and after the old dam had been removed, it was necessary to clear off all the old timber, stumps and debris on the site of the old pond, which covered 78 acres. The remainder of the basin was cleared off to an average width of 75 feet beyond the flow line. All small trees and brush were required to be cut down level with the ground, and all large trees so that the stumps should not project more than a foot above ground. The total area of the new reservoir is 180 acres and its capacity 1,200,000,000 gallons.

Glenwild reservoir dam is curved, the length of the chord of dam being 408 feet, and the versed sine of curve 30 feet. The dam is 450 feet long over all including tangents and is 13 feet wide on top with rear slope 2½ to 1 and front slope 2 to 1. The water face of the dam is protected with stone pavement, hand laid, the stones being from 10 to 24 inches deep and averaging 18 inches thick. The top of the dam is 7 feet above flow line, allowing ample depth for wave action. The rear slope is seeded.

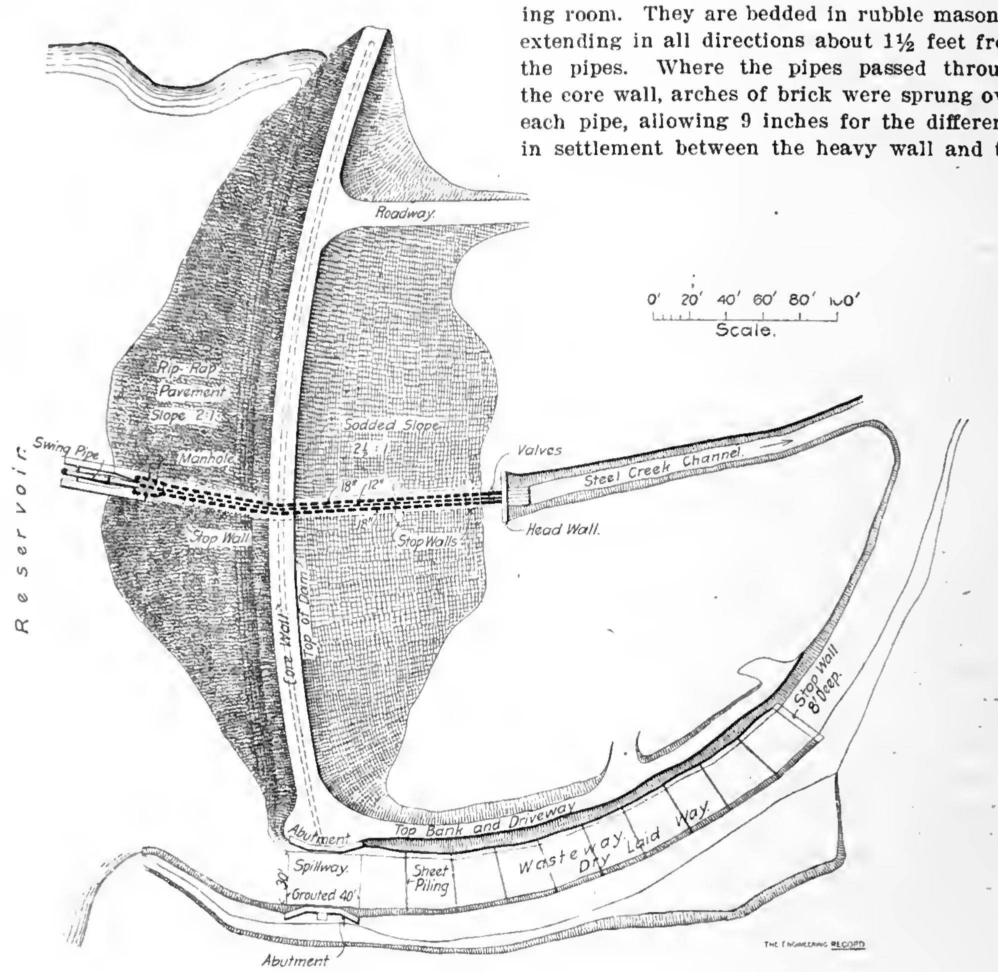
The spillway is 30 feet wide and 40 feet long, with the bottom paved with thin quarry stone set on edge and grouted. The wasteway, as well as the spillway, was formed by excavating back into the side hill, the material so excavated being used to make reservoir bank. The spillway has first-class rubble masonry abutments and wings coped with limestone. Beyond the spillway the channel, bottom and 4 feet up the sides, is dry paved with large stone averaging about 2 feet square on top face, and a line of sheet piling 4 feet deep was placed across the spillway channel and up the sides at every 25 feet, thus preventing any movement of the stone pavement. The lower end of the spillway channel is secured by a rubble wall in cement, 4 feet wide and extending down 8 feet below the pavement, the latter terminating at this wall.

It was impracticable to sink test pits at the old timber dam on account of its construction and the existence of the large amount of water there which could not be drawn off. It was assumed that rock bottom would be found at a depth of 5 to 6 feet below the level of the bottom of old timber dam or at least suitable hard bottom found, and the preliminary estimate upon which the contract was based was made upon this assumption. Such, however, proved not to be the case, but upon removing the old timber dam it was found to be bedded on rubbish and gravel and large fallen trees at least 10 feet below the base of the old dam were removed. Upon excavating for the masonry core wall down to the depth called for by the plans the bottom was found to be quick sand and entirely unsuitable to start the masonry from. The excavation was continued down some 22 feet, all through sand, until a stratum was found so compacted, as indicated by driving down a crowbar, as to be practically impervious to water, and the wall started on this bottom.

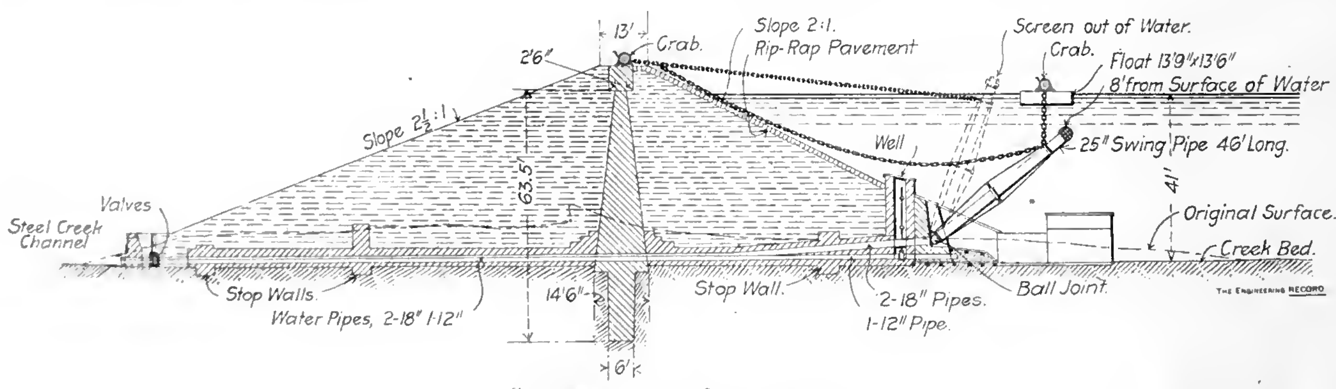
The cement masonry core wall starts 1 foot above the flow line and batters 3 inches to the foot down to a width of 14 feet 6 inches. Below this point it is 6 feet wide to the bottom. The wall is 63.5 feet high, and is composed of broken boulders, no stone exceeding ½ a cubic foot in size, all hand laid in place. The wall is grouted with a 1 to 3 mortar made of Glens Falls Portland cement. The grout was manipulated in small boxes holding only a wheelbarrow of mortar. The mortar box was dumped over the wall by two laborers, allowing all its contents to enter the wall at once. By this process the cement and sand have no time to separate, but are placed in the wall all thoroughly and properly mixed. The wall was grouted in 16-inch courses. At two places the wall was examined for depths of 4 and 6 feet, and in each case it was found all thoroughly filled and the mortar homogeneous.

Water is drawn from the reservoir by three lines of cast-iron pipe, two 18 and one 12-inch. These three pipes are laid side by side, with a space between of about 1½ feet to allow caulking room. They are bedded in rubble masonry, extending in all directions about 1½ feet from the pipes. Where the pipes passed through the core wall, arches of brick were sprung over each pipe, allowing 9 inches for the difference in settlement between the heavy wall and the masonry surrounding the pipes. Three 1½-inch wrought iron pipes were carried up in the center of the core wall to the top, and when the wall and embankment were completed and had reached their final settlement, grout was poured into the pipes and the arches below filled up solid.

The outlet pipes are continued on to the base of the front embankment and rip-rap wall, at which point a bulkhead and side walls are built. The lower or 12-inch pipe terminates at an elevation of 41 feet below the flow line. The reservoir may be drawn entirely dry with this pipe. At a distance of 36 feet back from the end of the 12-inch pipe the two 18-inch pipes rise on a steeper grade, so that at their ends the bottoms of the two 18-inch pipes are about 2



PLAN OF GLENWILD RESERVOIR DAM.



SECTION THROUGH OUTLET PIPES.

feet above the level of the top of the 12-inch pipe at its termination. The two 18-inch pipes terminate with two right angle bends facing one another. At this point a 25-inch steel riveted pipe begins, having a tee on its end which enters both 18-inch bends. This makes a swivel joint at the end of the 25-inch pipe. The swivel is made ball-bearing, by placing 56 brass balls in each bearing end of the 18-inch bends. The 25-inch pipe is then extended out into the reservoir 39 feet, and has a large ball screen on its end. A chain is attached to the outer end and toggled in at the center of a float 13x13 feet by 4 feet deep. The chain will usually be so toggled in the center of the float as to leave the outer end of the pipe suspended 8 feet below the surface of the water in the reservoir. As the water rises and falls in the reservoir the outer end of the pipe moves up and down a corresponding amount. The float is guyed by five wire cables securely fastened to anchors in boulders, out about 100 feet from the float. Provision is made for hoisting and lowering the 25-inch pipe by 10-ton crabs, one on the top of the dam and one on the float, a second chain cable being led up to the top of the bank. It is intended to lower the pipe in winter and rest it on a timber support near the bottom.

The valves which control the discharge of water are located at the lower end of reservoir embankment at the end of the sodded slope, discharging into the old channel of Steele Creek. The 12-inch pipe also has a valve located just back of its upper end with a well and valve rod carried up 20 feet above the bottom of the reservoir so that in case of repairs needed to the lower valve this upper one may be shut down when there is 20 feet of water in the reservoir. The end of the 25-inch pipe may also be swung up out of water to shut off flow through the two 18-inch pipes.

When the reservoir is drawn down and there is only sufficient water to cover the pipes, the two 18-inch pipes will discharge 15,000,000 gallons per day, while the 12-inch pipe will deliver 3,000,000 gallons. With the reservoir nearly full the three pipes will discharge upwards of 80 million gallons per day. Just below the dam a measuring weir with indicator arranged on a plank has been placed, so that the keeper can tell by inspection how much water is being delivered.

A dyke 460 feet long about half a mile from the dam was constructed across what was apparently an old lake outlet. The dyke is of varying height, from 3 to 15 feet. The top is placed 3 feet above the flow line of the reservoir. Should a cloudburst occur and be of such magnitude as to tax the capacity of the spillway at the dam then the dyke would act as a relief spillway 460 feet long after the water is 3 feet or thereabout above flow line. The dyke is 15 feet wide on top with side slopes of 2 to 1 on both sides. Through the center a double row of 2-inch sheet piling is carried from the top bank down 4 feet into the firm subsoil or hard pan formation. The dyke is in a cove and the wave action will be a minimum.

Upon filling the reservoir last spring, the cranberry bushes and logs, trees, stumps and debris rose up with the water and now constitute a series of floating islands out in the middle of the reservoir, and distant about 2,500 feet from the dam. The floating islands aggregate about 6 acres in area, and from soundings with a boat oar, are from 2 to 6 feet deep or thick. They seem to be composed of living cranberry bushes, held afloat by logs and old trees, and are anchored safely in place, probably by a number of old dead, but sound trees, the tops of which are tied in with cranberry bushes, the roots and stumps on the bottom making a safe anchorage. The early removal of these floating masses has been strongly recommended.

The Glenwild dam was designed by Mr. Stephen E. Babcock, of Utica, as consulting engineer, from whose report to the water commissioners of Amsterdam, the preceding account has been mainly taken. Mr. James R. Snell is superintendent of the Amsterdam waterworks. The work of construction was performed by Messrs. H. B. Hooker & Son, of Rochester, at a cost of $47,360. Including the cost of the land, clearing the site, etc., the total cost of the reservoir was about $65,000.

The Two-Hinged Arch.

By Edward Godfrey, 400 Monongahela Bank Building, Pittsburg, Pa.

A two-hinged arch is a trussed frame or a girder in the shape of an arch with two hinges or pins at the end supports or abutments. A difficulty in finding the stresses arises from the fact that the horizontal reaction depends upon the stiffness of the truss itself. The horizontal reaction may be supplied either by the abutments of the arch or by a tension member of steel forming a sort of bow-string for the arch. When the abutments supply this reaction, they

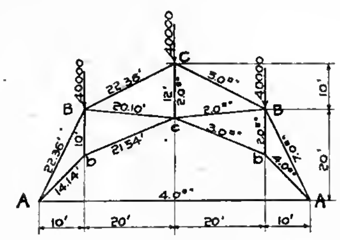


Fig. I

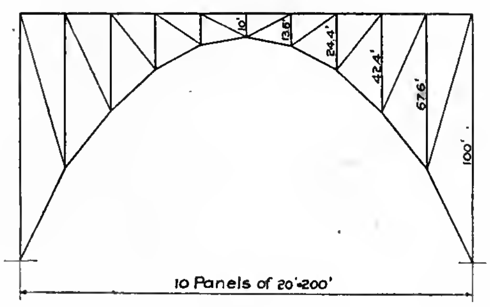


Fig. 2

must be assumed at an unvarying distance apart; that distance is the normal length of the unstressed arch at the temperature at which it was erected, or, say at a mean temperature. When a steel tie supplies the horizontal reaction, it will, if exposed to the same variation of temperature expand and contract with the arch itself; temperature stresses will then not enter into the computations. Cases may arise, however, where the tie is buried or protected from the sun's rays by the floor of a bridge, so that the difference of temperature of the arch and the tie may be considerable.

There are several methods given by various writers for finding the stresses in a two-hinged arch, all of which seem to be very tedious, difficult of application and practically impossible to retain in the memory. The writer proposes an analytic method which he believes renders the calculation simple and direct, and which is easily remembered, although, of necessity, the calculations are long.

The method is based on the "pull over E" formula, that is, the formula for finding deflections. Its application will be described first in finding the stresses in an arch assumed to be already proportioned. The formula referred to is:

$$D = \frac{\Sigma\, pul}{E}.$$

In this formula D is the deflection in inches of any point of a frame in any assumed direction, under any given condition of loading; p is the stress in any member of the frame due to a load of one pound applied at the point whose deflection is to be found, the load acting in the direction in which the deflection is to be computed; u is the unit stress, or stress per square inch, in the same member resulting from the given loading; l is the length of the member in inches; E is the modulus of elasticity of steel or 29,000,000 pounds per square inch. For each member in the frame the quantity pul over E must be found, and the algebraic sum of all will be the deflection sought; or the division by E may be made after the summation Σ pul has been found.

An example will best illustrate how this formula may be applied. Given the arch in Fig. 1, having areas and length as indicated and loaded as shown. Suppose the tie AA to be omitted, and we shall have a simple truss with stresses easy of computation by the ordinary analytic method. Under these stresses the points A and A will separate a certain amount, due to the deformation. The amount of this deformation, or the deflection at A may be found by the deflection formula. By applying a load of one pound horizontally at A and finding the resulting stresses in the various members, we shall have the values of p in the formula. The unit stresses resulting from the loads acting on the frame as a simple truss will give the values of u. The horizontal deflection at A is shown in table I to be 3.744 inches.

To bring the point A back to its original position, a force may be applied at A in a horizontal direction. The amount of the force thus applied necessary to move the point A 3.744 inches can be found in the following way: Assume a force of 1,000 pounds applied at A, and by the deflection formula find the resulting deflection. The values of p will be the same as before and those of u will be the unit stresses due to 1,000 times the p values for the various members. The deflection due to this force of 1,000 pounds is found by Table I to be .1015

TABLE I.

Stresses in Arch with Fixed Abutments. All Stresses, Except in Column 4, in Thousands of pounds.

Member.	Area.	Length in inches = l.	Stress due to 1-pound horizontal load at A, = p.	$1000 \times \frac{pl}{E}$	Stress due to vertical loads —simple truss.	Unit stress for vertical loads, equals u.	$\frac{pu}{E}$	Unit stress for 1,000 pounds at A, = u'.	$\frac{pu'}{E}$	Stresses due to 36,900 pounds at A.	Resultant stresses in members.
1	2	3	4	5	6	7	8	9	10	11	12
AB	7.0	268.3	+ 2.236	+ .0207	— 134.2	— 19.17	— .397	+ .319	— .0066	+ 82.5	— 51.7
BC	5.0	268.3	+ 1.677	+ .0155	— 93.2	— 18.64	— .289	+ .335	— .0052	+ 61.9	— 31.3
CB	5.0	268.3	+ 1.677	+ .0155	— 93.2	— 18.64	— .289	+ .335	— .0052	+ 61.9	— 31.3
BA	7.0	268.3	+ 2.236	+ .0207	— 134.2	— 19.17	— .397	+ .319	— .0066	+ 82.5	— 51.7
Ab	4.0	339.4	— 2.828	— .0331	+ 84.8	+ 21.20	— .702	— .707	— .0234	— 104.4	— 19.6
bc	3.0	258.5	— 2.154	— .0192	+ 64.6	+ 21.53	— .413	— .718	— .0138	— 79.5	— 14.9
cb	3.0	258.5	— 2.154	— .0192	+ 64.6	+ 21.53	— .413	— .718	— .0138	— 79.5	— 14.9
bA	4.0	339.4	— 8.828	— .0331	+ 84.8	+ 21.20	— .702	— .707	— .0234	— 104.4	— 19.6
Bb	2.0	120.0	— 1.200	+ .0050	+ 36.0	+ 18.00	— .089	— .600	— .0030	— 44.3	— 8.3
Bb	2.0	120.0	— 1.200	+ .0050	+ 36.0	+ 18.00	+ .089	— .600	— .0030	— 44.3	— 8.3
Cc	2.0	120.0	— 1.500	— .0062	+ 43.4	+ 21.70	+ .134	— .750	+ .0047	— 55.4	— 12.0
Bc	2.0	241.2	— 0.503	— .0042	+ 23.4	+ 11.70	— .049	— .251	— .0011	— 18.6	+ 4.8
cB	2.0	241.2	— 0.503	— .0042	+ 23.4	+ 11.70	— .049	— .251	— .0011	— 18.6	+ 4.8
Resultant deflections							3.744		.1015		

inch. Hence to restore the original distance between points A a horizontal force of

$$1000 \times \frac{3.744}{.1015} = 36900 \text{ pounds}$$

is necessary. This would be the horizontal reaction of this truss if the ends were fixed, as by stone abutments. The stresses in the member due to this horizontal reaction are found by setting on the slide rule the ratio 1:369000 and reading the amounts from column 4. The resultant stresses in the members are then found by combining the stresses in Columns 6 and 11.

If, as in the case under consideration, a tie AA is used, this tie will stretch out a certain amount, due to its own stress; and point A, instead of being brought back to its original position, will return the 3.744 inches less the stretch in the tie. The problem then arises to find the stress in the tie that will stretch it a distance x, which stress will just balance the force applied to the frame at A that will deflect it a distance y, where $x + y = 3.744$ inches. A force of 1,000 pounds on the tie, or 250 pounds per square inch, will stretch the tie $\frac{250 \times 720}{29,000,000} = .0062$ inches. Hence, letting H equal the stress sought in thousands of pounds, we have $.0062\ H + .1015\ H = 3.744$ inches, or $H = 34.8$. The new horizontal reaction is then 34,800 pounds. As before, with this horizontal reaction, the resultant stresses in the members can be found.

For temperature stresses in a two-hinged arch, assuming the arch to be put up at mean temperature, a variation from this of, say, 75 degrees each way should be provided for. For a rise or fall of temperature of 75 degrees a steel frame will tend to lengthen or shorten one-two-thousandth of its length. If the end supports are fixed in position, this lengthening or shortening of the frame is prevented. The result on the frame is equivalent to applying a horizontal force at the abutments that will give a deflection either way of one-two-thousandth of the length of the span, or in this case, .36 inch. The amount of this horizontal force as well as the stresses resulting therefrom may be found in the way described in treating the stresses caused by the vertical loads. Each piece will have equal positive and negative stresses. In cases where the tie is kept at a more uniform temperature, the assumed difference between the temperature of tie and frame will give the basis for determining the horizontal force and the temperature stresses.

When only the outlines of the arch are known and the members are to be proportioned, of course the method above outlined will require modification. The deflections cannot be found until the sections of the members are known, and the sections cannot be fixed upon until the stresses are known. Some assumption is therefore necessary. In all methods of finding the stresses in a two-hinged arch, some assumption seems to be necessary, since the change in the area of the cross-section of one member of the arch will alter the stress in every piece. In a paper written by Mr. A. R. McKim and published August 24, 1899, the assumption used to obtain the first trial areas is that the effect of the web members may be neglected in allowing for deflections. The arch treated in that article is shown in Fig. 2.

For finding the first trial areas an average area was assumed for both chords. The present writer applied the "pull over E" formula, taking the dead load stresses and the areas given in that article, and found that not only did the deflections due to chord stresses alone fail to balance, but the deflection due to the web members was all in the same direction and in amount was more than double that due to one chord and nearly seven times that due to the other. The resultant deflection was found to be over three inches, representing an error of 45,000 pounds in the horizontal reaction. Again it was found that, taking the areas given in that article and finding the dead load stresses by the method outlined above, scarcely any agreement was found with the dead load stresses in the same article. Some of the stresses were of a contrary sign. This is not given in criticism of the article referred to nor the method employed; that method would no doubt gravitate to the same final result as the one here given, if the effect of the web members in causing distortion be taken into account.

In the paper on the Rio Grande Bridge, in The Engineering Record, November 8, 1902, Mr. Aus states that there were eighteen diagrams needed to find the partial horizontal reactions, being the number of chord members in one-half of that arch. This would indicate that he, too, ignores the effect of the web members in causing deflection. This is manifestly incorrect, as any member which is subject to stress by a force applied in the position of the horizontal reaction will by its lengthening or shortening cause a deflection at the support; or, if the support be fixed in position, the member in question will have its effect in determining the amount of the horizontal reaction.

The assumption proposed here is this: The stresses found in the frame, considered as a simple span, will be much in excess of those considering the horizontal reaction. Suppose these stresses are double the actual stresses and assume that the average unit stress is, say, 10,000 pounds per square inch, or on these greater stresses 20,000 pounds per square inch. This will afford a basis for finding the horizontal reaction and trial stresses. While this is only an assumption, errors made will not be cumulative, but will balance more or less with other errors. The only thing that depends on this assumption is the amount of the horizontal reaction. If a uniform and not a rolling load is to be provided for, areas may be again found, based on the resulting stresses found by using the horizontal reaction thus obtained. Tentative proportions of the members should then be found and their areas tabulated, as conditions are often such that the actual area used in a member is several times that required, in order to use standard shapes and uniform details. With these areas a second trial for the horizontal reaction should be made and the areas adjusted to suit the new resulting stresses.

As a criterion for judging of the amount of error in the writer's assumption, the amount of the horizontal reaction for dead load stresses was found, using the areas in the article heretofore referred to, and it was found to differ by less than one per cent. from that found by trial areas at 20,000 pounds per square inch under total dead and live load as a simple span.

An advantage in this method of treating the two-hinged arch is that the stresses found are consistent with the areas used, and the calculated deflection at the abutment is just zero, including the effect of all members of the chords and webs. For a rolling load, that is, a live load that may be on any one of the panels of the arch, the method is just the same, but each load must be considered in its effect on the entire frame. It is best at the outset to find the stresses in all members due to a panel load of say 10,000 pounds, or the actual live load panel load, and to use combinations of these for the full live load, finding by the proper ratio the dead load stresses.

An arch of this sort will, in general, be stiff throughout, that is, with no rods, but all members counterbalanced. After finding the stresses due to the full dead and live load, the members should be given trial areas, the shapes being selected to suit the lengths of members and the details to be used, employing, say, a unit stress of 5,000 pounds per square inch. Then a live load is placed at one of the panel points and the stress in every member found, considering the truss as a simple span. Next the horizontal deflection at support is found, and the horizontal reaction to overcome this deflection. The resulting stresses due to this horizontal reaction are next set down and combined with those previously found (those due to the single panel load acting on the frame as a simple truss). This will give the stresses in the members due to this one panel load.

This must be repeated for each panel load and the result tabulated. The next step is to pick out the live load stresses of each sign in each member and to combine them with the dead load stresses, thus finding the minimum and maximum stresses. An adjustment of the areas required, based on the unit stresses given in the specifications, should then be made, and further refinement effected by repeating the whole operation. After once finding the stresses due to each panel load in every member and those due to one pound applied horizontally at the support, then the quantity $\frac{p\ l}{E}$ for each members, the labor involved in adjusting the areas and stresses is small. The quantity $\frac{p\ l}{E}$ will be the same for any member for all operations. One thousand times this quantity should be used to avoid long decimals, and then if the stresses be given in thousands of pounds, and unit stresses the same, the coefficient omitted in u will cancel that introduced in $1{,}000 \frac{p\ l}{E}$ giving as a product $\frac{pul}{E}$, or the partial deflection for the member considered.

Any reasonable assumption, or even sections proportioned at random, by one having sufficient experience to judge what is required, will serve as a basis for finding the stresses. Then on the basis of these stresses new areas may be found; and from these the stresses again computed. Thus any desired degree of accuracy may be obtained. By thus working over the areas and stresses any errors made will in all probability be eliminated, whereas in blindly following a complex formula only extreme care can be relied upon to prevent errors.

The Fire-Resisting Properties of Transformers was illustrated in a fire which broke out in the powerhouse of the Helena Light & Traction Co., at Helena, Mont., October 20, and completely demolished the building and nearly all of the machinery, the exception being a number of oil-insulated transformers, which were practically uninjured. In the case of two transformers, which were not overturned, the oil did not burn away sufficiently to injure their coils or cores. It is believed that it would not have ignited at all had not the covers been removed from the cases before the fire to facilitate cooling, the transformers being worked at a heavy overload. Four other transformers were standing on a wooden floor, and as soon as the latter burned away, they were upset and poured their oil into an engine pit below. The building originally contained a steam plant, but this had been abandoned and power was being purchased from the Missouri River Power Company. Three oil-insulated Westinghouse potential regulators in cast-iron cases, located behind a marble switchboard, which was destroyed, were found practically uninjured. Two 100-horse-power induction motors only somewhat damaged.

Compressive Resistance of Concrete-Steel and Hooped Concrete.—II.

The first five sections of this translation from M. Considère's original paper appeared in the preceding issue.

VI. *Spacing of Hoops.*—While testing prism B, cracks appeared under the light load of 1,730 pounds per square inch, and soon after the concrete began to chip off and finally failed between the spirals which served as hooping. These spirals were 1.18 inch apart. The failure of the prisms, which took place under a pressure of 5,120 pounds per square inch was due to the failure of the concrete and there was nothing to indicate that the metal had reached its elastic limit. In prism C whose spirals were only 0.59 inch apart the cracks did not show before a pressure of 2,480 pounds per square inch was exerted. Chipping occurred also later than in B and under a pressure of 5,400 pounds no failure of the concrete was observed, and the prism did not fail. In D and E cracks appeared under pressure of 2,900 to 3,360 pounds per square inch. These prisms contained, besides the same spirals as B and C, longitudinal rods, which were in contact with their interior surfaces, and formed with them a network which efficiently resisted the lateral failure of the concrete. Computations prove that the superiority of D and E, in this respect, considerably surpasses the resistance which could have been offered by the longitudinal rods alone. Connecting these facts to the figures given in the above table and to the observations made on other series of experiments, certain conclusions are arrived at as to the results obtained on the subject of the spacing of hoops and longitudinal reinforcing rods in contact with the inside of the hooping.

When the spacing of the spirals did not exceed 1/5 the diameter of the prisms, resistances were obtained almost independent of this spacing. *The facts mentioned and others which have been observed lead to the adoption of a spacing of the spirals of 1/7 to 1/10 the diameter when longitudinal reinforcing rods are added.* Experiments on prisms of quite different dimensions have proved that the above ratio holds true almost independently of the absolute values of the dimensions. The following consideration will explain it: If, taking the simplest case, the spirals are replaced by continuous hoops extending between planes perpendicular to the axis, the deformation which the continuity of hooping will indirectly prevent will consist of the swelling of the little cylinders enclosed between the tangent planes of the spirals. If the end pressure which is exerted on two similar prisms of different diameters has the same unit value, the lateral pressure required to prevent swelling will, in all probability, also have the same unit value. Such is certainly the case with sand. The total value of the lateral pressure will, for the small cylinders considered, be proportional to their sections along a diametral plane which is equal to the product of their height by the diameter, that is, to the square of the diameters since the prisms are similar. The hoops will offer this resistance to swelling, but it can only be transmitted from the metal to the small cylinders by the friction and cohesion acting on their bases whose areas are also proportional to the square of the diameter.

If two cylinders of different diameters are considered, all dimensions of which are proportional to each other, the shearing stress which will be produced in the planes tangent to the hoops will have the same value when the unit pressure on the prisms are the same. In other words, prisms of proportional dimensions behave the same way under the same unit pressures and it seems to be justifiable to express the rules as to the dimensions of the hooping element as a function of the ratio of these dimensions to the diameter, as was done above.

VII. *Ductility of Hooped Concrete.*—A removable metal tube 7½ inches in diameter was filled with Portland concrete and bent to a radius of curvature, of the neutral line of 21.6 inches. The metal shell was then removed and a piece of the cement was cut out. The cement which underwent such great deformations did not break, and on the compressed side only rare cracks were observed. Tests proved that it still had a great resistance. This observation on concrete enclosed in a metal shell led to the belief that similar results would be obtained for hooped concrete. Numerous experiments have indeed proved that in prisms which had bent under heavy pressures the concrete did not break and it maintained its cohesion. A hooped prism of the proportion of 840 pounds of cement per cubic yard of gravel and sand and which was subjected to a pressure of 7,940 pounds per square inch of original section showed great deformation, bending in the shape of the letter S with a greatest versed sine of 0.4 inch in a length of 13 inches. The curvature was much sharper at the middle so that the least radius of curvature was about 2 feet. The "fibers" of concrete nearest to the outside did not show any transverse cracks, and hence, could not have elongated much. The flexure of the prism was, therefore, produced almost wholly by the shortening of the opposite fibers, for which computation gave the enormous figure of 17 per cent.

TABLE I.—EFFECTS OF REPEATED LONGITUDINAL COMPRESSION ON FOUR HOOPED CONCRETE PRISMS.

					First Loading and Unloading.							
Pressure	1,053	1,850	2,375	3,330	3,825	4,490	3,825	3,300	2,375	1,850	1,053	0
Shortening of G	.0047	.0095	.0130	.0158	.0260	.0480	.0480	.0378	...	...	...	.0146
Shortening of H	.0173	.0276	.0350	.0437	.0567	.0709	.0658	.0615	...	.0496	.0480	.0248
Shortening of I	.0118	.0205	.0264	.0350	.0437	.0449	.0445	.0400	.0354	.0335	...	.0102
					Second Loading.							
Pressure	1,850	3,300	4,490	4,890	5,150	5,420	5,600	6,210	6,740			
Shortening of G	...	.0449	.0540	.0645	.0662	.0685	.0827	.1356	.1940	Flexure at .1930		
Shortening of H	.0540	.0642	.0745	.0772	.0934	.0945	...	...	...	Flexure at .1760		
Shortening of I	.0335	.0406	.0540	.0583	.0630	.0760	.0875	...	...	Flexure at .2195		

					First Loading and Unloading.								
Pressure	526	1,053	1,990	2,375	2,815	3,300	3,565	3,300	3,040	2,815	2,375	1,990	1,053	526
Shortening of J	.0146	.0236	.0276	.0323	.0437	.0567	.0831	.0827	.0807	.0787	.0768	.0748	.0615	.0540
					Second Loading.								
Pressure	0	526	1,053	1,990	2,815	3,040	3,300	3,570	3,980	4,350	4,750	5,150	5,285	..
Shortening of J	.0350	.0524	.0599	.0717	.0827	.0831	.0842	.0905	.0945	.0984	.1260	.1693	.2047	...

Note.—Pressures are given in pounds per square inch, and shortenings in decimals of an inch.

It is not certain whether the concrete could have stood this deformation if the sharpest curvature had not extended over only a short length; the obliquity and warping of the cross-sections could have had an important influence on the curvature. But the fact remains that the above prism stood considerable deformation. The hooping spirals and longitudinals were afterwards removed from this prism and the remaining concrete was coherent enough for its whole length of 4.25 feet to be handled without breaking. It was put on two blocks 3.61 feet apart and it required 55 pounds to break it by bending. One of the halves of the prism which was less bent by the warping, but which stood the same average pressure of 7,940 pounds was put on two supports 20.5 inches apart and a load of 428 pounds was required to break it.

The tensile resistance indicated by this bending test figures, by the formula $R = \frac{10\ M}{d^3}$, 250 pounds per square inch, in which M represents the bending moment and d the diameter, which the removal of the reinforcing had reduced to 4¾ inches. This tensile resistance of 205 pounds does not much differ from the initial tensile resistance of the concrete. In the compression tests without column flexure not more than 3 per cent. of shortening was observed before failure. The difference of these results is due to the considerable swelling which, in this case, is required by such shortening as would lead to failure, outside the elastic limit.

In two other prisms the compressive resistance instead of the resistance to bending was tested after the removal of the reinforcing hoops and longitudinals. The first, of the same mixture as the one above, bent under a pressure of 6,970 pounds per square inch, which caused a shortening of 0.6 per cent. The average compressive resistance of the plain concrete was 1,420 pounds and its real resistance must have much exceeded this figure, as the pressure was not well applied at the ends. A similar test was more carefully made on a prism mixed in the proportion of 630 pounds cement per cubic yard, and which stood a pressure of 10,270 pounds per square inch with a shortening of 2.4 per cent. on the average and 2.8 per cent. on the most stressed side. After removal of the reinforcing spirals, the inside cylinder, which had about 10.5 square inches section, sustained a pressure of 9,700 pounds.

From the above tests, selected as they are from many similar tests, it must be concluded that *hooped concrete sustains without failing considerable shortening and conserves a great part of its original resistance; and that with the small deformations which occur in structures, the resistance of hooped concrete can be considered to be constant from the instant when it reaches its maximum.* The analogy between this phenomenon and the behavior of concrete in tension, which the author made known some time ago, is evident.

VIII. *Elastic Behavior.—Experimental Data.*—From among a great number of results obtained from tests of prisms those given by four octagonal prisms 5.9 inches in diameter and 4.27 feet long have been chosen for the interpretation of the results. These prisms were reinforced by helicoidal spirals and longitudinal rods, as follows:

Prisms G and H, 840 pounds cement per cubic yard, spirals ¼ inch wire spaced 0.79 inch, 8 rods, 5/16 inch diameter; Prism I, concrete and spirals same as above, 20 rods, 0.276 inch diameter; Prism J, 420 pounds cement per cubic yard, spirals same as above, 8 rods, 0.276 inch diameter. Table I shows the shortening of these prisms under the given loads, the loading being repeated as indicated.

In all of these specimens the spirals had the same dimensions, and in the first three the concrete was of the same mixture. Similar results might have been expected of them, but the facts proved otherwise. While for the first prism the pressures below 2,845 pounds per square inch gave a co-efficient of elasticity of 7,111,000 pounds, the second of identical composition gave only 2,845,000. This great difference was due to the quantity of water used for the mixing of the concrete; it was correct for the first and excessive for the second. The first lesson taught by these experiments is the great irregularity of concrete as usually fabricated, and the doubtful value of results based on the coefficient of elasticity.

If the general behavior of the deformation curves of the prisms be studied, it is noticed that they show an important change of inclination after a certain pressure has been exceeded, the same as is shown for ductile metals.

This point may be called the elastic limit, but without attributing to it the sense usually given to this limit. An elastic limit, in the proper meaning of the words, does not exist for concrete. Prisms of the same concrete do not show so much irregularity in their elastic limit as in their coefficient. The first three specimens thus had an elastic limit varying between 4,830 and 5,400 pounds per square inch. The elastic limit, moreover, varies with the proportion of cement, while the coefficient of elasticity, on the contrary, is little influenced by it. For prism J it reached only 2,845 pounds per square inch. These results are in accord with what is known of concrete that is not reinforced.

The observation of the deformations during the loading and unloading of the specimens has given results of great practical interest. The first thing shown which could have been anticipated, was a permanent shortening which increases if the same load is repeated, but more and more slowly and tending rapidly towards a final limit. A reduction of the total deformations is thus obtained and with it an appreciable increase in the coefficient of elasticity for the succeeding loadings and unloadings of the specimens. The second result, which is more important, could not have been foreseen. It is the form of the deformation curves and especially the direction of their curvature, which is concave to the pressure axis, while during the first application of load it curves in the inverse sense. It follows that *the coefficient of elasticity which is represented by the inclination of the tangent to the curve of deformation increases with the pressure in the unloading and reloading instead of decreasing with increasing pressure as under the first application of load.* The importance of this fact will be more fully discussed under "column flexture," but it is well to indicate here its bearing.

Evidently flexure is to be feared in a column generating cylinder was 3.76 inches. In addition the prism was reinforced by 8 longitudinal wires of the same size and material. The length of the prism was 51.18 inches.

Column flexure prevented the measurement of the shortening under the pressure of 10,290 pounds per square inch. Figure 1 shows the plotted results of these and numerous other experiments not given in table No. II. The concrete surrounding the spirals was removed to a cylinder of 3.37 inches, which just passed through the middle of the re-enforcing wires. The effect of the external layer of concrete was thus eliminated because of the difficulty in determining its action precisely. The pressure was successively raised in four applications to 2,360, 5,530, 7,910 and 10,290 pounds. After each of the highest pressures, the load was gradually decreased and then applied again and the shortening measured carefully under each pressure.

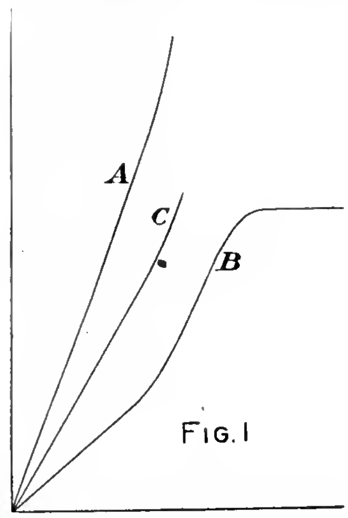


FIG. I

The coefficients of elasticity corresponding to the different pressures are proportional to the tangents of the deformation curves. They are given below as determined under the first reloading and under the following unloadings and reloadings. For simplicity's sake only the average of the two last operations is given:

TABLE II.—EFFECTS OF REPEATED LONGITUDINAL COMPRESSION ON A HOOPED CONCRETE PRISM.

First Loading and Unloading.													
Pressure	128	441	810	1,180	1,620	1,990	2,360	1,620	1,180	810	441	128	...
Shortening	.0	.0047	.0142	.0205	.0299	.0457	.0630	.0606	.0599	.0528	.0394	.0299	...
Second Loading and Unloading.													
Pressure	1,180	1,620	1.990	2,360	3,170	3,990	4,720	5,530	5,160	4,720	3,170	1,620	128
Shortening	.0504	.0544	.0615	.0693	.1088	.156	.224	.360	.359	.3386	.3245	.298	.241
Third Loading and Unloading.													
Pressure	1,620	3,170	4,720	5,530	6,340	7,525	7,910	7,525	7,100	6,340	4,720	1,620	128
Shortening	.279	.3105	.340	.358	.398	.659	.660	.6575	.658	.654	.641	.583	.548
Fourth Loading and Unloading.													
Pressure	1,620	4,720	6,340	7,100	7,525	7,910	8,710	10,290	9,280	7,910	6,340	128	...
Shortening	.553	.614	.638	.658	.669	.684	.768	...	.950	.950	.934	.795	...

Note.—Pressures in pounds per square inch; shortenings in decimals of an inch.

under high pressures and it is, therefore, unfortunate that the coefficient of elasticity, which is directly proportional to the column resistance, decreases with the increase of pressure. Such is the case under the first application of the load for hooped or otherwise reinforced concrete and also for structural iron and steel. On the other hand, it must be considered especially fortunate that hooped concrete which has been subjected to a first load has a coefficient of elasticity which is the greater the higher the pressure becomes, provided it does not exceed the first load. This fact has, to the author's knowledge, never before been observed on other materials. To better discuss this point the results of a very exact experiment, made at the laboratory of the Ponts et Chaussées, are given in table Number II, herewith. The prism tested had an octagonal section of 4.3 inches diameter and was made of concrete of the proportion of 1,000 pounds of cement to 32 cubic feet of gravel 0.2 to 1 inch in diameter and 10.7 cubic feet of sand passed through a screen of 0.2-inch holes. The helicoidal spirals were of iron wire 0.17 inch in diameter and 0.82 inch centers to centers. The average diameter of their

Pressures in pounds per square inch	853	1,990	4,270	6,830
Coefficient of elasticity under first loading	2,180,000	853,000	384,000	284,000
Coefficient of elasticity under unloadings and reloadings	1,990,000	4,910,000	2,420,000	3,275,000

After the considerable pressure of 10,290 pounds per square inch had been applied it was taken off and it was found that the prism had gone back to a coefficient of elasticity as high as after the application of the lightest pressures. The experiments given in the first table lead to the same conclusions. Besides, the comparison of the relative values of the different prisms shows that the first application of load improves the concrete in the same degree as it had initially been deficient. It is natural, indeed, that a strong pressure should diminish the final deformability by bringing the particles nearer together, and that this effect should be greater the less the concrete has been tamped and the farther apart the particles were before.

Continuing the discussion of the results of the above experiments on the effect of the first loading it may be stated:

The application of a first pressure on a hooped prism, no matter how high the pressure may be, has the effect of raising its elastic limit up to that pressure. The coefficient of elasticity which is developed by the hooped concrete under all the variations of the pressures between the lowest and the previously applied load is higher than the highest coefficient of elasticity which the prism had before the test load and which held out for a low pressure only. The increase in the coefficient of elasticity of the concrete after the test load, as compared to the coefficient before is so much more, the poorer the concrete was made and the lower quality it had.

These properties are similar to those of the ferric metals whose elastic limit also increases to the pressure once applied; but they differ by the curvature of the deformation curve, which shows increasing values of the coefficient of elasticity of hooped concrete at pressures below the test load. Hooped concrete does not show, in this regard, any similarity to reinforced concrete in tension, whose coefficient of elasticity decreases considerably after appreciable deformations, and the more so the greater the deformations have been.

It will be seen below that it appears possible to utilize the above properties of hooped concrete. This has never been attempted for the metals, and it is easily seen why. It is almost impossible to subject the individual members of a metal structure to a preliminary pressure. They do not, generally, offer convenient bearing places and it is to be feared that the riveted connections would be distorted under high stresses. But it seems, on the contrary, possible to submit to high pressures ring stones of hooped concrete with plane faces. It is not certain that in some cases it would not be advantageous to obtain hooped prisms whose elastic limit will reach up from 7,000 to 10,000 pounds per square inch and whose stresses may run up higher still. To obtain such results the prisms will have to be subjected to pressures which will crush the concrete layer outside of the spirals. After the test a concrete coating will be put on in which asbestos may be substituted for the sand, which will make it much more ductile. It is already used in the making of roofing material of surprising solidity.

The Water Supply of Paris is to be increased so as to give a total of 237,760,000 gallons daily instead of 73,970,000 gallons as at present, if the plan now proposed by the engineers is carried out. The estimated population for 1903 is 4,000,000, and a per capita consumption of 59.4 gallons is taken as a fair average. It is proposed to increase the supply by collecting the water in the Val d'Orleans, where there is a subterranean lake fed by the River Loire. This will require an aqueduct 62 miles long, and the estimated cost of the project is $25,090,000. It is necessary for the Paris Municipal Council to give its sanction to the scheme.

The Safety-Appliance Law of 1893, designed to protect railway employes engaged in coupling cars, is performing its work efficiently, according to the last report of the Interstate Commerce Commission. The number of persons killed and injured in coupling and uncoupling cars during the year ending June 30, 1902—the first entire year reported since the law went into full effect—shows a diminution as compared with 1893, of 68 per cent. in the number killed and 81 per cent. in the number injured. In 1893 the number of casualties from this cause was 11,710, of which 433 were killed and 11,277 were injured. In 1902 the total number was 2,256, of which 143 were killed and 2,113 injured. This shows a reduction of 9,454; and it it is to be borne in mind that the number of men engaged in this work is much greater now than it was in 1893.

Boston's Projected Underground Railways.

In the preceding issue was a brief mention of the acceptance, by the citizens of Boston, of an act providing for additional underground railways. In 1895-98, after prolonged and thorough study of the rapid transit problem, Boston built a system of subways extending in a general north and south direction through the congested shopping district of the older part of the city, with a branch subway toward the southwest to accommodate the large number of cars carrying passengers to the western residential districts and suburbs. In 1896 the West End Street Railway Company leased these subways and, in 1898 the Boston Elevated Railway Company (lessee of the West End Street Railway Company) built a system of elevated railways extending northerly through Charlestown and southwesterly into Roxbury, with a line connecting the North and South railroad terminal stations.

The subways were intended originally for surface cars only, but were adapted for elevated trains and are being used by both elevated and surface cars, on independent tracks. In 1900 the East Boston tunnel was begun to supplant the ferries across the harbor and connect the East Boston car system with the subways in Boston. This tunnel is still under construction. All the works mentioned above have been described in The Engineering Record from time to time.

While much has been gained by these improved means of transportation, certain car lines and some streets have remained congested and even the newer facilities are already crowded in the busy hours. Chapter 534 of the Acts of the Legislature of 1902, "To provide for the construction of additional tunnels and subways in the city of Boston" was accepted, on referendum, at the city election, December 9, by a vote of 41,970 to 15,333. The act empowers the Boston Transit Commission, which has had charge of the construction of the earlier subways and the East Boston tunnel, to build a system of tunnels and subways so designed as to be adapted for the accommodation of two tracks especially for use by elevated cars or trains and two tracks for surface cars, with the necessary approaches, stations and other appurtenances, including connections with the East Boston tunnel and the existing subway. The new tunnel and the new subway may be built entirely separate or may be connected, as may be decided by the commission to be most economical and convenient for traffic. The exact locations have not been determined but are limited to a territory averaging about 1,200 feet in width easterly from the existing subway, excepting that north of Scollay Square the zone of location extends to the westward of the existing subway a similar distance, as well as to the eastward.

The act requires that the construction of the tunnel shall be begun immediately and of the subway at such time after the expiration of one year from the completion of the tunnel as the Commission and the Boston Elevated Railway Company may agree upon, but it is intended to push the construction of the subway also.

Preliminary examinations, in the way of borings and surveys and tests of building foundations along probable routes, have already been instituted. It is hoped that these examinations and the preparation of plans and specifications may be so expedited as to make possible the letting of contracts for construction within six months. The act, approved June 27. 1902, required that a contract for the use of the tunnel and subway should be made by and between the Boston Transit Commission and the Boston Elevated Railway Company before a reference of the act to the voters at the succeeding municipal election. Such a contract was signed September 25, and many of its items are so interesting that they are abstracted below.

The term is twenty-five years from the beginning of the use of the tunnel, and the annual rental is to be 4½ per cent. of the net cost of the tunnel and subway respectively, including all expenditures incurred in acquisition and construction—damages, expenses, salaries of the commission, and interest at 3¼ per cent. per annum on the debt incurred in construction prior to the beginning of use. Such net cost shall also include amounts expended for preliminary investigations and for alterations in the existing subway and approaches thereto necessary to readapt it to the use of surface cars. Deductions shall be made from the cost for the proceeds from sales of property and for a fair valuation of lands and structures no longed needed for the purposes of transportation.

If at any time during the continuance of the term of this contract the company shall be deprived in whole or in part of the use of the premises by any cause growing out of the act of God, of public enemies, of mobs or of riots; or growing out of works or excavations carried on or permitted by the city or other public authority; or growing out of explosions or the bursting of pipes outside the premises, the falling or settling of buildings, the filling or caving in or other physical obstruction of the premises or any part thereof not due to any act of the company, or its agents, servants or licensees, in the use of the premises, or to any negligence on its or their part, or to any failure of the company to maintain the premises in good order and condition as provided; or growing out of the location, maintenance or use of the wires or other apparatus which the city is authorized to maintain in the premises; then the rental or a just and reasonable part thereof, as agreed upon by the Mayor of the city and the company or in case of difference as determined by arbitration, shall be suspended or abated during such deprivation.

All the tracks and equipment provided by the company shall remain its property so long as it continues to occupy or use the tunnel under the provisions of the contract and upon the termination of such use the city agrees to take and pay for all such property at its then fair value. The company is to maintain the premises in good order and shall be entitled at all reasonable times to a permit to open the streets and other public grounds for the purpose of repairs, which shall be at the expense of the company except repairs made necessary by the uncontrollable causes mentioned above. The city shall not be responsible to the company for damages of any description resulting from any defects in the premises, whether structural or arising out of want of repair or from any cause after use by the company has begun.

The company shall keep the premises thoroughly clean and free from unnecessary dampness, and the approaches to stations clean and free from ice and snow. When the premises are in use it shall suitably light the same in all parts, and by means of artificial ventilation shall keep the air adequately pure for health and comfort. The governor of the commonwealth, the Mayor and engineer of the city, and the members of the Board of Railroad Commissioners, and of the commission, and their respective engineers shall at all times have free entry to the premises for the purpose of inspecting the same.

The company may permit persons or corporations not engaged in the railway business to use and maintain wires, conduits and similar structures to such extent as may be practicable without interfering with the safe and convenient operation of the railway. But the privilege shall not extend to gas or water pipes. The city may place in the premises wires and apparatus for its police and fire alarm service, the location and construction, maintenance and repair to be subject to such reasonable direction and regulations as the company may impose.

In the event of the failure of the company or its assigns to pay the rental for three months after such rental shall have become due, or in the event of a failure to maintain and operate a railway within the premises, and if such failure shall have continued for three months, then in either of said events the city upon three months' notice, such default still continuing, shall have the right to terminate this contract and to re-enter upon and repossess itself of the premises, unless such failure to maintain and operate grows out of the previously mentioned uncontrollable causes.

In case the right of re-entry and repossession above given shall be exercised, all the tracks, wires, apparatus, equipment and other property in the nature of fixtures of the company or its assigns within the premises may be taken by the city and be paid for by it at a valuation to be determined as provided for the occasion when the same are to be surrendered by the company at the expiration of the term of the contract. The company shall have no right at any time to remove from the premises any tracks, wires, apparatus, equipment or other property necessary to the use and maintenance of the premises and the operation of a railway therein, except for the purpose of repairs or renewal or for the substitution of equivalent structures, property, apparatus or equipment.

The act requires that the commission shall not begin construction until it has filed in the office of the city engineer a plan showing the location of that part of the work which it is about to construct. All work under or near public streets shall be conducted, so far as practicable, so as to leave the streets or a reasonable part of them open for traffc between the hours of 8 A. M. and 6 P. M. of each secular day except public holidays. Recollection of the disastrous explosion which occurred in connection with the construction of the existing subway is shown in the provision that any gas company can shut off the gas from any pipes affected by the work when necessary to avoid danger.

The Name of the American Society of Civil Engineers is being dishonestly used by a certain party, and so the secretary has sent to members the following letter of warning:

"It has come to the attention of the secretary that members in various parts of the country have been approached by persons claiming connection with the society, and, on the basis of such claim, securing financial aid. A recent case is that of a young man who by impersonating F. F. Hall, Jun., Am. Soc. C. E., at Duluth, Minn., has succeeded in swindling several of our members there. Members are warned to look out for this man. It is needless to say that such use of the name of the society should be promptly punished, but this is difficult and can only be accomplished by the individual who is victimized. The object of this circular is to suggest to members that the mere statement of connection with this society is not proof of such connection, and that in all cases the production of some identification by a self-introduced claimant should be insisted upon, both for the protection of the individual and the good name of the society."

Property Returns on Public Works.

By A. F. Bridgman, Auditor, Metropolitan Water and Sewerage Board, Boston.

The taking account of stock or annual inventory of the merchant or manufacturer is so manifestly a part of his business system, and the care and thoroughness with which it is done is so clearly an important element in arriving at his business standing, that no one doubts its necessity. On public works, however, the accounting for property used in the construction or operation of the works is often thought to be of little importance, and in fact when looked at from the point of view of the merchant or manufacturer this may be true; but when it is remembered that a public work by its very nature requires regular and systematic statements regarding the means used for its prosecution, whether of men, money or appliance, the account of stock is seen to have its value.

When office furniture and fittings, engineering instruments, machinery, tools, appliances and materials for construction are purchased and delivered to a department for use in the work of construction or operation, there should be a thorough and systematic accounting for the same at regular intervals to some person who has entire knowledge of all supplies purchased and disbursed; and in general it may be said, the greater the work, the more important are careful returns.

A brief outline of the methods adopted by the federal and State governments, and various commissions in charge of public works, will show how this matter is regarded. The United States government requires a property return from its disbursing officers at the close of each three months, and the details of these quarterly returns are so elaborate as to make the return usually made on engineering works seem like play. The articles received and disbursed during each quarter are not only given in much detail, but the former are accompanied by the vouchers showing the source from which the property came and the latter by the certificate of the person under whose direction the articles were used.

In some of the Massachusetts State departments a return is made semi-annually, showing property on hand at the beginning, the amount received during the six months, the amount used up and the balance remaining on hand. Of the commissions carrying on important public works in Boston and in the metropolitan district, the Metropolitan Park Commission has a general return of property annually. The superintendents of the different reservations make up their returns and send the same in book form to the secretary of the Board, who compares and compiles the entire account.

The act under which the Metropolitan water works are being constructed requires that a full property account be kept and an abstract of the same published in the annual report of the Metropolitan Water and Sewerage Board, which carries on that work. A property return is, therefore, compiled showing all property on hand at the close of the fiscal year and for articles not classed as perishable the amount on hand at the beginning of the year as well as the amount received and disposed of during the year.

Members of the engineering profession do not as a rule look with unalloyed pleasure upon this work of recording and reporting the receipts and disbursements of property placed in their charge, and usually carry it to completion only under the stimulus of a forced draught. When a dam is to be designed or a road built the work is entered upon with the same zest that the well-known war horse is said to show when entering a battle, but when an inventory is to be taken and a return of the property compiled the task is approached with anticipations similar to those of a boy approaching a school house. And the reason is that a great responsibility for the good character of the strictly engineering work under his care has such a prominent place in his mind, and rightly, too, that the care and accounting for the means used in carrying on the work seems dull business. In other words it seems a kind of a by-product of engineering work and an unprofitable one at that.

Now, how can a full and regular accounting for engineering property be obtained without making life miserable at stated times for the members of the engineering profession? First, by remembering that the accounting of property is like the accounting for money, and should be expected and planned for in a similar way, for unless one is willing to account for things submitted to his care, he should not accept the trust. Second, by entering property received in a book, in a similar manner to which cash received is entered, and, so far as is possible, stating what has become of property not on hand when each periodical account is rendered. Third, by using blanks which will cover the range of articles to be used, as far as may be foreseen, with plenty of room for additional items, a grouping of different classes of property under separate headings, so that any item may be easily placed, and entering items in each class in alphabetical order. When these things are done, the principal aids in the work will be at command.

For most engineering work, so called, the following general classification will be found to locate property in a natural way:

Office furniture, fixtures and supplies.

Engineering and draughting instruments and supplies.

Tools, machinery and appliances for construction.

Horses, vehicles and stable supplies.

Stock, i. e., material to be used in and in connection with the structures themselves.

Under each general heading place the items, grouping small classes of articles where practicable and avoiding too fine a separation of different kinds of the same article. The accompanying example will suggest a form of blank:

PROPERTY RETURN.

Tools, Machinery and Appliances.

	On hand last account.	Received since.	Total to account for.	Disposed of.	Now on hand.	Remarks.
Axes, all kinds	12	0	12	2	10	....
Barrows, wood	40	20	60	14	46	Worn out
Barrows, iron	10	0	10	1	9	Broken
Bars	34	10	44	36	8	4 lost in trench, 2 stolen
Blasting supplies—						
Battery	1	0	1	0	1	....
Black powder (lbs.)	200	0	200	50	150	Used at dam
Dynamite (lbs.)	40	30	70	60	10	Used at dam
Fuse (ft.)	..	200	200	250	50	Used at dam
Leading wire (ft.)	..	500	500	...	500	....
Boilers—						
Horizontal, 10 H.-P.; upright, 25 H.-P.	2	0	2	1	1	Transferred to Road Dept.

In the general office, where bills are filed after payment, should be kept a book called the Property Book and arranged as shown by the accompanying example:

PROPERTY BOOK.

Date of bill.	Number of bill.	Name of article. Axes.	Sent to— Sec. 1.	Sec. 2.	Pump. Sta.
Jan. 31	2240	Wood chopping	12	..	..
Feb. 4	2422	Hand	..	6	..
		Broad	..	..	3
Mar. 1	2690	Wood chopping	12	..	..

On most large works all bills after payment and before being turned over to the bookkeeper receive a consecutive number, and are thenceforward for convenience referred to by that number alone. If this method is not used the firm name may be entered instead in the second column. Each article has a half-page, page or two pages, as is judged sufficient, and is indexed the same as in a letter book.

When the return is made by the different departments to the general office, the second column of the first table ("received since last account") is checked with the charges in the property book, and by this means it may be seen whether the property sent out has been accounted for, and in case of variance the difference can usually be adjusted by correspondence. Property received or disposed of by transfer from one department to another should be so noted in the column of remarks. A comparison of the two reports will then show a proper accounting. Property condemned as unfit for use should, to avoid uncertainty as to reporting it in future accounts, be marked as such, or be permanently disposed of.

The cost of making a complete report of miscellaneous property as outlined above will be found to be about one per cent. of the value of the property reported.

Civil Service Examinations for engineers in the New York State department will be held January 24, 1903, for the following positions: Assistant civil engineer, $5 per day; chainman, $2.50 and $3 per day; leveler, $4.50 per day; rodman, $3.50 per day; and structural engineer in the State architect's office, $2,000 per year. Persons desiring to take these examinations should file applications on regular blanks before noon of January 19. For places of examination and particulars, address Chief Examiner, State Civil Service Commission, Albany.

The Purification of Polluted Sea Water by aquatic plants was brought to the attention of the British Association for the Advancement of Science recently by Professor E. A. Letts and Mr. J. S. Totton, a summary of the paper appearing in "Engineering." It was stated that the so-called sea lettuce (ulva latissima) grows luxuriously in the shallow parts of Belfast Harbor, where the water is almost constantly polluted by sewage, and often drifts ashore in thick layers, where it rots during the summer and autumn and becomes a serious nuisance. The decomposition is so like animal putrefaction that investigations were begun. It was found that the dry weed contains as much as 6.2 per cent. of nitrogen, corresponding to 38 per cent. of albuminoids, which is very high for a plant. Bringing the lettuce, before and after its fronds had developed, in contact with polluted sea water, it was observed that the nitrogenous matter—ammonia and nitrates contained in sewage—was absorbed from the sea water to which it was added in five hours. The sea lettuce would thus appear to be capable of acting as a scavenger. There are other sea-weeds and fresh-water plants, including an alga, about whose name Professor Letts was not certain, capable of absorbing ammonia, and it was hence suggested that these weeds might be utilized as purifying agents, either alone or for a final treatment of the effluent from some ordinary sewage process before that effluent is allowed to pass into the rivers or estuaries.

Superheated Steam.

Abstract of a paper read by Mr. Ernest Foster before the Engine Builders' Association of the United States.

In considering the advantages and disadvantages of superheating with regard to engine work, let us recognize the four distinct conditions under which steam is used: Saturated, superdried, moderately superheated, highly superheated. Saturated steam may be taken as commercially dry steam or such as is delivered by a good boiler under ordinary conditions. By superdried steam, we mean steam which is not only thoroughly dried in the superheater, but which is raised in temperature thirty or forty degrees above the saturation point, or just enough to insure its arriving at the engine in a perfectly dry state. To such an arrangement there could possibly be no objection as the steam is delivered at the engine free from moisture and without the use of a separator or means of trapping out condensation.

By a moderate superheat, we mean from 100 to 150 degrees at the boiler, which should give in the neighborhood of 100 degrees at the engine and be sufficient, with proper protection, to carry the steam nearly, if not quite, through one cylinder without condensation. If the engine is compound, the steam, having lost its superheat at the terminal point of the high pressure cylinder, is re-superheated about 100 degrees in a reheater between the high and low pressure cylinders and again loses its superheat while expanding into the low pressure cylinder, arriving at the point of exhaust with the temperature of saturation. This arrangement may be considered at the present time as the best which can be proposed. The amount of superheat is so moderate as not to require anything more than good construction for modern high steam pressures.

Highly superheated steam must be treated with more consideration. Engines which will stand a temperature of 500 degrees F. are not necessarily fitted to handle steam at 750 degrees, but these temperatures may be, and have been repeatedly, used successfully. As shown by many published reports of tests at various points of superheat, an increase in temperature is accompanied by a decrease in steam consumption, hence it is worth while pursuing this line. To employ these high temperatures, it is at present considered important to use poppet valves on the high pressure cylinders at least, as it is here that the full effect of the superheat is felt, and this type of valve is easier to lubricate and does not become distorted with heat. We believe, however, that a Corliss valve may be so proportioned as to operate successfully under even these conditions.

One of the well known methods of utilizing high superheat is that known as the Schmidt system. This consists in passing a portion of the highly superheated steam directly from the boiler through the reheating tubes of a receiver, between the high and low pressure cylinder of a compound engine, and then letting this steam mix with that which enters the high pressure cylinder direct from the boiler. The high pressure exhaust is thus superheated on its way to the low pressure cylinder while the temperature of the steam admitted to the high pressure cylinder is modified by its admixture with steam which has already been through the reheater coils and incidentally a receiver drain is unnecessary. Automatic regulation of the superheat to a desirable point in each cylinder, under a varying load, is claimed for this system. Ordinarily an increase of load beyond normal necessitating a late point of cut-off in the high pressure cylinder will give an excess of superheat in this cylinder while the reheater will not be sufficiently active to superheat this steam on its way to the second cylinder. With the Schmidt system, however, the effect is reversed by causing a greater amount of steam to pass through the receiver coils where it gives up its superheat to the low pressure cylinder during periods of heavy draught and the high pressure cylinder is thus protected from excessive heat. The contrary effect in both instances may be followed through in case of an engine running under a light load.

In the present state of the art it would seem that the condition most attractive to American engine builders would be one of moderate superheat. We thus confine ourselves to a conservative policy and avoid the necessity for making any special provision for extremely high temperature. We use lubricants, and gaskets and packing which may be obtained in the open market at a reasonable cost, while at the same time we avail ourselves of such positive and direct benefits of superheating as: Dry steam in the pipes and throughout the engine, elimination of separator, low steam consumption per unit of work done, smaller steam pipes and ports, simplified system of steam jackets, greater amount of work done per boiler capacity, and efficiency at light loads. These are all practical and common sense improvements, and are of such proportion as to fix our attention.

The absence of water with the steam need not be dwelt upon. Every practical man will admit that this is of great value. It is further noticeable that a steam pipe system which will show leakage at the joints with saturated steam will become perfectly tight under superheated steam. The point of maximum economy, while using superheated steam, has by no means been reached. The amount of data available is not in proportion to the extent of the practice.

In order to make a comparison between superheated and saturated steam consumption of an engine it is, of course, only fair to place both on a heat unit basis, thus eliminating entirely the question of the cost of the superheat. Assuming a compound engine of about 1,000 horse-power and running with 150 pounds initial and 26 inches vacuum, we would consider 12½ pounds of fuel per indicated horsepower per hour a very good result. We have well authenticated reports of a similar engine, supplied with steam with a temperature of 720 degrees Fahrenheit at the boiler, consuming less than 9 pounds of steam per indicated horsepower, or a gain of 39 per cent. in economy with an expenditure of but 16 per cent. more heat units in the boiler.

The reduction in the size of steam pipes and ports rendered possible by using superheated steam is due to the diminished density of an equal volume as compared with saturated steam as well as from the absence of entrained water. The velocity of superheated steam in pipes should be kept up in the neighborhood of 6,000 feet per minute. As a rough approximation it may be said that superheating will make a difference of 20 per cent. in the size of the steam pipe.

The question of steam jackets on a cylinder, which has occupied so much profound attention in recent years, is quickly solved by the aid of superheated steam, and we see at once the benefit of the jacket disappear as a steam economizer. There seems to be no excuse for retaining them on the low pressure cylinder, and indeed we have proved by trial that on this cylinder a steam jacket is positively wasteful. We do not think it clearly proved, however, that they may not still be useful when applied to the high pressure cylinder even if only for the sake of warming a large engine up preliminary to starting.

The effect of getting more work out of a certain volume of steam is naturally felt in the handling of the boilers and in a reduction in the number of fires necessary to do a given amount of work. Unexpected results have been frequently obtained by the addition of a superheater to a boiler and a higher evaporative efficiency with the superheater in commission has been shown. This is doubtless due to the increase of the heating surface and the lowering of the temperature of the flue gases. In such cases the saving by superheating is felt in the coal pile to the same extent as in the steam consumption.

On the acceptance test of some vertical compound engines of 1,200 and 2,400 horse-power on electric light service in Boston the maintaining of efficiency under light loads was well demonstrated. The feed water per indicated horse power per hour was 12.54, 12.51 and 12.00 pounds at full load, three-quarter load, and one-half load respectively, while the amount of superheat was 80 degrees, 64 degrees and 48 degrees at the high pressure admission and 60 degrees, 67 degrees and 84 degress at the low pressure admission. The engine had reheaters and steam jackets on both cylinders, and it is not unlikely that still better results would have been obtained had the low pressure jackets been omitted. It must not be considered necessary to make any very extensive preparations for the use of superheated steam, it may almost be said that the requirements are merely in the line of good practice, and, as such, should be inaugurated in any event.

It is important to have the joints of the steam pipes firmly made and well bolted; corrugated brass gaskets are usually found very satisfactory with superheated steam. Provision must, of course, be made for the expansion and contraction of the steam lines to a somewhat greater extent than ordinarily, and the steam pipes as well as the flanged unions should be covered with a good non-conducting material in a thick layer. It is important to have the flanged unions covered as well as the pipe. With proper precautions of this sort and with a velocity of steam in the pipes of from 4,000 to 6,000 feet per minute, the drop in temperature per foot of run may easily be kept down to 1 degree in 6 or 7 feet of length.

Metal of low melting point must, of course, be avoided in the construction of the engine, especially about the valves and piston rods. The stuffing box bushings must be made of metal which will not run under the temperatures likely to be encountered. The metal should be uniformly distributed in designing the valves and cylinders to get the best results with superheated steam, as in this way a uniform expansion by heat is provided for. The boiler and the cylinders are preferably made without projections or ribs. The poppet valve has the advantage in form, but the Corliss valve is also made in such a manner as to expand and contract without warping, and the large number of Corliss engines using superheated steam is a strong evidence of their adaptability.

The lubrication of the cylinders is apt to cause one who has not had experience with superheated steam a great deal of unnecessary anxiety, but really this problem is very simple. It must be borne in mind that the temperature inside of the cylinder is never very high, even when the superheat at the entrance is very considerable, and if the cylinder is lubricated directly without mixing the oil with the steam at the entrance point there can possibly be no difficulty. With any reasonably good grade mineral oil, however, it cannot be claimed that any difficulty has been experienced with the lubrication of the parts, even when applied in the ordinary way.

The effect of superheated steam in the indicator diagrams is worthy of notice. Steam being used as a perfect gas, the diagram approaches more nearly the theoretical, and, as there can be no re-evaporation in the cylinder the tendency of the pressure to rise during the stroke is absent and the amount of work done in the low pressure cylinder is brought down to the proper point.

In designing an engine to be run with superheated steam it is well to bear this point in mind as there is danger of applying the usual constants in the selection of the size of the cylinder for the reason that the horse power of the steam end used with superheated steam will be nearer the theoretical.

Superheated steam is destined to play an important part in the adoption of the steam turbine. Already a number of tests have been published which show a considerable decrease in the steam consumption with the amount of superheating, and it is not difficult to understand that a machine of this type would be greatly benefited even by the elimination of moisture and dense vapor from the propelling medium. Other uses for superheated steam, such as for dryers, chemical processes and boiling or distilling apparatus, will not be touched upon in this paper, and it may be said in conclusion that the author believes that the time has arrived when steam will not be used to any great extent in any branch of industry without being superheated.

A Turbine Water Meter.

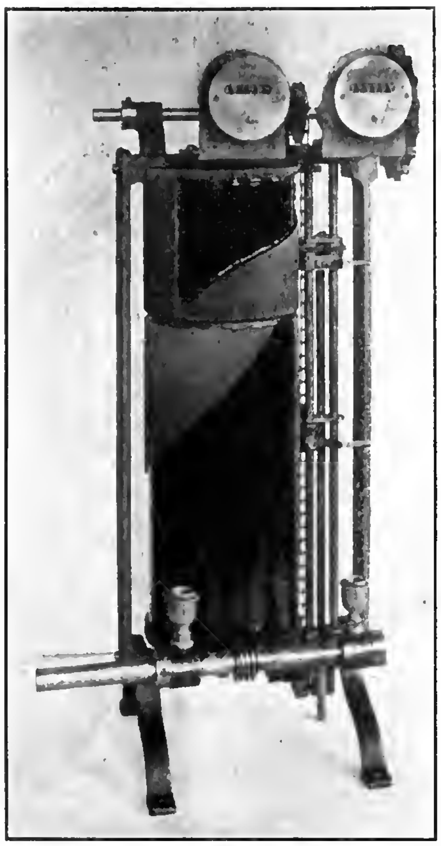
The accompanying illustration is a reproduction from a photograph of a water-wheel flow recorder designed by Mr. George I. Rockwood, of Worcester, Mass., and Mr. C. M. Allen, assistant professor in experimental engineering at the Worcester Polytechnic Institute. It is an ingenious device for recording the discharge of a turbine, taking into account the effect of the degree of gate opening and the effect of change of head. It is intended to secure a continuous reading of the amount of water diverted for power purposes and also allows simultaneous direct readings of both head and gate opening to be made in a convenient way, displacing the common practice of taking two or three observations daily of these conditions, to estimate the amount of power developed by the turbine. As a water meter and an indicator of the operating head, the apparatus is held as more reliable in the way of evidence in water power litigations than the comparatively infrequent records of the ordinary method of securing these data.

The essential part of the machine consists of two cylindrical drums, each having a toothed surface, covering a portion of the cylinders. The lower drum is driven by worm wheel gearing from the turbine, and always bears a definite speed relation to the turbine. By means of its toothed surface it drives a small gear wheel mounted on a shaft on the top of which is another pinion. This wheel drives the upper cylinder and this in turn, by means of its toothed surface, drives a third pinion, mounted loosely on the shaft between the other two pinions. The third pinion mates with a fourth pinion of the same size, which is keyed to a second shaft and actuates by means of bevel gearing at the top a clock-work registering device.

The lower cylinder is designed to give the reading as affected by a change of gate opening. The pinion corresponding to this cylinder is mounted on a feather key and is raised or lowered along the shaft by means of a chain, shown in the photograph, the chain being actuated as the gate is opened or closed by means of another chain, not shown, engaging the sprocket at the right of the right-hand dial.

For any given gate opening the pinion assumes a particular position and is revolved by the gate cylinder, as the lower cylinder may be called. The number of turns it makes depends on the number of teeth on the gate cylinder, corresponding to that position. The toothed surface is thus bounded by a curved line, so that for any gate opening the pinion will be rotated to the proper extent, that is, by the proper number of teeth proportional to the turbine discharge; and this curve is obtained from a previous test of the turbine under a given constant head and varying amounts of gate opening, checked against a weir.

In a similar way the head or upper cylinder has a toothed surface which varies the number of revolutions through which its pinion is turned proportionally to the amount of water the turbine discharges at a particular head; and the pinion moves vertically as the head is changed. For a maximum gate opening and a maximum head, the gate pinion will be at the top of the gate cylinder and be revolved the



Water Wheel Flow Recorder.

greatest number of times per revolution of the gate cylinder; and the head cylinder, which will move at its highest speed, being driven through the gate pinion, will turn the head pinion, which will be located opposite the bottom of the head cylinder, at its highest number of turns and thus give to the dial its maximum reading per revolution of the gate cylinder.

For a maximum gate opening and a varying head, the upper pinion will rise and reduce the maximum reading by the required amount. In short, the lower cylinder will give the reading at maximum head and any given gate opening and the upper cylinder will reduce that reading if the head is less than the maximum.

The apparatus for measuring the head acting on the wheel, takes into account the level of the tail water. It consists of a leather diaphragm submerged in the tail race. One side of the diaphragm is exposed to the tail water and the other forms one end of a water-tight chamber, which is connected to an oil reservoir in the wheel casing. The chamber and pipe connections are kept full of oil to prevent freezing. The pressure on the diaphragm is balanced by a heavy spring. The motion of the diaphragm caused by a change in head is transmitted through a rod and multiplying lever to the carriage which holds the pair of gears opposite the head cylinder.

Such a meter has been installed by the Worcester Polytechnic Institute for recording the flow of water at the hydraulic testing laboratory, at Holden, Mass., in connection with an 18-inch Hercules turbine operating under a head of 30 feet. The cylinders of the meter are 5¾ inches in diameter, and the two together, 16⅝ inches long. There are 276 teeth on the full circumference of each cylinder, and 48 on each of the small gears. The two pointers show directly the location of the gate and head pinions, traveling against scales for that purpose. The left-hand dial gives the revolutions of the turbine by connection with the gate cylinder. Other installations of these meters have been made, the first one being at the woolen mills at Gilbertville, Mass., nearly two years ago.

The Two Public Baths of Yonkers, N. Y., furnished 23,182 and 11,043 baths during the year ending December 1, 1902, according to the annual message of Mayor M. J. Walsh. Of the total number, 8,438 were free, the remainder having been paid for at the rate of 5 cents each.

The Pumpage of Water for the city of Chicago during 1901 was at the average daily rate of 343,282,508 gallons, an increase of 20,276,316 gallons over that of the previous year. The amount of coal consumed, however, was 2,294 tons less than during the previous year, according to the annual report of Mr. F. W. Blocki, Commissioner of Public Works. The daily pumpage per capita was 164.8 gallons.

The Roadways of Birmingham, England, were recently described in the presidential address of Mr. John Price to the Association of Birmingham Students of the Institution of Civil Engineers, from which the following notes have been taken. It is found that when a macadamized road requires an entirely new surface once in three years, granite block paving becomes more economical; and again, when this period is reduced below two years, then wood, for the same reason, can be laid down with advantage. When the grade of the road is less than 1 in 25 macadam is considered a suitable material. Above that, granite paving can be used; and it is not considered wise to use soft wood where the grade is steeper than 1 in 40, or hard wood with a grade steeper than 1 in 50. Various kinds of wood blocks have been used in Birmingham, with very satisfactory results. The pavement is laid on a 5-inch cement concrete foundation, carefully finished off to a smooth surface with 1 inch of 1:2 Portland cement mortar. The blocks, varying from 4 to 6 inches in depth, are laid close and run solid with hot asphalt. Along the curb on both sides an expansion joint of clay and sand is left, from 1 to 2 inches width, the greater width being used with blocks of soft wood. It is necessary to keep hard wood block paving watered in the summer time or the blocks are likely to become loose. The crowning of the roadways in Birmingham is determined according to a series of constants, and depends on the different classes of paving materials used. For macadam, the height of crown above the gutter is 1/24 the half width of the roadway, for granite it is 1/36, for soft wood 1/40, and for hard wood 1/45. Having determined the height of the center above the gutter, three equidistant intermediate points are found by multiplying this height by .87, .65, and .35.

The Stability of Effluents of Sewage Filters of Coarse Materials.

Slightly condensed from a paper by H. W. Clark, Chemist, in the 1901 Report of the State Board of Health of Massachusetts. Tables omitted.

All organic matter is presumably subject to change by bacteria. It may be in such a state or condition that bacteria change it easily, or it may be in such a condition that bacteria can change it but slowly. Most of the organic matter present in sewage is illustrative of the first condition, and that present in soil and loam is illustrative of the second condition. One of the objects of this paper is to show that organic matter of the first class can be so changed by bacterial agencies, working under favorable conditions in sewage filters of coarse material, that this matter practically takes its place in the second class; that this change can occur in filters operated at high rates; and that this matter, when changed to a more or less stable condition, can, as far as the effluent itself is concerned, safely remain in the effluent instead of being strained or filtered from it. That is, it will not under ordinary conditions rob this effluent of its dissolved oxygen and subsequently putrefy.

It was observed at the experiment station for a number of years that very turbid, poor appearing effluents from filters of coarse materials operated at high rates of filtration would often remain without change for an indefinite time, and that the matter coming from these filters in suspension in their effluents and rendering them turbid to eventually deposit as sediment, or washed from them purposely at times to relieve clogging, was apparently in a stable condition quite different from the condition of the putrefying, ill-smelling matters in suspension in the sewage itself when applied to such filters. The results obtained caused further studies to be made.

Series No. 1.—The construction and rate of operation of each of the filters of this series at this time was as follows: Filter No. 82 was constructed of cinders and was operated at the rate of 400,000 gallons per acre daily; Filter No. 103 was constructed of small pieces of coke and was operated at the rate of 660,000 gallons per acre daily; Filter No. 137 was constructed of broken stones and was operated at the rate of 800,000 gallons per acre daily; Filter No. 138 was constructed of broken stones and was operated at the rate of 480,000 gallons per acre daily; and Filter No. 133 was constructed of broken stones and was operated continuously in such a manner that air was not admitted and only putrefaction occurred within it, its rate of operation being 2,700,000 gallons per acre daily. All were contact filters with the exception of Filter No. 133. [The usual method of operating contact filters at Lawrence is as follows: The outlet is closed and the filter filled in four applications of sewage one hour apart, then allowed to stand full two hours, and drained slowly.]

The manner of making this experiment was as follows: from each filter a considerable volume of the effluent was collected and twelve one-gallon bottles were filled with each effluent. These bottles stood in the laboratory stoppered, and once a week the liquid in one of the bottles was taken for analysis.

Studying the results in detail it is seen that the dissolved oxgyen and the nitrates disappeared more or less rapidly from the effluents of Filters Nos. 82, 137 and 138, and the free ammonia increased in amount, as did eventually the oxgyen consumed, and the amount of nitrogen found as albuminoid ammonia decreased slowly, the appearance of each sample deteriorated and an increased odor was noticeable. The results with these three effluents showed that all organic matter in the sewage at the time that this sewage appeared as effluent at the outlets of these filters had not been sufficiently broken down by anaerobic action, and subsequently oxidized, to become stable. Oxidation and nitrification were occurring in the filters and a large portion of this organic matter present in the effluents was in a condition for slow oxidation to occur, but some of the organic matter present in these effluents was not ready for this under the conditions prevailing, without some further anaerobic bacterial action, and this occurred after the dissolved oxygen present in these effluents and the oxgyen of the nitrates had been consumed. That is, this matter had not, while passing through the filter, reached such a state of stable equilibrium that it was not affected appreciably by the bacteria of putrefaction, and hence these effluents deteriorated.

The organic matter in the effluent of Filter No. 103, however, which received septic sewage,—that is, sewage which had undergone prolonged anaerobic bacterial action before application to the filter,—had evidently passed the putrefactive stage. Slight oxidation only occurred in this effluent, the very slight odor primarily present disappeared and dissolved oxygen was present at the end of eleven weeks, notwithstanding the very considerable quantity of organic matter present. In other words, the organic matter in this effluent, although considerable in amount, as shown by the high free and albuminoid ammonia and oxygen consumed, was in a condition of fairly complete oxidation, the anaerobic action having been carried to its limit in the septic tank and in the filter, and good oxidation having occurred in the filter. The effluent of the anaerobic Filter No. 133 continued, on standing in the laboratory, to undergo putrefaction.

Series No. 2.—In this series the effluents of six filters were studied, the method of procedure being as follows: an average sample of the effluent of each filter was siphoned into five one-gallon bottles, each bottle being completely filled. These bottles then stood in the warm laboratory tightly stoppered, and analyses were made weekly for five weeks, using one of the samples for each analysis. The sample for the determination of oxygen dissolved was obtained by siphoning it from the bottle into the flask in which the determination was to be made as soon as the bottle containing the sample to be examined was unstoppered.

Two of the filters from which samples of effluent were collected were the intermittent-continuous Filters Nos. 135 and 136, constructed of broken stone, operated at a rate of rather more than 1,400,000 gallons per acre daily, and producing a highly nitrified effluent, but also containing considerable free ammonia and nitrogenous organic matter as albuminoid ammonia; one filter was No. 103, previously described, and operated this time at the rate of 520,000 gallons per acre daily; one filter, No. 133, was the anaerobic filter operated this time at the rate of 1,000,000 gallons per acre daily, and through which the sewage was passed for putrefaction to occur, as previously explained; and two filters, Nos. 137 and 163, were contact filters, one constructed of broken stone and one of coke, the rate of operation of these two filters being 960,000 and 720,000 gallons per acre daily respectively.

The changes in the effluent of each filter showed a variation as follows: the effluent of Filter No. 103 remained practically unchanged for reasons previously explained, and dissolved oxygen was present in it at the end of the period. The large amount of residual organic matter in the effluents of Filters Nos. 135 and 136 had been, owing to the anaerobic conditions prevailing in these filters, as evidenced by the high nitrates in the effluents, so changed by the bacteria and air that it was in a fairly stable condition. The effluents of these two filters—Nos. 135 and 136—contained dissolved oxygen at the end of the period of experiment notwithstanding the large amount of organic matter present, no putrefaction took place, odors did not develop, and the organic matter present remained practically without change. The effluents of Filters Nos. 137 and 163 contained less organic matter than the effluents of Filters Nos. 135 and 136, but were, nevertheless, in a much lower state of nitrification; dissolved oxygen either was not present or disappeared quickly, and putrefaction occurred. Instead of the amount of nitrogen present as free ammonia remaining constant, as in the effluents of Filters Nos. 135 and 136, it increased. The amount of oxygen consumed, instead of decreasing, increased eventually in the effluent of Filter No. 137, and the anaerobic actions in the bottles containing this effluent and the formation of gas were quite noticeable, odors developing also.

Series No. 3.—In this series of experiments the effluents were mixed with equal parts of river water containing dissolved oxygen. The gallon bottles were only partially filled and were allowed to stand in the laboratory without being stoppered. One sample of each mixture was analyzed each week for a period of four weeks. This manner of experimentation was used to make the conditions resemble, as nearly as possible upon a laboratory scale, the conditions prevailing if such effluents ran in large volumes into ordinarily pure ponds or rivers.

The effluents of Filters Nos. 103, 105, 136, 137 and 163 and sewage were experimented with. Treating the effluents in this way,—that is, mixing them with water containing dissolved oxygen and also allowing access of air,—they improved in character in every instance. The comparatively well-purified effluents of Filters Nos. 103, 135 and 136 showed slight or decided decreases in free and albuminoid ammonia and oxygen consumed, with an oxidation of organic nitrogen to nitrites and nitrates; the poorly purified effluents of Filters Nos. 137 and 163 showed remarkable improvement in the reduction of organic matter and the production of nitrites and nitrates, together with a reduction in color and odor.

Sewage, when mixed in this way and allowed to remain in contact with air, showed at first putrefaction for a period of two weeks, followed by rapid oxidation and the production of high nitrites. The explanation of this is that, although the surface of the sewage in the bottle was exposed to the air and hence oxygen must have been continually passing into the sewage, yet the organic matter on the surface water of this mixture consumed this oxygen so rapidly that the conditions below the surface favored the development of anaerobic bacteria, as shown by the formation of sulphuretted hydrogen, and only after this putrefactive action had been carried on for a certain period was the matter in a condition for aerobic bacteria to attain ascendancy and for oxidation to occur. During the first period, however, ammonium carbonate, determined as free ammonia, was forming, thus showing that some oxidation was occurring. The free ammonia increased during the first two weeks from 2.70 parts to 4.20 parts per 100,000, then in two weeks it fell to 1.15 parts, the nitrites and nitrates were reduced at first, then the nitrites increased in two weeks from .00 to 1.70 parts per 100,000.

Putrefaction did not occur in any of the samples of effluent and water, although decomposition or change in the presence of oxygen did occur. In the mixture of sewage and water, however, we first had putrefaction, followed by decomposition; that is, oxidation.

Series No. 3 A.—In this series the same effluents were experimented with as in Series No. 3, and the same mixture with river water was made, but the bottles were stoppered and air was prevented from entering. The samples then stood in the laboratory one month. In the effluents of Filters Nos. 103, 135 and 136 there was a continual slow oxidation of the organic matter, largely at the expense of the dissolved oxygen present, which was not entirely consumed, however, although some oxygen from the nitrates was also used. Odors did not develop in these effluents, but in fact became less. In the effluents of Filters Nos. 137 and 163, which were less satisfactorily purified than the effluents of the filters already named, decomposition occurred,—the oxygen of the water being quickly consumed,—followed by a putrefaction, the effluents becoming dark colored and having a strong odor.

At the end of the month the effluent of Filter No. 163 was allowed to stand with its surface exposed to the air in an open bottle. During the period of putrefaction the free ammonia had increased from 1.30 parts to 1.52 parts per 100,000, and the nitrates had decreased from .4700 to .0100 part per 100,000. During the month when air was allowed access to the surface of the effluent in the bottle the free ammonia decreased from 1.5200 to .0140 parts and the nitrates increased from .0100 part to 1.5900 parts per 100,000. The sewage quickly consumed the dissolved oxygen present in the water added, and continued to putrefy during the period of experiment.

Series No. 4.—In this series the effluents experimented with were from anaerobic Filter No. 133, the coarse and high rate Filters Nos. 134, 135 and 136, and the coke contact Filters Nos. 175 and 176. Five bottles of each effluent were filled and stoppered and placed in an incubator, the temperature of which was maintained at 80 degrees Fahrenheit, one sample being examined each day, the period covered being nearly five days.

The effluent of Filter No. 133, containing no nitrates or dissolved oxygen, putrefied, rapidly becoming black and ill-smelling, although the oxygen consumed from permanganate increased but slightly. The effluents of Filters Nos. 134 and 135, although containing but a small amount of dissolved oxygen at the beginning of the experiment, were three days in exhausting this oxygen, and subsequently a small amount of the oxygen of the nitrates was consumed. Neither effluent developed any odor nor changed in appearance. The effluent of Filter No. 136 deserves especial mention as it contained at the beginning of the experiment 1.24 parts per 100,000 of albuminoid ammonia, 9.03 parts of nitrates, and 22 per cent. of saturation of dissolved oxygen; and it is noticeable that, notwithstanding the enormous amount of organic matter present in the effluent determined as albuminoid ammonia, it was in an almost stable condition, the oxygen consumed from permanganate remaining practically constant during the period of incubation, the nitrates being reduced to 5.76 parts per 100,000 in the course of the experiment, the dissolved oxygen not being quite exhausted, and the effluent showing no change in appearance and not developing an odor.

The effluents of the coke contact Filters Nos. 175 and 176 were also incubated for the same period without any appreciable change of their organic contents, or the development of odors. The rate of operation of each of these two filters was at this time about 1,200,000 gallons per acre daily, and nitrification was active within them.

Series No. 5.—This series of experiments was with the effluents of Filters Nos. 135 and 136, the suspended matter having been largely removed by filtration of the effluents through paper. It was an incubation experiment covering a period of five days at a temperature of 80 degrees Fahrenheit, and the effluents remained practically unchanged.

Series No. 6.—Two experiments covering a period of five weeks, were made with the effluents of Filters Nos. 135 and 136, the effluents not being incubated, but standing in the laboratory for this period of time in gallon bottles open to the air. Both effluents improved in quality, the free ammonia of the effluent of Filter No. 135 decreasing from 2.00 parts to .90 part per 100,000 and the nitrates increasing from 4.02 parts to 5.10 parts per 100,000; the free ammonia in the effluent of Filter No. 136 decreasing from 4.00 parts to .90 part per 100,000, and the nitrates increasing from 1.56 parts to 3.43 parts per 100,000. Various other experiments of a like nature were made with similar results.

Summary.—The changes which go on in contact or other filters of coarse material are not always the same, but are dependent on the presence or absence of oxygen, and this in turn is dependent on various conditions, such as the character of the sewage, time of filling, time of contact and time of drawing off the effluent, etc. But that both anaerobic and aerobic actions usually go on in contact filters with the results described there can be no reasonable doubt. Further, that a limited period of anaerobic action, whether taking place within the contact filter or in the septic tank, is a favorable preparation of the organic matter for the subsequent action of the aerobic or oxidizing bacteria seems to be well proven. Thus we usually have within a contact filter both putrefaction and decomposition going on, and one or both of these processes is generally continued in the effluent. If the bacterial changes within the filter are very incomplete, the phenomenon of "secondary decomposition" (more properly called putrefaction) is the one to manifest itself in the effluent.

It is evident, moreover, from a study of all these results that the amount of organic matter determined as albuminoid ammonia and oxygen consumed in the effluent of a sewage filter constructed of coarse material, and operated at a high rate of filtration, is not a true index of the degree of purification of such an effluent, if we mean by purification the oxidation in the filter of the organic matter of the sewage to a more or less stable condition, and the production of an effluent which will not, when having free access to the air, putrefy. In order that such a stable effluent may be produced, it is only necessary that sewage shall have been for a comparatively short period of time in thin layers in contact with an abundance of air and that aerobic bacterial life shall have been active without the added straining out of organic matter obtained by sand or other filters of fine material. Such an effluent will show good nitrification and the presence of dissolved oxygen when running from the filter, irrespective of the amount of stable organic matter that it contains. These effluents, produced either by intermittent-continuous filters or by the best of contact filters, show little tendency to change when excluding air, and maintained at summer temperature for a considerable period. When mixed with water containing oxygen they invariably improve in quality. Even much poorer effluents improve when under the conditions last named, although they decompose and putrefy under the first-named conditions.

If such an effluent, showing good oxidation and nitrification occurring in the filter, contains dissolved oxygen, and habitually retains this dissolved oxygen for a considerable period, it is fairly certain that putrefaction will not occur in it under ordinary conditions, as when exposed to air. Slow oxidation may and probably will occur, this latter action improving the effluent without producing odors. This is abundantly proved by the experiments above described. If, on the other hand, the effluent as it runs from the filter does not contain dissolved oxygen, or if the oxygen present disappears with comparative rapidity, it may be taken as assured that such an effluent will putrefy eventually unless mixed with a considerable volume of water containing dissolved oxygen, even though it contains a smaller amount of organic matter, determined as albuminoid ammonia and oxygen consumed, than other effluents of the character just described, and even though a considerable amount of nitrates is at first present.

In the purification of untreated sewage by sand filtration there is upon many of these filters a constant tendency for surface clogging caused by the accumulation of the coarser and more stable organic matter of the sewage, and in order to keep these filters in operation, this matter either has to be scraped from the beds from time to time, or ploughing with periods of rest has to be resorted to. With an intermittent continuous filter of broken stone, on the other hand, much of this coarse organic matter passes through the filter, as already stated, and appears in the effluent, and surface clogging does not occur. Moreover, as this matter passes through and encounters aerobic conditions, it is, as illustrated by the experiments, oxidized to an innocous condition, and can be easily strained from the effluent at very high rates, if desired, leaving this effluent well purified, clear and highly nitrified, or about equal to the average effluents of sand filters, and produced by a rate of filtration many times as great.

Incubation Tests.—Studying the results of the many determinations of oxygen consumed from permanganate that have been made during these various experiments, we find (1) that the oxygen consumed from permanganate invariably decreases in effluents which are in such condition when collected that they undergo slow oxidation only; (2) that with effluents that finally putrefy the amount of oxygen consumed generally decreases at first, if any amount of nitrates and dissolved oxygen is primarily present in the effluent, to increase later when putrefaction occurs; (3) that in one instance, when the effluent of anaerobic Filter No. 133 was incubated at 80 degrees Fahrenheit for five days, the oxygen consumed increased only very slightly, although the change in the appearance and odor of the sample was very marked, owing to the putrefaction occurring within it; and (4) that in one instance, although the amount of oxygen consumed increased largely in this effluent when it was kept for a period of eleven weeks, yet during the first three weeks it decreased. These results, taken in connection with the complete analyses of the samples in each series, seem to throw some doubt upon the significance of the so-called five-day incubation test with the determination of oxygen consumed only, used to determine the stability or instability of the organic matter of the effluents of sewage filters, that is, to determine their liability to undergo the so-called secondary decomposition. This determination is very much depended upon, however, in England, to show the character of the effluents of sewage filters, as being a much shorter way than complete analyses of these effluents. It would seem, however, that in most instances a determination of the dissolved oxygen present at the beginning and the end of the period of incubation, together with observations of the change in appearance of the sample, if any occurs, would be a more satisfactory and simple test.

Letters to the Editor.

COMPUTATIONS FOR RIO GRANDE BRIDGE.

Sir: In your issue of November 8, referring to calculation of stresses, Rio Grande Bridge, Pacific Railway of Costa Rica, it is stated that the matter is clearly and concisely explained by Mr. Aus. I fail to see it.

Mr. Aus gives the formula:

$$H = \frac{\Sigma\, S_0\, S_1 \frac{m}{a}}{\Sigma\, S_0^2 \frac{m}{a}}$$

In which (as corrected on page 515 of the issue of November 29), H = horizontal thrust; S_0 = total stress in a member from horizontal unit reaction only; S_1 = total stress in a member from vertical unit reaction; m = length of a member, and a = area of cross-section of a member.

The information is given that this formula was originated by Professor Maxwell and explained and elaborated by Professor Greene. The writer was struck by the bold way in which, when making deductions from his equation (5), Mr. Aus writes:

$$h = \frac{v\, S_1\, S_0\, \frac{m}{E\,a}}{S_0^2 \frac{m}{E\,a}}, \text{ and}$$

$$\Sigma\, h = H = \Sigma \frac{v\, S_1\, S_0\, \frac{m}{E\,a}}{S_0^2 \frac{m}{E\,a}} = \frac{\Sigma\, v\, S_1\, S_0\, \frac{m}{E\,a}}{\Sigma\, S_0^2 \frac{m}{E\,a}}$$

Making things clear, it is proper to deduce the fundamental formula. Assumed an arch as given by Mr. Aus.—Stresses to be determined. Removing one condition (that is, removing any one single member, or the horizontal thrust) makes the structure determinate, subject to ordinary stress calculations. Suppose, for a trial, the horizontal thrust H is removed and instead an external force X substituted. Then the stress S in any member must appear under the form

$$S = S_0 + S_1 X \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This is evident from the fact that the stress S is a linear function of the loads which produce it. Knowing the form under which S must appear, only one more condition is needed to determine X. This condition is supplied by the law of virtual work, first stated, actually and distinctly, by Lagrange (1736-1813), which law, for present purposes, can be written:

$$\Sigma\, P\, \delta + \Sigma\, C\, \Delta\, c = \Sigma\, S\, \Delta\, m \ldots\ldots\ldots\ldots\ldots (2)$$

Where P = any exterior force acting on the structure; δ = movement of this force in its own direction; C = a reaction of any support; Δc = movement of C in its own direction; S = stress in any member of structure; and Δm = change of length of same member. It must be noted that P must correspond to C, which must correspond to S; also, δ must correspond to Δc, which must correspond to Δm. But it is important to note that neither P nor δ, nor C nor Δc, nor S nor Δm are corresponding quantities, necessarily. This is stated summarily, but having understood equation (2) the missing condition of our calculation can be supplied.

Returning to the arch of Messrs. Cooper and Aus: Remove the horizontal thrust and substitute an exterior force X. Applying equation (2) it is written:

$$-1.\, \Delta\, l = \Sigma\, S_1\, \Delta\, m \ldots\ldots\ldots\ldots\ldots (3)$$

Where 1 and S_1, Δl and Δm are corresponding quantities. One familiar with the theory of elasticity will know the equation:

$$\Delta\, m = \frac{S\, m}{E\, a} + e\, t\, m \quad \ldots\ldots\ldots\ldots (4)$$

Where Δm = change of length in any member, as before; S = stress in same member; m = length of same member; a = area of cross-section of same member; E = modulus of elasticity; e = coefficient of expansion; and t = change of temperature.

From equation (1)

$$\Delta\, m = \frac{[S_0 + S_1\, X]\, m}{E\, a} + e\, t\, m \ldots\ldots (5)$$

and from equation (3)

$$-\Delta\, l = \Sigma\, S_1 \frac{[S_0 + S_1\, X]\, m}{E\, a} + \Sigma\, S_1\, t\, e\, m,$$

X being constant with reference to other quantities under the summation mark, also E and t and e.

$$X = -\frac{\Sigma\, S_1\, S_0\, \frac{m}{a} + e\, t\, E\, \Sigma\, S_1\, m + E\, \Delta\, l}{\Sigma\, S_1^2 \frac{m}{a}} \ldots (6)$$

Which is the general formula for the thrust X. Assuming the temperature and span length constant, equation (6) becomes, for external loads only,

$$X = -\frac{\Sigma\, S_1\, S_0 \frac{m}{a}}{\Sigma\, S_1^2 \frac{m}{a}} \ldots\ldots\ldots\ldots\ldots (7)$$

It is not necessary to be confined to any particular condition, such as the horizontal thrust. In fact, any member of the arch shown by Mr. Aus may be removed, and the external force X substituted and written, when all else but external loading is neglected:

$$X = -\frac{\Sigma\, S_1\, S_0 \frac{m}{a}}{\Sigma\, S_1^2 \frac{m}{e}}$$

Where X = stress in member removed; S_0 = stress in any member for given loading and X = 0; S_1 = stress in any member when X = 1 and assumed external loading removed; m = length of any member; and a = area of cross-section of same.

Even interchanging S_0 and S_1 this does not agree with Mr. Aus' definitions as above.

That Mr. Aus neglects the quantity $\frac{m}{a}$, or in fact, makes this quantity = 1 is a doubtful expedient. This proposition has been tested, numerically, and involves a considerable error, making the entire calculation of doubtful utility, especially in arches like that of Mr. Aus. But it is not necessary to question this proceeding so much as his "approximate formula."

Let the formula for X, or the horizontal thrust, when only one elastic member *a* in the structure is assumed, be deduced:

It is written again, as per equation (2)

$$-1 \times \Delta\, l = \Sigma\, S_1\, \Delta\, m$$

in which case, when only one member is elastic, it becomes:

$$-\Delta\, l = S_{1(a)}\, \Delta\, m_{(a)}$$

Δm according to assumption being = 0 for every member except *a*. Having immovable supports $\Delta l = 0$, therefore $S_{1(a)}\, \Delta m_{(a)} = 0$. As $S_{1(a)}$ must necessarily be a finite quantity $\Delta m_{(a)} = 0$, or the stress in member *a* : $S_{(a)} = 0$. In plain English, there is no stress in member *a*, which alone was assumed elastic. But $S_{(a)} = S_{0(a)} + S_{1(a)}\, X = 0$, and for member *a* only being elastic,

$$X = -\frac{S_{0(a)}}{S_{1(a)}} \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

The result of above mathematical argument is primarily evident; for, as neither the abutments can move, nor any member but *a* change length it is plain that if the arch stands, as it does, no deflection or change of position can take place in any point. Hence, no change in length of member *a* is possible, that is to say, *a* can have no stress. This fact shows that, when considering only one member of the structure as elastic, the horizontal thrust, or X, obtained, must necessarily be the X for a three hinged arch with one hinge opposite, or in the moment point of, member *a*. Therefore the value of

$$X = -\frac{S_{0(a)}}{S_{1(a)}}$$

as obtained must be one which makes stress *a* = 0.

Having understood this, it becomes increasingly difficult to understand not only the "approximate formula" of Mr. Aus, but it is also difficult to understand the deduction of equation (7) attempted by Mr. Aus and Professor Green, which deduction originally is attributed to Prof. Maxwell, as per Cyclopedia Britannica.

To further elaborate this point equation (7) may be written:

$$X = -\frac{S_{1(a)}\, S_{0(a)} \frac{m_a}{a_a}}{\Sigma\, S_1^2 \frac{m}{a}} - \frac{S_{1(b)}\, S_{0(b)} \frac{m_b}{a_b}}{\Sigma\, S_1^2 \frac{m}{a}} - \text{etc.}$$

The indices a, b, etc., denoting the various members of the structure. In this form of equation (7) we see that when the whole structure is assumed elastic, the contribution of any member *a* to X is

$$= -\frac{S_{1(a)}\, S_{0(a)} \frac{m_a}{a_a}}{\Sigma\, S_1^2 \frac{m}{a}} \ldots\ldots\ldots\ldots\ldots (9)$$

Even, making the unwarranted assumption of Mr. Aus that $\frac{m}{a} = 1$, it would appear from equation (8) that, multiplying dividend and divisor by $S_{1(a)}$

$$X = -\frac{S_{1(a)}\, S_{0(a)}}{S_{1(a)}^2}$$

$$\text{should be} = -\frac{S_{1(a)}\, S_{0(a)}}{\Sigma\, S_1^2}$$

Which is to say, in one case the quantity $S_{1(a)}\, S_{0(a)}$ is divided by $S_{1(a)}^2$ and in the other case by ΣS_1^2. Or, stated explicitly, in one case the divisor is $S_{1(a)}^2$ for one member, and in the other case the divisor is ΣS_1^2 extended to all members of the structure. These two quotients cannot be equal. Nor is this proceeding materially improved by assuming, as Mr. Cooper, two symmetrical elastic members:

For let the formula of X for two symmetrical elastic members *a*, *b*, be deduced:

It is written again:

$$-1 \times \Delta\, l = \Sigma\, S_1\, \Delta\, m$$

and as before

$$S = S_0 + S_1\, X$$

and

$$\Delta\, m = \frac{S.m}{E\, a}$$

Neglecting temperature, which for

$$\Delta\, l = 0$$

as before, gives:

$$\Sigma\, S_1\, [S_0 + S_1\, X]\, \frac{m}{E\, a} = 0$$

Or, for only two symmetrical members, *a* and *b*, being elastic:

$$X = -\frac{S_{0(a)} + S_{0(b)}}{2\, S_{1(a)}} \ldots\ldots\ldots\ldots\ldots (10)$$

in view of the fact that S_1, m and a are the same for both members. Also that $S_{1(a)} = S_{1(b)}$ both are put $= S_{1(a)}$ in the divisor.

This formula is the same as the one given by Messrs. Cooper and Aus for a special case. Here again is met with the same difficulty as before. That is, the contribution to X of two members, *a* and *b*, using equation (10) is:

$$X_{(a,b)} = -\frac{S_{0(a)}\, S_{1(a)} + S_{0(b)}\, S_{1(a)}}{2\, S_{1(a)}^2}$$

Obtained by multiplying dividend and divisor by $S_{1(a)} = S_{1(b)}$ as before. This expression of X must be, according to equation (9), and putting $\frac{m}{a} = 1$:

$$X_{(a,b)} = -\frac{S_{0(a)}\, S_{1(a)} + S_{0(b)}\, S_{1(a)}}{\Sigma\, S_1^2}$$

But the two quotients cannot have the same value. It is evident on the face of it. It is also evident that an "approximation" of this kind will lead to results of doubtful value.

Yours truly

Chicago, Ill., Nov. 24, 1902. E. S—n.

[The above communication was submitted to Mr. Aus, and his reply is printed below.]

Sir: I have read with much interest the criticism of my attempt at a popular demonstration of the derivation of the formula for computing the horizontal reaction in a spandrel arch. The writer in his criticism of the mathematical work in developing the formula can hardly seriously believe that I mean to say that the summary of a series of fractions is equal to the summary of the numerators, divided by the summary of the denominators. I certainly did not say so, but may be subject to criticism for not having more fully illustrated the method of arriving at the final formula for H.

As Mr. S—n undoubtedly knows the summation of the elongations due to stress in the individual members of the arch is made, and this elongation being equal to 0, the equation for H is found. Nor is Mr. S—n right in stating that I assumed $\frac{m}{a} = 1$. It was only assumed as an approximation that all members were of the same length and cross section, in order to arrive at the approximate stress in the members, so that the approximate section of these members could be found, and by introducing these approximately correct sections in the formula for H find the actual sections.

However, the real question is not whether I in a somewhat hurried explanation that in no way claimed originality (being, as already stated, fully demonstrated by Professors Clerk Maxwell and Green) did or did not succeed. The question that is of interest to the profession is, whether the formula $H = \dfrac{\Sigma\, S_1\, S_0\, \frac{m}{a}}{\Sigma\, S_0^2\, \frac{m}{a}}$ is or is not the proper value for the horizontal reaction in the two-hinged spandrel arch. That the formula is accepted by the authorities above mentioned and has been used by eminent engineers in proportioning such arches, is, of course, no proof of its absolute correctness, but is, on the other hand, a fairly safe precedent to go by for practical purposes.

The assumptions on which the formula is built are, of course, to some extent empirical, and the result consequently not theoretically correct, but the question is, how to calculate this form of bridge in a practical and yet theoretically correct manner. How this can be done by the formulas developed by Mr. S—n I fail to see, and am sure that I voice the opinion of many engineers who have read Mr. S—n's discussion, when I request him to give explanation of the method he proposes to employ.

Respectfully,

GUNVALD AUS.

New York, Dec. 3, 1902.

TILE DRAINAGE OF TOWNS.

Sir: The writer would like to learn whether any cities or towns have been successfully tile drained to prevent water creeping into basements. Accounts of experience in any part of the world, together with statements of conditions existing before and after the execution of the work would be acceptable; likewise information as to where literature on the subject can be procured.

Yours truly,

December 15, 1902. IRRIGATION ENGINEER.

[Replies may be addressed to The Engineering Record.]

Effect of River Regulation on Down-stream Water Level.

Interference with streams has been one of the most fruitful sources of litigation. Numerous more or less effective efforts have been made by the engineering profession to reduce to computation some of the results of changes proposed in water courses. Approximations only can be attained with the data which can be economically procured for problems of this class. In the "Centralblatt der Bauverwaltung" Herr E. Krüger publishes an investigation of the complaints almost invariably made when the regulation of a waterway is undertaken. These claims are generally that by improving the flood discharge of the up-stream section the high water in the down-stream section is raised above its former levels. The author finds that these claims rest on exaggerated assertions and inaccurate conceptions, and presents methods for computing some of the effects of steam regulation.

If an up-stream section of a waterway is improved by the clearing or widening of the channel and the flood discharge is thereby increased, the conditions of the down-stream section will not be disturbed as long as the discharge remains in a state of permanence. This is because the drainage area has remained unchanged by the stream improvement and it therefore will discharge the same amount of water as before. The average velocity of the water only can be increased, and since the velocity of the high-water discharge is a function of the discharge, it can also be increased. In waterways in which the high-water swell extends over a long distance this effect is small; if, however, the overflowing water has not yet reached its state of permanence, but rises and falls, the conditions of discharge in the lower section will be changed. Let Figure 1 represent

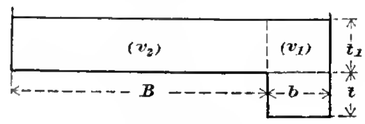


FIGURE 1.

the section of a stream and its adjacent shores, t being the depth of the stream and t_1 the depth of the water overflowing the shores, then the discharge will be:

Due to the stream channel, $Q_1 = b(t + t_1)\,v_1$
Due to the inundated shores, $Q_2 = Bt_1\,v_2$

Total, $Q = Q_1 + Q_2$

During the time T of the rise of the water from t to t_1 the whole quantity of water coming from up-stream was not discharged into the down-stream section as the inundated area had to be filled by the quantity $a = (B + b)t_1$ per unit of length of the valley. If b be neglected as small, $a = Bt_1$. Thus of the whole regulated up-stream section of length l the inundated region retains the total amount $A = Bt_1\,l$.

The storage of this amount of water reduces the discharge at the beginning of the down-stream section by $q = \frac{Bt_1\,l}{T} = Bl\Delta t$, in which $\Delta\, t$, denotes the rise of level per second. If the water is falling, the discharge in the down-stream section is increased by $q^1 = B\, l\, \Delta^1\, t_1$ because the water falls according to different laws from those which govern its rising.

The discharge per second in the down-stream section is then:

During rise, $Q = Q_1 + Q_2 - q$
During fall, $Q' = Q_1 + Q_2 + q^1$

The effect of the quantity A retained by the overflow area on the discharge can be seen from the above equations. This effect will also be felt in all streams which do not overflow but lose their permanency of flow, but it will be so small as to be negligible.

The author also gives a method for determining the changes of level. The values $\Delta\, t$ and $\Delta^1\, t_1$ can be found by observation and l is known. If the overflow region is irregular the length of the stream is divided into reaches and comparative cross-sections are taken. From these cross-sections the width of overflow B can be determined for different water levels and $q = \Sigma\, B\, l\, \Delta\, t$.

The relation t_1 and q are represented graphically in Figure 2. The discharge in the down-

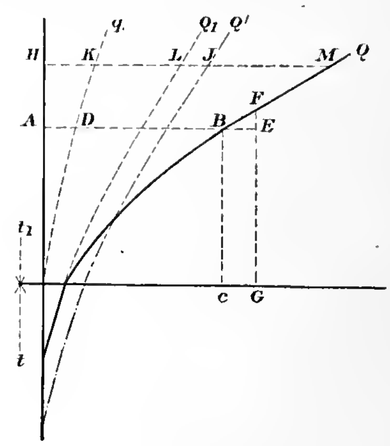


FIGURE 2.

stream section $Q = Q_1 + Q_2$ as well as the discharge Q' in the up-stream section are also plotted. t and t_1 are the ordinates, q and Q the abscissas. If in a regulated stream the overflow begins with the discharge $Q' = HJ$ the rise of level in the down-stream section can be determined as follows: Before regulation $Q = AB$, $t_1 = BC$, then $q = AD$ and the discharge of the down-stream section after regulation must be $Q = AB + AD = AE$. For the section down-stream which has not been regulated, this corresponds to $t_1 = FG$ and the rise of level is $s = FG - EG = EF$.

The wider the overflow area in the unregulated reach and the steeper the slopes of the stream, the flatter the Q-curve will be and the smaller the effect of q on the rise of level. If the discharge $Q' = HJ$ is exceeded the regulated stream will overflow and the overflow region will also take a part in the discharge the same as before the regulation. In the improved section no further rise of the water takes place until the amount discharged has increased from HJ to HJ + LM and has exceeded the same. For all discharges between HJ and HJ + LM the greatest value of q is constantly equivalent to HK.

The Experiments on the Filtration of the water supply of Springfield, Mass., were described at some length in The Engineering Record of July 12. Full details of the many analyses made, which were summarized in that article, are given in the official report of the chemist, Mr. H. W. Clark, to the Massachusetts State Board of Health, and are published in the 1901 report of the board, in which form they are available to those specially interested in this unusual case.

Iron in the Water Supply of Attleborough, Mass., led to an investigation by the State Board of Health during 1901. It was found that the trouble was almost wholly due to the action of the water on the service pipes, nearly all of which were of galvanized iron, and not to action of the cast-iron mains. Several service pipes of galvanized iron where complaints had been made of the character of the water were replaced with pipes lined with cement or tin, and no further trouble from iron was observed.

Retempering Cement Mortar: Modulus of Rupture of Concrete.

In the construction of the Manhattan Railway Company's power station, at Seventy-fourth Street and East River, New York City, during the past two years, about 40,000 barrels of cement were used, all of which was carefully inspected, over 3,500 briquettes being made and broken. In the course of this work several special investigations were made, which are described in a paper by Mr. Thomas S. Clark, resident engineer in charge of construction of the power station, printed in "Cement and Engineering News" for October, from which the following paragraphs have been taken:

It is to be regretted that the practice of retempering Rosendale cement mortar after it has lain in the mason's tubs over the noon hour, is a frequent practice by builders in New York City. It is not a question whether a wall built with retempered Rosendale cement mortar will fail or not, but it is a question of getting the best wall for the money expended. To prove to the satisfaction of all concerned that Rosendale cement mortar is injured by retempering after 60 minutes, the experiments shown in the table were made. All briquettes in like sets of same brand were made from the same bag of cement and their treatment was exactly the same, except the retempering, which was done at the end of the hour, and enough water added, as in practice, to bring the mass back to its original consistency.

Effect of Retempering Rosendale Cement Mortars.

Hours in air.	Age in days.	Tensile strength. Aver. No. of tests.	Tensile strength. Lbs. per sq. in.	Remarks.
		Neat cement; Water, 28%.*		
3	1	43	139	Not retempered.
3	1	13	27	Retempered after 60 mins.
24	7	27	166	Not retempered.
24	7	20	64	Retempered after 60 mins.
24	14	20	180	Not retempered.
24	14	7	80	Retempered after 60 mins.
24	28	6	219	Not retempered.
24	28	6	94	Retempered after 60 mins.
24	56	5	322	Not retempered.
24	56	3	180	Retempered after 60 mins.
		1 Cement, 3 Sand Mortar; Water, 14%.		
24	28	5	39	Not retempered.
24	28	5	31	Retempered after 60 mins.
24	56	5	73	Not retempered.
24	56	5	59	Retempered after 60 mins.
24	112	5	113	Not retempered.
24	112	5	56	Retempered after 60 mins.

*Per cent. of water given is the initial wetting.

The same disastrous results were obtained even when the cement was moistened every fifteen minutes of the hour. Contractors have argued that if a little fresh cement is added the mortar is as good as it was originally. It is quite true that the strength is increased, but the old mortar must be considered as almost inert material. It cannot be supposed that the fresh cement has any life-giving effect upon the particles of the old cement which has passed through the first stages of set. Builders may be able to point to walls where this practice was in vogue, but there is no question that the wall built where it was not allowed is the better wall, will endure longer and stand more shock. With several brands of Portland cement under the same treatment the machine used failed to show any injury done.

As with Rosendale cement, there must be a limit where retempered Portland will fail, and we are inclined to believe that it is somewhere within the second hour of standing. That the retempered Portland did not fail may be explained by the fact that the time of active set of Rosendale is shorter than that of Portland. The safest rule is to allow no retempering under any circumstances.

It is safe to assume that concrete a little too wet is ofttimes better than that which is too dry, especially when laid in warm weather, but when forced to lay Portland concrete in freezing temperatures, the least possible water used the better.

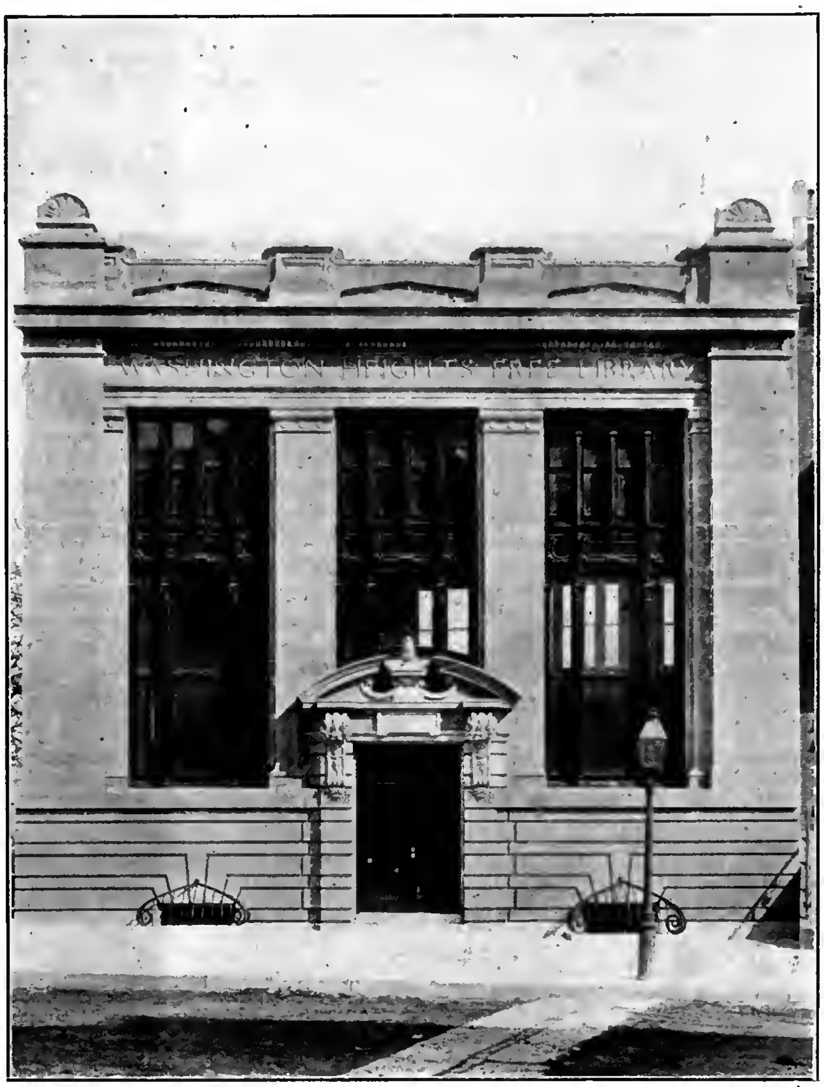
In order to determine roughly the relation between the tensile strength of neat cement, cement mortar, stone and cinder concrete and its so-called modulus of rupture when acting as a beam under a concentrated center load, briquettes and beams were made, the latter with rectangular cross section, using the same cement and aggregate for like sets and subjecting them to exactly the same treatment. After breaking the briquettes by direct tension, and the beams by cross-bending, it was found that the substances mentioned showed, on a fair average, that the modulus of rupture of cross-breaking was about one and one-half times greater than the strength in direct tension.

The fracture in the beams often showed the place of rupture passed directly through the stones of the aggregate, so the strength of the stone was largely a factor of the strength of the beam.

Referring to the Waste of Water in New York City, Mr. Thomas A. Fulton, in an address to the commission of engineers appointed by Mayor Low to investigate the supply, humorously summed up the position of the City Club as follows: "Opposed as we are to the acquisition of new watersheds by and for this city until the present supply is fully exploited, we would yet urge one exception. There is one watershed which is very accessible, will cost very little to acquire and will yield four or five times as much water as any other area of like dimensions. It is only 21 square miles in extent,—Manhattan Island."

Heating in the Washington Heights Free Library, New York.

The building now occupied by the Washington Heights Free Library is on the east side of St. Nicholas Avenue, near 156th Street, New York City. It is not a very large building and consequently it was decided to warm and ventilate it without mechanical means for producing the flow of air. The heating is done for the most part by indirect radiation, which, by taking its air supply from outdoors, provides the desired fresh air for the ventilating. A downward system of circulation is employed, the supply registers being located in the walls and the exhaust registers in the floor. A current of air is maintained through the exhausts by furnishing heat to the interior of the riser shafts to the roof, so that a natural chimney action is thereby ensured.

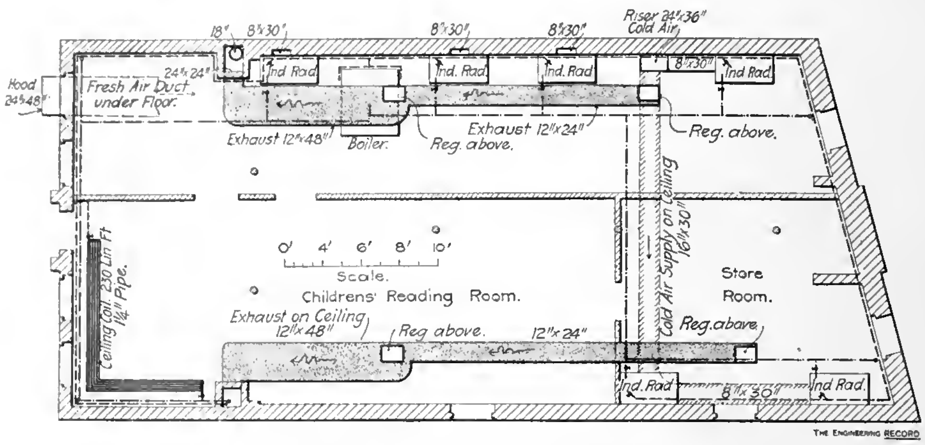


WASHINGTON HEIGHTS FREE LIBRARY.

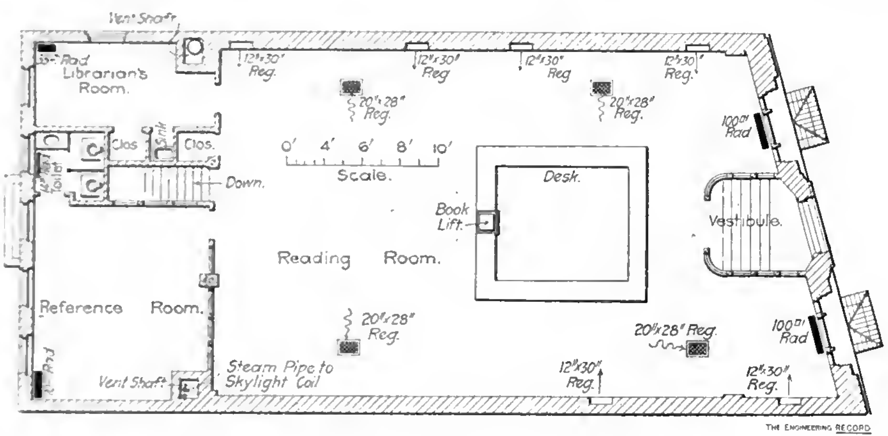
The library was incorporated in 1868 and existed mainly by private subscription until October, 1901, at which time it was conveyed over to the greater library, officially known as "The New York Public Library, Astor, Lenox and Tilden Foundations," with the condition that under the new control a library must be perpetually maintained in the section which it now supplies. In May of 1901 the library was moved into its new quarters on St. Nicholas Avenue. The accompanying reproduction from a photograph of the front shows its street facade. The building has a frontage of 41 feet and a depth, its longer dimension, of 89½ feet, the ground area occupied being about 3,740 square feet. It was erected at a cost of $30,000, and the site cost another $30,000. Its expenses are $6,000 a year, and it supplies a population of about 75,000. The total number of volumes in the library at the time of the last report was 18,664, and it is calculated that its circulation for the current year will be more than 100,000 volumes.

The basement, a plan of which is included in the illustrations, is given up to the heating plant in one-half and a children's reading room and a store room in the other. The main floor, shown in another plan, consists of one large reading room with a mean height of 29 feet, and a rear extension of less height containing a reference room and a room for the librarian. An idea of the form of the interior may be obtained from the sectional elevation from front to rear. The book stacks are ranged along the walls of the reading and reference rooms. They are of steel, manufactured by the Art Metal Company, and have adjustable sheives. The steel construction, besides being fire-proof, has, of course, the advantages of compactness and lightness. The main reading room is lighted from the ends by large windows and also has a skylight in the center of the ceiling. The latter has been stained because it was found to give a light that was too glaring; the elevated position of the building, with nothing to cut off the light at either end, making the windows amply sufficient.

The indirect and direct radiation for the heating are supplied with steam by a No. 110 Thatcher sectional boiler, consisting of ten sec-



Basement Plan, Showing Ducts.



Plan of the Main Floor.

tions. It has a grate surface of 13½ square feet and a rated capacity of supplying 3,200 square feet of radiating surface. It is covered with a jacket of asbestos cement and has the usual fixtures and fittings, including an automatic damper regulator. The boiler is fed through a feed and a check valve by water taken directly from the city service, and may be drained through a valve to a blow-off tank. The complete piping system is dripped through a trapped discharge pipe to the blow-off tank or may be emptled entirely into it. The waste gases are taken through a horizontal cylindrical smoke connection 20 inches in diameter, of No. 12 gauge black iron, and lagged with 2 inches of air-cell magnesia covering. This smoke duct connects to the base of an 18-inch flue of the same material, extending to the roof through an exhaust air-shaft. This portion is unlagged so that its heat may render positive the upward draft of impure air within the shaft. The stack is supported at the base 4 feet above the boiler room floor on an angle-iron frame and contains a 16x22-inch cast-iron clean-out door.

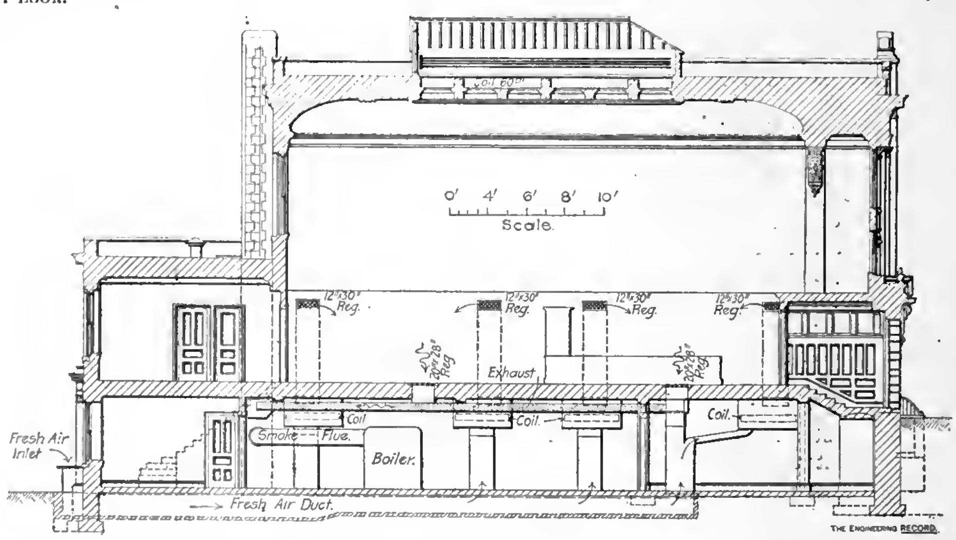
From the steam outlet in the boiler a single main is taken, from which are run the branches to all radiators, indirect stacks and coils. In general the supply pipes are 2 inches in diameter, decreasing where allowable, and the returns are one size smaller than the supplies; the smallest being 1 inch in diameter. Except in locations where their radiation is desirable, the pipes and fittings are covered with magnesia lagging.

The fresh air inlet to the indirect system is at the rear of the building near the south side. It is 24x48 inches in area and protected by a galvanized iron hood with heavy wire netting directly over the intake. From its inlet the air passes through an air duct or tunnel below the basement floor, containing a damper, and is taken through branches from this to four flues along the south wall with indirect stacks in their bases. A galvanized-iron cross-duct on the basement ceiling near the front of the building carries fresh air to two more flues containing indirects along the north wall near the front. The indirect heaters are hung from the ceiling of the basement and each has a total surface of 250 square feet.

A vertical riser from each indirect stack leads to a single register in the main story. The registers are located 7½ feet from the floor and have 12x30-inch openings, which are controlled by ordinary slat dampers. The stack casings are provided with bottom doors to give access to the stacks and are made of No. 22 galvanized iron. The connections from the casings to the main duct and to the registers above are made of the same material and the flues on the main floor are surrounded with metal lath.

The heating of the main floor is assisted by a few direct radiators. Two with 100 square feet of surface each are on either side of the entrance. There is also one in the reference room having 70 square feet of surface, one in the toilet having 14 square feet, and one in the librarian's room having 35 square feet. Under the skylight in the ceiling of the large room is hung a pipe coil having 60 square feet of radiating surface. The basement is well heated by the proximity of the boiler room and the bases of indirect flues. The most exposed corner has a ceiling coil of 1¼-inch pipe containing 100 square feet of surface. All radiators, stacks and coils are equipped with automatic air valves and ordinary valves on the supply and return ends.

In the proportioning of pipes, radiators, etc., it was designed to provide a free circulation of steam throughout the apparatus with a pressure as low as one pound. The designing and disposing of parts was also calculated to maintain the building at 70 degrees in zero weather with a pressure of steam not to exceed 5 pounds.



Longitudinal Elevation.

The exhaust registers for the removal of vitiated air are located in the floor of the reading room and have no dampers so that they cannot be closed. There are four of them, two on each side of the room, 20x28 inches in size. On the ceiling of the basement these are connected into two duct systems; the north side venting into the shaft containing the smoke stack and the other to one in which the uncovered steam supply pipe to the skylight coil is carried.

The architects for the building were Messrs.

Benson & Brockway, of New York, and the heating was laid out on the general lines proposed by them. All of the contract work was under the charge of Messrs. Isaac A. Hopper & Sons, the heating contract having been sublet to Messrs. Baker, Smith & Company, of New York.

Recent Municipal Works at Aldershot, England.

Abstract of a paper by Mr. Nelson F. Dennis, Assoc. M. Inst. C. E., before the Association of Municipal and County Engineers.

The government camp at Aldershot, established in 1853-4, and originally a collection of wooden huts, now consists of blocks of brick and stone buildings and well-made roads and paths. Thought and attention has been given, in the laying out of the camp, to the provision of the many things calculated to make the life of the soldier cheerful, as well as useful. There are provided for him reading-rooms, libraries, recreation-rooms, gymnasiums, swimming bath, recreation grounds, and various institutions where he can improve his general knowledge.

The area of the Aldershot urban district is 4,177 acres, and the taxable value of the property is about $630,000. The water supply is under the control of the Aldershot Gas and Water Company. The supply is derived from wells sunk into the chalk, and is ample in quantity and good in quality, although somewhat hard. The water charges are based upon the rental, being 6 per cent. for houses renting for less than $250, 5½ per cent. for places renting at $250 to $500, and 5 per cent. for those commanding higher rents. The gas costs about 65 cents per 1,000 cubic feet. The town has an official testing station for the gas, and the candle-power must not be below 15, as determined here.

Sewage Works.—The "contour sewer," so called, was constructed in 1901, and provides for an area of 430 acres. Commencing at the sewage works, 18-inch pipes were laid for 5,320 feet at a gradient of 1 in 410, 2,000 feet of that length being laid in tunnel, at a depth of from 25 to 43 feet. Shafts were sunk every 150 feet, which were afterwards bricked up, circular in plan, for man-holes. The progress of the work through the tunnel was slow, owing to the loose, watery nature of the soil in a portion of the work; foul air had also to be contended with. Where the sewer was laid at depths from 9 to 15 feet the pipes were embedded in concrete to the half-diameter, and at depths above 15 feet the pipes were encased in concrete. From the tunnel the size of the sewer is diminished to 15 inches, with a fall of 1 in 330, for a length of 2,640 feet. The remaining 3,470 feet is of 12-inch pipes, and the gradient 1 in 73.

The rain water from yards and the back portions of the roofs of houses flows into the sewers, but the front roof water and street water is collected on the separate system, which has been laid down in nearly every road in the district. The main surface drainage is discharged at two outfalls. Since 1899 there have been erected 47 steel columns at the curb line for sewer ventilation. They are 8 inches in diameter for the lower half, 6 inches for the upper half, and 30 feet high. They have been found to be satisfactory.

Since the introduction of the bacteria system and the abandonment of chemicals the effluent from the disposal works has given no cause for anxiety. The experimental period, usual when the bacteria system is under consideration, was terminated about four years ago, and it was determined to adopt the contact beds for the treatment of the Aldershot sewage. Since then sufficient primary beds, and half the area of the secondary beds, have been constructed for the treatment of the whole of the ordinary flow of sewage. It has been found that the quality of the effluent is impaired by the compliance with the Local Government Board's requirement to pass it over land before discharging into the Blackwater. The land at the town disposal works is not good, being flat, with its surface very little above that of the river. The subsoil water at times is within 2 feet of the surface for a considerable area. Rye grass, for which there is little demand, is the only crop grown.

The sewage (the dry weather flow being about 600,000 imperial gallons per day) is raised from the pump well a height of 18 feet, by means of centrifugal pumps, to a detritus chamber 24 feet long by 10 feet wide; and, without further treatment or screening, is conveyed along a carrier of brickwork, lined with vitrified bricks and supported on arches, to the series of primary beds, from which it is passed after contact, varying from 2 to 3 hours according to the strength of the sewage, on to and through the secondary beds with continuous flow. The effluent then enters a carrier dug in the earth, 6 feet wide, along which it travels for a distance of 600 yards to the outfall. The average rate of charging the primary beds with sewage is 2¼ times per day.

There are 13 primary beds, three of which are each 138 feet long, 24 feet 6 inches wide, and 5 feet 3 inches deep, and ten, each of the average dimensions of 57 by 35 feet by 4 feet 6 inches deep—a total area of 3,344 square yards. The beds are enclosed with brick walls, 14 inches thick, with buttresses. The bottoms are of Portland cement concrete. The sewage is admitted to each of these beds by gates fitted in the middle of the long side, and falls over some large clinker lumps into the filter. Neither distributors nor sprinklers are employed. The filter medium consists of furnace clinkers, graded from large lumps at the bottom, affording good drainage, to fine ashes at the top, and is 1 foot 3 inches thick. The outlet valves, at the opposite side to the inlets, upon being opened permit the primary effluent to flow into the low-level secondary bed carrier. The primary effluent can be controlled in this carrier by gates so as to flow into any of the secondary beds, of which there are four at present—two, each 100 by 57 feet by 2 feet deep (four more of this size are to be constructed); and two, 105 by 85 feet by 1 foot 9 inches deep. The filling of the secondary beds consists of a layer of coarse clinker at the bottom and the top 1 foot 2 inches of fine ashes.

Mr. Dennis, who is the engineer for the town, has come to the conclusion that the disposal of a town's sewage on the contact method cannot be left to an automatic machine, neither can it be entrusted to the inexperienced laborer. Elaborate arrangements of valves, feeding troughs, etc., he does not consider essential.

The surface of the primary beds for about 10 inches is delved over once a fortnight, and the deposit on the top near the inlet is raked off and burnt in the destructor. The total accumulation thus removed amounts to an average of 5 barrows per day for the whole of the primary beds. The secondary beds are harrowed once a week. Two men are constantly employed on this work. The effluent from the beds has been good at all times. The cost of the primary beds, including carriers, has averaged $730 each, complete, and the secondary beds, $1,070 each.

During wet weather, owing to the diluted state of the sewage, the period of retention in the primary beds is reduced to about 1½ hours, and the excess flow is passed into the storm-water tank, the overflow being treated on a storm-water filter. The latter has only just been completed, and it is therefore impossible to say anything as to its efficiency.

Refuse Destructor.—Until October, 1900, the collection and disposal of house refuse was done under contract. Since that date the work has been performed by the direct employment of labor, and the refuse disposed of in a Meldrum's destructor erected at the sewage works. There are two cells, each connected with the old Cornish boilers (which had previously been stoked with coal), worked in duplicate. The average quantity of domestic refuse collected per week is about 68½ tons, but in addition to this the destructor deals with about 7 tons per week of trade refuse, which the tradesmen have to cart themselves. One cell only is worked at a time. This quantity of refuse is more than sufficient for raising steam to work the sewage pumping plant, and the council are therefore considering the advisability of building an electric light plant. The average quantity of sewage pumped per day is about 800,000 imperial gallons. The grate area of each cell is 33 square feet. The old chimney stack, which is 70 feet high and 2 feet 6 inches in diameter, is ample for the work it is called upon to perform, and no complaints have been received from residents in the neighborhood of the destructor. The cost of the works, including the inclined roadway and the slight alterations necessary to the old boiler-house, was $5,850. The cost of working of the destructor is about 27 cents per ton. The additional cost of stoking with refuse over the cost incurred when the boilers were stoked with coal is 7 cents per ton of refuse; but it must be noted that the destructor has done away with the previous consumption of coal, costing $1,700 per annum. The clinker produced, amounting to about 30 per cent. of weight of refuse destroyed, is at present being used in the formation of bacteria beds, and can therefore be reckoned as a valuable asset.

The work of collection is so arranged that the refuse is removed thrice weekly from every house, and so that this work will be finished before noon each day. The desirability of providing each house with a properly covered portable sanitary ash-bin, and thereby doing away with the varied assortment of receptacles now employed by the householder, is occupying the attention of the Sanitation Committee. The cost of house refuse collection is 61 cents per ton.

Municipal Depot.—A depot for the storage of materials, housing of horses and carts, etc., is being constructed at an estimated cost of $15,000. The new stables and depot are designed to accommodate seventeen horses. The width of the stables is 30 feet and the height 13 feet. The stalls are 7 feet in width, and will be paved with concrete. The cart sheds, of which there will be two, each 50 by 30 feet, will be covered with slate. The paving of the cart sheds will be of bricks on concrete. That portion of the depot through which the heavy traffic will pass will be paved with granite and the remaining area with tarred macadam.

Provision will be made for two steam rollers, cement store, tool-house, yard office, forge and workmen's mess-room, harness-room, general stores, and the usual conveniences. The caretaker's quarters will be at the entrance to the depot.

Electricity Supply Works.—The electricity supply works, for which Mr. Dennis acted as consulting engineer, were inaugurated in May, 1902; and so well has the public supported the undertaking, that there are eighty consumers connected, and the revenue is sufficient to cover all working expenses.

The engine house is 50x30 feet in plan, affording room for doubling the present engine power. The boiler house is 41x45 feet. The most interesting feature of the plant is the completeness of the installation considering the comparatively small amount of power generated. The engine house contains three Willans-Parker sets, each of 90 kilowatts capacity, which deliver current at 420 to 460 volts. The balancer and boosters are four Parker machines all coupled to the same shaft. The two boosters, for charging the two halves of the battery, are driven by either or both of the balancer armatures, the output of each being 40 amperes at from 10 to 100 volts. The output of each balancer armature is 40 amperes at 210 volts, capable of dealing with an out-of-balance current of 75 amperes on either side of the system. A storage battery of 244 cells, each of 11 plates and 300 ampere-hour capacity is provided. There are 12 cells of the same size, fitted up as a meter-testing battery and for charging small accumulators for motor-cars, etc.

The boiler house contains two Babcock & Wilcox boilers, each with a heating surface of 1,619 square feet, capable of evaporating 5,000 pounds of water per hour at a working pressure of 160 pounds per square inch. One pulsometer surface condenser, having 850 square feet of brass tube surface, is provided. There are two Worthington feed pumps, each capable of feeding two boilers when working at full capacity. A Baker's oil-extractor is inserted in the main exhaust pipe before it reaches the condenser. In the vertical exhaust pipe in the engine room is a Bailey's atmospheric balanced valve, which automatically opens the exhaust to atmosphere in case of the condenser failing. Outside of the boiler house there is a cooling pond, 40 by 80 feet by 4 feet 6 inches deep, for the condenser circulating water. The pond is connected to a system of surface-water drainage, which receives the water from house roofs and roadways of a residential part of the district. There is a connection from the pond to the hot well, to avoid as far as possible the use of town's water, which is very hard for boiler purposes. A Green economizer of 144 tubes is provided, the scrapers of which are driven by a Parker enclosed motor of 2 brake horse-power. The economizer was designed to deal with a boiler power much greater than that at present installed.

The average price for current obtained from private consumers has been practically 10 cents per kilowatt-hour. The eight arc lamps used for public lighting are charged at $77.90 per lamp per year, lighted till one A. M., and incandescent street lamps are charged at $13.20 per annum, lighted till 2.30 A. M. The total cost of the installation was about $97,500.

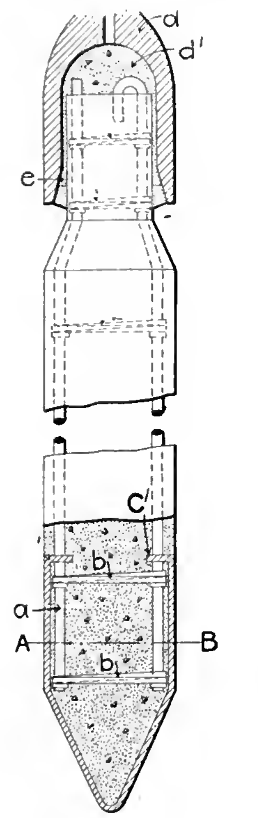
The current for electric lighting and power for the military camp is furnished by an entirely separate plant consisting of three sets of 250 kilowatts and one of 100 kilowatts capacity. In this lighting system there were about 14,000 points to be wired for, several points having from three to five lights each.

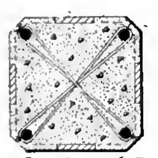
Cold Weather's Effect upon water consumption was shown in a marked way during a recent brief period of low temperature in the Boston metropolitan district. The total consumption for each day from December 7 to 13 is reported to have been respectively about 106,000,000, 125,000,000, 151,000,000, 145,000,000, 134,000,000 1[illegible],000,000 and 138,000,000 gallons, the maximum exceeding 150 gallons per capita. During November the daily consumption was about 102,000,000 gallons, equivalent to 116 gallons per capita.

Concrete Piles of the Hennebique System.

In a paper describing the Hennebique system of armored concrete construction presented to the Civil Engineers Club of Cleveland by Mr. Leopold Mensch, C. E., there is an interesting description of solid concrete-steel piles. They are made in moulds, and each contains four vertical rods a at the corners of the cross-section as shown in the accompanying drawings. The rods are stayed by loops or hooks b of large wire sprung into place across the sides of the pile and held transversely by horizontal strips of thin metal with their ends split and curled down to make stiff clamps.

The feet of the piles are either wedge-shape or pyramidal and are protected by cast iron points with side plates which bend in at c' to lock with the concrete. The upper ends of the





Section A-B.

piles are shouldered in to give clearance between them for the driving cap d. This is a cast steel hood which fits loosely around the neck of the pile, and is filled with a cushion of dry sand d' retained by a clay ring and hemp gasket e at the bottom of the cap. The sand absorbs the impact of the hammer so as to permit the piles to be driven safely, and it raises the hood sufficiently above the top of the pile to permit the reenforcement rods to extend beyond the concrete, if desired, for connection with the superstructure.

The sheet piles are similar in side elevation to the bearing piles except for the flat wedge-shaped points beveled on one side only in the usual manner. They are grooved on both the narrow faces with semi-circular slots o' o' extending to the shoe. On the long face there is a short tongue or tennon at the bottom of this slot which has a semi-circular projection beyond the face of the pile to engage the groove in the short face of the pile previously driven. When two piles are set up together, the adjacent grooves afford an opening to receive a pipe through which an hydraulic jet is operated to scour the earth around the point and facilitate the driving of the pile. The grooves on the short faces of the piles extend to the points and provide orifices for the discharge of the jet.

The jet pipe serves as a guide in driving, and after it is withdrawn the grooves are filled with grout which locks the piles together and makes water-tight joints. The piles are said to be rather more expensive than wooden ones; but are considered very satisfactory because of their immunity from decay and attacks of the teredo.

In connection with this European system, it is interesting to note that the Raymond Company have recently built the foundation of the new Carnegie library, Aurora, Ill., with vertical concrete foundation columns set in the earth so as to act like piles, but cast in place in permanent steel moulds previously driven into the ground. Conical steel shells 14 feet long, 13 inches in diameter at the bottom and 20 inches in diameter at the top were fitted with heavy collapsible steel cores and driven through a gravel and cinder fill with sometimes as many as 200 blows of a 2,400 pound hammer. The cores were removed and the steel shells rammed full of concrete. Trenches were dug around the piles, and the exposed upper portions of the shells being removed, the concrete wall of the superstructure was built to enclose, and be supported on, the tops of the piles.

Personal and Obituary Notes.

Mr. William J. Wintyen has been reappointed borough engineer of Doylestown, Pa.

Mr. A. Lincoln Walters has been appointed superintendent of streets, sewers and parks of Seattle, Wash.

Mr. A. M. Poynton has been promoted to principal assistant inspector of buildings of the District of Columbia.

Messrs. George W. Harrison, Frank P. Rice, W. S. Duncan and Samuel W. Wilkes have been elected water commissioners of Atlanta, Ga.

Mr. E. von der Osten has resigned as chief of the Engineering Department of the United States Garbage Reduction Co., of Lynn, Mass.

Mr. Dennison Fairchild, for the past six years division engineer at Buffalo of the Erie Railroad, has resigned, to resume private practice in that city.

Mr. John Flynn, Jr., has been appointed city engineer of Troy, N. Y., succeeding Mr. Edwin R. Cary, who was removed, it is understood, for political reasons.

Mr. Bleecher Ogden, formerly manager of the advertising department of the International Correspondence Schools, is now connected with the advertising department of the H. W. Johns-Manville Co., of New York.

Mr. James H. Fuertes, M. Am. Soc. C. E., consulting engineer for the Public Works Commission of Harrisburg, Pa., has been retained by the Steelton, Pa., water commissioners, to analyze the river water at Steelton.

Mr. Marshall N. Shoemaker has resigned his position with the American Bridge Co., in order to take charge of the Philadelphia office, in the Commonwealth Building, of the American Concrete-Steel Co., of Newark, of which he is vice-president.

Mr. E. Lawrence Corthell, M. Am. Soc. C. E., who recently returned from the Argentine Republic, where he was consulting engineer for the Ministry of Public Works, in the employ of Hall, Eddy & Cia., addressed the Boston Society of Civil Engineers December 17 on the prospects in that country.

Edward Hughes, a member of the contracting firm of Hughes Brothers & Bangs, of Syracuse, died suddenly in Buffalo, December 19. He was 45 years of age and succeeded to the business on the death of his father 30 years ago. Among the important contracts which have been awarded to the firm were the locks at Sault Ste. Marie, Mich.; the Delaware breakwater at Philadelphia, a breakwater in Narragansett Bay and the breakwater at Buffalo, which had called him to that city.

Mr. Frank Hedley, general superintendent of the Lake Street and Northwestern elevated railroads in Chicago, has been appointed general superintendent of the Interborough Rapid Transit Co., of New York, which has control of the surface, elevated and subway railways of that city. Though but 40 years of age, he has held a responsible position since 1894 in Chicago in elevated railway equipment and operation. Mr. Elzer C. Noe has been appointed to succeed him.

The following changes in railroad engineering positions have been reported: On the Pennsylvania Railroad, Mr. E. W. Atterbury has been appointed general manager and he is succeeded as general superintendent of motive power by Mr. A. W. Gibbs. Mr. G. W. Creighton has been appointed general superintendent at Altoona, and Mr. R. L. O'Donnell succeeds Mr. Creighton as general superintendent of the Buffalo & Allegheny Valley division. Mr. M. L. Byers, engineer of maintenance of way of the Baltimore & Ohio Railroad, has been appointed assistant to the general manager. Mr. D. D. Carothers has been appointed general superintendent of the Baltimore & Ohio Southwestern Railroad. Mr. A. B. Atwater, for the last three years assistant general superintendent of the Michigan Central Railroad, and previous to that engineer, has been appointed assistant to the second vice-president and general manager of the Grand Trunk Railway, of the lines west of the St. Clair River, with headquarters at Detroit.

Concrete Sidewalks to the extent of 27½ miles are reported have been laid in Toronto, Ont., during the year.

Faulty Ignition in Gas Engines is not always due to the ignition gear proper, according to a paper read by Mr. H. Mensforth before the Sheffield Society of Engineers and Metallurgists, April 28, 1902. One cause of late ignition, he claims, is the presence of water in the cylinder. He has found that oatmeal thrown in the tank supplying the jacket will cure some cases of leaking into the cylinder. Pre-ignition, he says, is often caused by some deposit in the cylinder becoming heated by the working of the cylinder. This is usually traceable to either tar in the gas, carbonization of the lubricating oil, or foreign matter in the air inlet pipe, and this, getting hot, he has found, will cause pre-ignition. Blast-furnace gas, often so poor that it will not burn under steam boilers, he has proved satisfactorily in gas engines by providing special ignition arrangements. The requirements are an exceedingly high temperature and an adequate area of well sustained igniting incandescence. Mixed gas and air under pressure allow any desired heat on the ignition tube to be obtained for the ignition with satisfactory results.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 23, 24 and 36.

WATER.

Providence, R. I.—The Builders Iron Foundry, of Providence, have secured the contract for furnishing special casting, iron work for sewers, etc., bids for which were opened on Dec. 18.

Worcester, Mass.—John G. Brady, Water Comr., in his annual report is stated to have recommended a more complete metering of water used, and an extension of the low service system to relieve the high pressure service.

Long Island City, N. Y.—Bids are wanted Jan. 2 (extension of date) for furnishing, delivering and laying water mains in several streets in the Boro. of Queens. Robt. Grier Monroe, Water Comr., N. Y. City.

New York, N. Y.—The Bd. of Estimate on Dec. 19 appropriated $515,000 for improving the water supply system, of which $400,000 is for improvements in reservoirs and lands taken for the Manhattan and Bronx supply, $13,500 for improvements to pumping stations in Queens and $100,000 for remodeling and consolidating the present Gravesend and New Utrecht pumping station in Brooklyn.

Baltimore, Md.—The Water Bd. on Dec. 18 approved the specifications for meters. It also decided to increase the number of disc meters to be purchased with rotary meters.

Bids will be received Dec. 31 by the Bd. of Awards for furnishing and delivering to the Water Bd. such supplies as may be required during the year ending Dec. 31, 1903, including cement, lead-lined iron pipe, cast iron pipe and fittings, valves, etc. Alfred M. Quick, Water Engr.; Thos. G. Hayes, Pres. Bd. of Awards.

Paterson, N. J.—Bids were opened as follows, Dec. 22, for brick lining the Hook Met. tunnel, not including cement: Jas. B. Hall, Jersey City—8-in., $18.24 per ft.; 12-in., $21.24 per ft. G. H. Bouton, Jersey City—8-in., $10.58; 12-in., $13.52. Abbot-Gamble Constn. Co., Times Bldg., N. Y. City—8-in., $62.37; 12-in., $70.

Washington, D. C.—The District Comrs. are stated to have authorized the laying of 3,620 ft. of 12-in. water main from 28th St. and Bladensburg Road, at a cost of $5,750.

Punxsutowney, Pa.—The management of the Buffalo, Rochester & Pittsburg R. R. is reported to be considering the advisability of establishing water purifying plants at Butler Junction and Punxsutawney. J. M. Floesch, Ch. Engr., Rochester, N. Y.

Middletown, N. Y.—The Clerk of Bd. of Water Comrs. writes that it was voted Dec. 23 to issue $27,000 bonds to complete the water works.

South Brooklyn, O.—Bids will be received Jan. 12 by the Village Bd. of Water Wks. Trus. for laying water mains on several streets. Specifications and blanks can be had at the office of the Wm. H. Evers Engineering Co., 634-635 Williamson Bldg. W. T. Rupikofer, Village Clk.

Lansing, Ia.—N. A. Nelson, City Clk., writes that plans and specifications have been prepared for water works. Electric light plant will not be constructed for the present.

Lake Wilson, Minn.—It is reported that at a mass meeting here it was voted to construct water works.

Burlington, Ia.—Local press reports state the Citizens' Water Co. will probably make extensive improvements.

Centralia, Ill.—Bids will be received by the Water Com. Jan. 6 for furnishing material and laying 6-in. water mains on E. Bway. Address A. J. Sliger.

Wausau, Wis.—Prof. E. G. Smith, of Beloit College, employed to make an analysis of the water supply, is reported to have recommended a filtering plant, and estimates the cost at about $20,000.

Cuba, Wis.—This city is reported to have voted to erect a 2,000-bbl. steel tower and tank for the water works, at a cost of $4,100.

Boone, Ia.—City is prospecting for water in shallow veins, and expects to put in an auxiliary plant in the near future. Chas. E. Russell, City Engr.

Milwaukee, Wis.—Bids will be received Jan. 3 for constructing brick conduits on 2 avenues under the depressed tracks of the Chicago & North Western Ry. in 18th Ward for the reception of the large water mains of the city. Chas. J. Poetsch, Chmn. Comrs. of Pub. Wks.

Cincinnati, O.—Bids will be received Jan. 23 by the Bd. of Trus., "Comrs. of Water Wks.," for $1,000,000 water works bonds. August Herman, Pres.

Ashland, O.—An ordinance is reported to have been passed authorizing the issue of $8,000 bonds for improving the water system.

Kansas City, Mo.—Local press reports state that the Bd. of Pub. Wks. has under consideration the proposition of building a new water plant on the Clay County side of Missouri River. It contemplates the abandonment of the Quindaro and Turkey Creek pumping stations, and the construction of a high pressure line from the proposed new pumping station through a tunnel under Missouri River. The Supt. of Water Wks. will be required to furnish the Bd. with an estimate of cost of proposed improvement.

Liberty, Mo.—The Council is reported to be considering the issue of bonds for the construction of water works.

New Orleans, La.—The Council has passed an ordinance authorizing the New Orleans Water Works Co. to extend its water mains on Magazine St. and to erect 15 plugs along that street.

Obion, Tenn.—There is talk of constructing water works and an electric light plant, $8,200 having already been subscribed for this work. As soon as the town is permitted to do so by the Legislature, it will grant a 15-year franchise.

Springfield, Tenn.—Robt. L. Lund, Engr., of Nashville, writes in regard to bids opened on Dec. 15 for constructing water works and an electric light plant that the contract (with the exception of the cast iron pipe, tower and tank) was awarded to the Union Machine Co., of Nashville, for $17,600. The Chicago Bridge & Iron Co. secured the contract for the 80,000 gal. tank and tower, total height 134 ft. 6 in., for $6,400. Pipe furnishing and laying not yet awarded.

Laredo, Tex.—S. F. Wiles, of San Antonio, is reported interested in the construction of an irrigation plant in Laredo.

San Antonio, Tex.—The Acme Irrigation Co. has been incorporated, with a capital of $50,000, to irrigate a tract of 1,200 acres of land s. w. of San Antonio. It is also proposed to erect a cannery. J. B. Fears, of San Antonio, is Secy.

Austin, Tex.—A press report states that the Committee appointed by Governor Sayers to negotiate with the city of Austin for the purchase of the old plant of the water company, has reported recommending that the State construct its own plant and not buy the old plant from the city.

Eagle Lake, Tex.—N. S. Hunsdon, 503 E. 8th St., Austin, Pres. Colorado Agricultural Co., writes in regard to the construction of an irrigation system that it is proposed to expend about $3,000 this year. Machinery wanted now.

Paris, Ky.—N. Mitchell, Supt. Paris Water Co., writes that it is proposed to erect a filter plant in 1903. Wm. Wheeler, 14 Beacon St., Boston, Mass., is the Engineer.

Birmingham, Ala.—A resolution has been presented in Council to the effect that the Mayor appoint a committee to consider and make a report on the question as to the best way and means of securing a water system for the city.

South McAlester, Ind. Ter.—Contracts will be let about Jan. 12 for the construction of water works and a sewerage system, estimated to cost $160,000. Engineer, Chester B. Davis, 10 Wall St., New York, N. Y., and San Antonio, Tex.

Bisbee, Ariz.—It is stated that the Bisbee West Mining Co. will probably begin the construction of water works to supply this city, early in the coming year.

Havre, Mont.—The Town Clk. writes that the date of receiving bids for the construction of water works and an electric light plant has been extended to Jan. 30.

Pueblo, Colo.—The Trus. of the North Side Water Works are stated to have decided to construct a new standpipe north of Fairmount Park.

Gillette, Colo.—Geo. Atherton, Chas. Gillett, and others are reported to have located the waters of north Oil Creek at Waters Station. They intend building a reservoir and using the Horse Thief Park as a storage basin.

Greeley, Colo.—The City Council is stated to have voted to purchase water rights on the Big Thompson, the water to be brought to Greeley for domestic purposes.

Evans, Colo.—Bids are wanted Jan. 20 for constructing the outlet ditch of the Union Reservoir Co., including head gates. Jas. L. McCain, Secy.

Wessington Springs, S. D.—Bids will be received Jan. 5 by Geo. R. Bateman, Town Clk., for sinking an artesian well.

Caldwell, Idaho.—Faris & Kesl, of Boise, are stated to have secured the contract for work on the Phyllis Canal for the Pioneer Irrigation District for $65,000.

Riverside, Cal.—The Jurupa Heights Water Co. has been incorporated, with a capital of $500,000, by W. E. Pedley, F. D. Hudson, and others, all of Riverside.

Julesbury, Colo.—Bids will be received Jan. 1 by the South Side Irrigation Co. for constructing a tunnel 300 ft. in length on the ditch of the company. P. D. Goss, Secy.

Weiser, Idaho.—The Weiser Irrigation District is stated to have sold bonds to the amount of $60,000. It is reported that contracts will shortly be let for the enlargement of the ditch.

Claremont, Cal.—The Citizens' Light & Water Co., of Claremont, has been incorporated, with capital of $75,000. Directors: L. T. Gillet, G. A. Gates, C. C. Johnson, and others, all of Claremont.

Hawkesbury, Ont.—A press report states that Thos. McLaughlin, of Ottawa, has secured the contract for constructing water works and a sewerage system, for about $70,000.

Woodstock, Ont.—The Town Council is reported to be considering the question of water works.

Marieville, Que.—V. H. Dupont, 35 James St., Montreal, Engineer for Marieville, writes that John F. Connolly, Toronto, will receive the contract for constructing water works, his bid (opened Dec. 22) being $32,900. Other bids were as follows: H. Hubert, Marieville, $40,769; Henault & Heffermann, Montreal, $38,677; P. Denis & S. Sinical, St. Cesaire, Que., $38,925.

SEWERAGE AND SEWAGE DISPOSAL.

Fairhaven, Vt.—It is proposed to construct sewers for the village, at a probable cost of $30,000. W. H. Preston, Town Clk.

Corinth, N. Y.—Surveyor Mott is reported to have estimated the cost of a sewerage system between $17,000 and $20,000. A vote on the question will probably be taken some time in January.

Fishkill Landing, N. Y.—The citizens are stated to have voted Dec. 18 to appropriate $30,000 additional for the completion of the sewerage system.

Bradley Beach, N. J.—The W. J. McCloud Construction Co., of Elizabeth, is stated to have secured the contract for constructing the sewerage system, for $20,803.

Reading, Pa.—It is stated that Mayor Yeager will probably soon sign the ordinance to set aside $30,000 out of next year's revenue to extend the intercepting storm water sewer to its planned completion.

Abington, Pa.—Cheltenham Township Comrs. are reported to be considering an ordinance for a general sewer system to extend over into Abington.

Penn Yan, N. Y.—The citizens are stated to have voted to expend $500 to secure the services of an engineer to draw plans for a system of sewers and the disposal of sewage.

New York, N. Y.—The following bids were opened Dec. 23 by Boro. Pres. J. A. Cantor for extension of outlet sewer at the ft. of W. 72d St.:

Main items.	Wm. J. Moore.	N. Y. Sewer Const. Co.	F. Thilemann, Jr.
4-ft. wooden barrel sewer, 371 ft...	$40	$29	$41
4-ft. brick sewer, 79 ft...........	25	35	51

Philadelphia, Pa.—The Fin. Com. of Council is stated to have made the following recommendations: $100,000 for the Market St. sewer, $200,000 to complete the Aramingo sewer system, to the Bureau of Highways $100,000 for repairing, altering and extending sewers and inlets, and to the Bureau of Surveys $60,000 for branch sewers and inlets; $100,000 for main sewers, $100,000 for the McKean St. relief sewer and $100,000 for the Cobocksink relief sewer.

Schenectady, N. Y.—The City Council is stated to have passed a resolution providing for an increased expenditure of $125,000 for sewers.

Hazelton, Pa.—City Engr. Cellax estimates the cost to arch Mill Creek at $8,574. He also estimates the cost of paving Wyoming St., 5,885 sq. yds., as follows: Brick, $12,359; Bituminous macadam, $13,241, and sheet asphalt, $14,124.

Brooklyn, N. Y.—The Bd. of Estimate is reported to have granted $749,000 for the completion of the Foster Ave. sewer.

Belleville, Ill.—G. W. Beinecke, City Clk., writes that it is proposed to construct a sewer in W. Main St., at a cost of $14,000. Louis Graner, Engr. in Charge.

St. Paul, Minn.—A press report states that $250,000 will be expended next year for sewers, and $300,000 for paving.

Cedar Falls, Ia.—The City Council is reported to have divided the city into sewer districts, which is the beginning of a very extensive system, which will be established and added to as the city grows. At present there is no sewer system. Several sewers are in existence, but each is perfect in itself and are not all connected. The plan now outlined provides for a sewer system costing between $100,000 and $200,000.

Grand Rapids, Mich.—A press report states that Alderman Hilton has a plan for a system of sewers at the base of the hill bluffs running from East Bridge St. to Coldbrook St. They are to be storm water overflow sewers, 7 of them, and not connected in any way.

Rockford, Ill.—The Com. of Sewers is stated to have decided to ask for an appropriation of $14,000 for sewer building. One-half of this is to be expended on the east side and an equal amount on the west side of the river.

Ft. Scott, Kan.—Contracts will soon be let for a sewer, and 22 blocks of brick paving. U. S. Stoner, City Engr.

South McAlester, Ind. Ter.—See "Water."

Beaumont, Tex.—Bids will be received Jan. 6 by Thos. H. Langham, Mayor, for the following bonds, $75,000 for sewerage, $75,000 school, $95,000 paving and $40,000 for city hall.

Moscow, Idaho.—The City Council is reported to be considering the construction of a sewerage system, and have asked Otto Welle, of Spokane, Wash., to visit the city and prepare estimates, etc.

Portland, Ore.—Local press reports state that the following bids were opened Dec. 16 by the Bd. of Pub. Wks. for the Cook Ave. sewer: John Kiernan, $82,303; Jacobsen-Bade Co., $81,100; Frsiney, Sweeney & Keating, $77,960, and J. B. Slemmons, 348 Yamhill St., $69,838.

Hawkesbury, Ont.—See "Water."

BRIDGES.

Providence, R. I.—A resolution has been passed by the City Council authorizing the issue of $120,000 for building the bridge and retaining walls in the rear of the site for a Post Office on Exchange Place.

Fall River, Mass.—The building of a bridge between Fall River and Somerset is again reported to be under consideration.

Boston, Mass.—The Cambridge Bridge Comn. is reported to have voted to annul the contract made last April with the Cape Ann Granite Co. for furnishing cut stone for the 2 central piers of the new bridge, and have also voted, according to reports, to award said contract to the Rockport Granite Co.

Greenfield, Mass.—An agreement is reported to have been reached between the Grade Crossing Comrs. and the officials of the Boston & Maine R. R. to do away with the grade crossing at Sprout's Crossing, in South Deerfield, by building a bridge, estimated to cost $25,000.

Essex, Mass.—It is stated that a steel bridge is to replace wooden structure at Main St.

New York, N. Y.—Comr. Lindenthal is reported to have instructed the engineers to prepare plans for the Blackwell's Island Bridge according to the suggestions made by the Mayor's Special Comn. The plan is to have a bridge 91 ft. wide.

Newtown, Pa.—The Co. Comrs. have awarded, according to press reports, the contract for building a bridge at Jefferson Ave., Newtown, to the Wynkoop-Breley Co., for $6,590.

Baltimore, Md.—Local press reports state that a bridge is to be built across the middle branch of the Patapsco River at Spring Garden by the Wabash R. R. Co.

Philadelphia, Pa.—The Finance Com. of Councils on Dec. 18 made the following recommendations: To the Bureau of Highways, $15,000 for general repairs to bridges, and to the Bureau of Surveys, $150,000 for new bridges and $20,000 for the reconstruction of bridges over Poquessing Creek, on the line of Frankford Ave.

Trenton, N. J.—It is stated that the building of a bridge across the Canal connecting the plants of the Trenton Fire Clay & Porcelain Co. and the Mott Iron Co. is being considered.

Lewisburg, Pa.—The Comrs. of Northumberland & Union Counties have petitioned the State Bd. of Property, at Harrisburg, to construct a bridge across Susquehanna River at Lewisburg.

Pine Grove, Pa.—The Comrs. appointed by Dauphin Co. Court have recommended by the State the building of a steel bridge across Schuylkill River, near Auburn, to cost about $10,000.

Allegheny, Pa.—An ordinance has been passed by the Select Council authorizing the Western Bridge Co. to construct and maintain a bridge across Ohio River from Wilkins St. to McKees Rocks.

McKees Rocks, Pa.—The Boro. Council has voted to build a bridge across Chartiers Creek, at Singer Ave.

Utica, N. Y.—The lowest bid received for building a culvert on Welsh Bush Road is reported to have been submitted by the Dwyer Construction Co. at $5,420.

Erie, Pa.—An ordinance has passed 3d reading in the City Councils authorizing the issue of $15,000 bonds as the city's portion of the cost of overhead crossing on Buffalo Road.

Jacksonville, Fla.—The Bd. Pub. Wks. has received from the Jacksonville Electric Co., with their approval, plans for a viaduct to be built in this city.

Berkley, Va.—The Bd. of Superv. intend building, at a cost of about $5,000, a steel bridge across Pascara Creek at Maple Ave.

Bay City, Mich.—The Bay County Bridge Comn. is contemplating the substitution of steel for the present wooden floor systems of the Cass and Lafayette Ave. bridges, and also other changes. Each bridge is about 650 ft. long. Blomshield & McCloy, of Bay City, are the Consulting Engineers.

Port Huron, Mich.—Mayor-elect Graves is reported to be in favor of building a cantilever bridge at Military St.

Milwaukee, Wis.—The Board of Pub. Debt Comrs. have approved the bond issue of $150,000 for a bridge to Jones Island. The bonds, according to local press reports, will be sold early in January.

Fairmount, W. Va.—The building of a bridge across Monongahela River, to replace present structure at Washington St., is reported to be under consideration.

Youngstown, O.—Press reports state that the United States Steel Co. has accepted plans for a viaduct to be built by the Steel Co. across Mahoning River.

Columbus, O.—The South Side Business Improv. Assoc. is reported to be interested in the building of a viaduct at South High St.

Chicago, Ill.—The following bids for the substructure of the North Western Ave. bridge were received by F. W. Blocki, Comr. of Pub. Wks., Dec. 15: Fitzsimmons & Connell, $80,273; Lydon & Drews, $87,065; Jackson & Corbett, $92,767.

Steubenville, O.—The bridge which it is proposed to build across Ohio River at Market St. will cost, according to press reports, about $300,000.

Cincinnati, O.—The question of issuing $175,000 bonds for the purpose of constructing the Grandin Road viaduct is reported to be under consideration.

The Bd. Pub. Service has instructed Engr. Stanley to prepare plans and specifications and estimate of cost of a viaduct to be built from Fourth and Pike Sts. to Mt. Adams.

St. Paul, Minn.—The building of a bridge from Jackson to Eaton Sts. is being agitated.

Duluth, Minn.—The City Engr. is preparing estimates of the cost of replacing about 35 bridges in the 8th Ward, which are said to be worn out.

Oshkosh, Wis.—The City Council is stated to have adopted plans prepared by Erickson & Lehman, of Chicago, for a $6,000 bridge to be built across Sawyer Creek, and bids will be received by the Bd. of Pub. Wks. Jan. 5.

Milwaukee, Wis.—It is reported that the Com. on Bridges has rejected the bid of the Milwaukee Steel Structural Co. for the Muskegon Ave. bridge. The price was reported to be $93,800.

A resolution has been passed by the Common Council calling for bids for a bascule bridge to be built at West Water St.

Chicago, Ill.—Local press reports state that the Jackson & Corbett Co. submitted to the Drainage Bd. the only bid for the superstructure of the proposed new bascule bridge at Harrison St., at $159,000.

Mt. Carroll, Ill.—It is stated that the proposition to issue $3,000 bonds to build a bridge in Elkhorn Grove Townships, Carroll Co., carried at the recent election.

Ashland, Wis.—The Bd. of Pub. Wks. has, according to reports, authorized the rebuilding of St. Clair St. bridge.

Newton, Ia.—Bids will be received Jan. 5 by the Co. Bd. of Superv. for furnishing bridge material for the ensuing year. Joe Horn, Co. Aud.

Brookfield, Mo.—L. F. Goodale, of St. Louis, Ch. Engr. Hannibal & St. Joseph R. R. Co., writes that it is proposed to rebuild the steel bridge over Yellow Creek which recently collapsed.

Lake Charles, La.—The Police Jury is reported to be preparing to let the contract for building a 124-ft. steel span bridge across English Bayou.

Arkadelphia, Ark.—M. C. Hasselle, Chattanooga, Tenn., has submitted to the Co. Comrs. plans and specifications for a steel bridge to be built across Ouachita River, this city, at a cost of $25,000.

San Antonio, Tex.—The City Council has passed an ordinance requiring the Southern Pacific R. R. to build a viaduct at Walnut St.

White Eagle, Okla. Ter.—See "Government Work."

Stockton, Cal.—Bids will be received Jan. 6 by W. B. Hamilton, Clk. of Bd. of Superv. of Sacramento Co., at Sacramento, for constructing a joint steel drawbridge over the Mokelumne River, between Sacramento and San Joaquin Counties, at Miller's Ferry.

Spokane, Wash.—Local press reports state that the City Comrs. will soon ask for bids for improving the south end of Monroe St. bridge, for the filling in and extending of Main Ave. to the bridge, which has been roughly estimated by City Engr. A. F. Gill at $30,000. The plans call for the tearing out of the south end of the bridge, the building of a new stone pier and the construction of a 10-ft. steel girder span extending over the road into Peaceful valley and the moving of the present 50-ft. steel span over the road to the extreme south end of the bridge.

PAVING AND ROADMAKING.

Gloucester, Mass.—The City Council has passed an order to issue $50,000 bonds for the layout and extension of Rogers St.

Bridgeport, Conn.—City Engr. Scofield estimates the cost of paving East Main St. at $10,425 and Broad St. at $13,750.

Springfield, Mass.—The Common Council has approved of the issue of $125,000 bonds to be used for the Court Square extension.

Philadelphia, Pa.—The Fin. Com. of Council has made the following recommendations: To the Bur. of Highways, $75,000 for paving intersections of streets in front of unassessable property, $150,000 for repairs to paved streets, $250,000 for repaving and maintaining unpaved and gravel streets, $100,000 for surfacing and resurfacing roads and streets, and $50,000 for repairs to asphalt streets.

The Select Council has passed an ordinance making 21st St. a Fairmount Park driveway, and authorizing the removal of car tracks from it.

The Council on Dec. 22 passed ordinances providing for a $2,500,000 driveway from Torresdale to Broad and Cayuga Sts., and apropriating $80,000 to repave streets with improved pavements, not occupied by passenger railways.

Somerville, N. J.—The Somerset Co. Bd. of Chosen Freeholders has, according to local press reports, awarded to Richards & Gaston, of Raritan, the contract to macadamize the road from Woods Tavern to Neshanic Station, for $36,509.

Pittsburg, Pa.—Local press reports state that bids recently received for the $550,000 Allegheny Co. bonds have been rejected.

New York, N. Y.—The following bids were opened Dec. 23 by J. A. Cantor, Boro. Pres., for repaving with asphalt on present pavement relaid as foundation, 23d St., from 6th to 10th Aves.—A, Barber Asphalt Paving Co.; B, Uvalde Asphalt Paving Co.; C, Continental Asphalt Paving Co.; D, Sicilian Asphalt Paving Co.:

Bidders.	Asph., 14,220 sq. yds.	Relay, 11,560 sq. yds.	Concrete 360 cu. yds.	New curb, 6,200 ft.	Old curb, 350 ft.	Manhole covers, 26.
A........	$2.56	$0.45	$4.95	$0.82	$0.38	$20.00
B........	1.85	.42	6.00	.85	.35	20.00
C........	1.20	.36	5.00	.72	.30	21.00
D........	1.10	.30	5.00	.80	.30	17.00

St. George, S. I.—The Local Bd. of Pub. Improv. has been petitioned to regulate, grade, and pave with brick on portions of numerous streets, estimated to cost in all $218,000.

Binghamton, N. Y.—The macadamizing of a portion of Front St. is being considered.

Rochester, N. Y.—The Park Bd. is said to be considering the building of a boulevard on the west bank of the river.

Ithaca, N. Y.—The Bd. of Superv. has made an appropriation of $18,000 to macadamize Catskill turnpike under the provisions of the Higbie-Armstrong act.

Harrisburg, Pa.—Local press reports state that the contract for paving with sheet asphalt and curbing with granite on Market St. has been awarded to the Barber Asphalt Paving Co. at $1.98 per sq. yd. for paving, $1.23 per lin. ft. for curbing, and 25 cts. per lin. ft. for resetting curb. About 1,375 sq. yds. of pavement is to be laid and 1,530 lin. ft. of new curbing.

Allegheny, Pa.—The Select Council has passed the following resolutions: Submitting to a vote the question of increasing the city's indebtedness $7,490 for the grading, paving and curbing of Drum St.; authorizing the issuing of $15,527 bonds for the grading and paving of Woodland Ave., and $8,242 for a like improvement of Norwood Ave.

Pittsburg, Pa.—The Bds. of Select and Common Councils have passed ordinances authorizing the grading, paving and curbing of Homer St., from Negley to Haights Aves., estimated to cost $8,500, and the grading, paving and curbing of Breedshill St., from Winebiddle to Pacific Aves., estimated to cost $12,800.

Hazelton, Pa.—See "Sewerage and Sewage Disposal."

Brooklyn, N. Y.—The following bids were opened Dec. 24 by J. Edw. Swanstrom, Boro. Pres., for asphalt pavt. on Hinsdale St. from Atlantic to Sutter Aves.: 7,825 sq. yds. asphalt, Uvalde Asph. Pavg. Co., $1.60; Cranford Co., $1.30. 1,090 cu. yds. concrete, Uvalde, $5, and Cranford, $5. 18 manhole covers, Uvalde, $4, and Cranford, $5.

Charlottesville, Va.—Local press reports state that the question of issuing $80,000 street improvement bonds voted upon Dec. 17 resulted in favor of said issue.

Lynchburg, Va.—Press reports state that the Co. Comrs. intend purchasing a road roller.

Wilmington, N. C.—The Bd. of Audit & Finance has concurred in the appropriation of $20,000 made by the Bd. of Aldermen for the permanent improvement of streets, with the understanding that all material necessary for the improvement must be contracted for.

Portsmouth, Va.—City Engr. Bascom Sykes writes that the following bids were opened Dec. 22 for paving: For sheet asphalt with 7,000 ft. 4-in. curb, 3,500 sq. yds. granite block, 41,300 sq. yds. asphalt and repairs per sq. yd. for 5 yrs.: Cleveland Trinidad Pav. Co., Cleveland, 56 cts., $2.51, $2.18 and $3.00 respectively; total, $102,739. Southern Pavg. & Constn. Co., Chattanooga, 46 cts., $1.96, $1.92 and $2.25; total, $89,376. Warren Bros. Co., New York, 49 cts., $1.97, $1.93 and $1.93; total, $90,034. For 41,300 sq. yds. vitrified brick, Frank Pidgeon, Saugerties, 60 cts., $2.50, $2.45 and $4; total, $114,135. Va.-Carolina Constn. Co., Norfolk, 55 cts., $1.69, $2.31 and $2.31; total, $105,168. Cranford Pavg. Co., Washington, 75 cts., $2.60, $2.99 and $3.50; total, $137,837. Patterson & Briesen, Baltimore, 50 cts., $1.97, $2.53 and 15 cts.; total, $114,884. For bituminous macadam, Warren Bros. Co., N. Y. City, 49 cts., $1.97, $2.03 and $2.03; total, $94,164. Granite block: Southern Pavg. & Constn. Co., $1.97; total, $88,256. Va.-Carolina Constn. Co., $1.69; total, $75,712. Cranford Pavg. Co., $2.69; total, $120,512. Patterson & Briesen, $1.93; total, $86,464.

St. Paul, Minn.—See "Sewerage and Sewage Disposal."

Marinette, Wis.—The Bd. Pub. Wks. is reported to be preparing plans for macadamizing portions of several streets and for paving with brick on a portion of Vine St.

Lansing, Mich.—City Engr. Collar estimates the cost of paving with brick on Michigan Ave., from the Michigan Central Ry. to east line of Pennsylvania Ave., at $13,518.

Ft. Dodge, Ia.—The Barber Asphalt Paving Co., Chicago, has been awarded the contract for 29,836 sq. yds. asphalt paving at $1.99 and 16,628 ft. combined curb and gutter at 75 cts., total $71,053. The Standard Pavg. Co., Chicago, bid $2.15 on asphalt and 76 cts. on curb and gutter, total $76,828.

Lafayette, Ind.—Bids will be received by the Tippecanoe Co. Comrs. until Feb. 14 for paving the Main St. levee with sheet asphalt, cement sidewalk and cement curb and gutter. Estimated quantity, 6,800 sq. yds. pavement, 2,500 lin. ft. curb and gutter and 14,000 sq. ft. cement walk.

Sioux City, Ia.—The City Council will order 34,000 lin. ft. of paving to be done in 1903; 24,000 ft. will probably be asphalt, 10,000 lin. ft. brick. J. M. Lewis, City Engr.

Washington, Ia.—Local press reports state that the City Clerk will receive bids Jan. 15 for paving, with brick, on 12 blocks in the business portion of the city.

Menasha, Wis.—Local press reports state that John O. Jones, of Racine, submitted the lowest bid for paving Church St. at $6,684.

Saginaw, Mich.—Resolutions have been adopted by the Common Council to instruct the City Engr. to prepare plans, specifications and estimates of the cost of paving, with waterproof bituminous macadam, a width of 20 ft., on 3d St., and brick gutter on each side, 3 ft. wide, on a 6-in. concrete foundation, also for paving a width of 38 ft. in the center of Ames St. with similar macadam, and a brick gutter on each side 5 ft. wide, laid in a 6-in. concrete foundation.
The Pavement & Sewers Com. has decided to recommend the paving of Holland Ave., 30 ft. wide, with bituminous macadam, with brick gutters and cement curbs.

St. Joseph, Mo.—Resolutions have been passed by the Municipal Assembly for paving a portion of Jones St. with brick and for remacadamizing a portion of 15th St.

Lima, O.—The City Council has adopted resolutions for the grading, draining, curbing and paving with sheet asphalt portions of Cole St. and Lakewood Ave., also a portion of Jameson Ave., with vitrified brick.

Crookston, Minn.—Mayor Hitchcock has signed the contract with the Barber Asphalt Co. for paving with asphalt the business streets of the city. Estimated cost, $60,000.

Faribault, Minn.—It is stated that the City Council has decided to pave the streets in the business section of the city next season.

Milwaukee, Wis.—The Common Council has passed a resolution to issue $200,000 street improvement bonds.

Toledo, O.—Bids will be received Jan. 19 by Chas. H. Nauts, City Clk., for furnishing material and improving portions of 11th St. by paving with block on a concrete foundation or with asphalt block on the present sand foundation.

Cleveland, O.—The City Council has adopted resolutions to grade, curb and pave with asphalt on a 6-in. concrete foundation a portion of Crawford Pl. and to improve, similarly, portions of numerous streets, paving with brick.

Nevada, Mo.—The City Council has ordered resolutions drafted for paving Cherry St. with vitrified brick or asphalt, about 30,000 yds. J. M. Clack, City Engr.

Seattle, Wash.—The Bd. Park Comrs. and the City Engr. are considering the building of a system of boulevards, embracing about 50 miles.

Ft. Collins, Colo.—Bids will be received Jan. 15 by the Co. Comrs. for constructing about 20 miles of road for Larimer Co. John E. Ramer, Co. Clk.

Woodstock, Ont.—The City Council has adopted a resolution to pave with vitrified brick on Dundas St., at an estimated cost of $21,000.

POWER PLANTS, GAS AND ELECTRICITY.

Montague, Mass.—The State Gas & Electric Light Comn. is reported to have received a petition from the Dirs. of the Montague Electric Light & Power Co. for approval of an issue of stock to the amount of $20,000, to be used in establishing an electric light and power plant for private and public use within the town.

Boston, Mass.—The School House Com. have under consideration the following bids for installing electric work in the school to be erected on Norman St., West End: Edwin C. Lewis, $13,488; Erickson Equipment Co., $16,983; Jas. Wilkinson & Co., $13,491; Thos. W. Byrne, $14,450; D. Ross & Co., $12,309; Clark & Mills, $11,664; Lord Electric Co., $13,421.

Kent Furance, Conn.—A press report states that the New Milford Power Co. has been incorporated, with a capital of $1,000,000, to construct a dam across the Housatonic River at Kent Furnace, and another at the Great Falls, Falls Village.

Hammonton, N. J.—W. S. Graham, of Philadelphia, Pa., and Chas. E. Starr, of Camden, are stated to have petitioned the Council for a franchise to lay 5 miles of gas mains in the town. They propose to build a plant to cost $30,000.

Edwardsville, Pa.—The Boro. Council is stated to have granted a franchise to the Shawnee Electric Light Co., of Plymouth.

Utica, N. Y.—The Ways & Means Com. of the Bd. of Superv. is stated to have presented to the Bd. a resolution appropriating $10,000 for a new power house and boilers at the County House.

Philadelphia, Pa.—The Fin. Com. of Councils has recommended an appropriation of $309,891 for lighting with naphtha and Welsbach lamps.

Patchogue, L. I., N. Y.—The Town Bd. is stated to have granted on Dec. 20 a franchise to the Patchogue Gas Co.

Philadelphia, Pa.—The Select Council has passed an ordinance granting the Philadelphia Electric Co. permission to construct, acquire, maintain and operate a system of electric lighting, heat and power.

Glens Falls, N. Y.—A press report states that the Hudson River Water Power Co., which is building a dam at Spier Falls, has voted to increase its capital from $2,000,000 to $5,000,000. The increase will be used principally in constructing 2 more dams. One will be on Hudson River, 6 miles above the Spier Falls dam; the other on Sacandaga River, near Conklingville.

Erie, Pa.—The Erie Gas Co. is stated to have secured the contract for lighting 519 gas lamps for 5 yrs., at $18.75 per lamp per yr.

York, Pa.—An ordinance has been introduced in Select Council granting to the People's Steam Htg. Co. the right and privilege of laying pipes in the city.

Canandaigua, N. Y.—The Village Bd. is stated to have granted a franchise to the Lima Gas Co.

Portsmouth, Va.—An ordinance is stated to have been introduced in Council providing that the Com. on Finance & Lights and the City Engr. be authorized to look into the feasibility of the city constructing an electric plant or acquiring one of those already in operation here.

Hamlet, N. C.—A charter is stated to have been granted to the Hamlet Electric Light Co., with a capital of $100,000, to construct an electric light plant. Incorporators: Geo. O. Sanders, F. C. Allen, and others.

Appleton, Wis.—A press report states that O'Keefe & Orbison, of Appleton, are preparing plans for a water power improvement on Clinch River in Western Virginia for a company of Cleveland capitalists, who will erect a barytes mill with a capacity of 100 tons a day. The plans include a concrete dam, which will develop about 1,800 H.-P.

Lansing, Ia.—See "Water."

Brazil, Ind.—The Putnam Electric Co. has been incorporated, with a capital of $25,000, to construct and operate plants to furnish heat, light and power in Putnam County. John G. Bryson and Jas. N. Halstead, of Brazil, are among the incorporators.

St. Paul, Minn.—The Bd. of Aldermen and Assembly on Dec. 18 voted to award the contract for supplying gas for street lighting next year to the St. Paul Gaslight Co., at $16 a post, and for furnishing the lamps and caring for them to the Cleveland Vapor Light Co., at $10.50 a post.
The St. Paul Gaslight Co. is also reported to have secured the contract for lighting the city with electricity during next year.

Cleveland, O.—The only bid submitted Dec. 23 for furnishing, lighting, extinguishing and keeping in repair electric lamps, for 1 year, was from the Cleveland Electric Illuminating Co. for 450 watts overhead service, $77.88, and 450 watts underground service, $92.76.

Crystal Falls, Mich.—Bids will be received by the Bd. Pub. Wks. until Jan. 10 for 2 generators, etc., as advertised in The Engineering Record.

Grand Rapids, Wis.—A press report states that the Consolidated Water Power & Paper Co. announce that they will harness up the water power at this point of Wisconsin River the coming spring and summer. They will construct a dam 1,700 ft. long, 40 ft. wide at the base and 12 ft. at the top and will develop 7,000 H.-P., half of which will be used by the company for its paper mill and the remainder to develop electrical power for rent. It is estimated that $500,000 will be spent on the improvements. J. C. Jacobson is now preparing plans and will supervise the construction.

Detroit, Minn.—E. J. Bestick, Recorder, writes that the citizens voted on Dec. 17 to issue $14,000 bonds for the purchase of the electric light plant.

Cincinnati, O.—Bids are wanted Jan. 5 for improving Grandview Ave. by grading, curbing and macadamizing the roadway; also on Jan. 19 for improving Westwood Ave. in a similar manner, paving the roadway with brick and constructing the necessary drains. Robert Allison, Pres. Bd. Pub. Service.

Freeport, Ill.—Petitions have been presented to the Bd. of Local Improv. for 60,000 sq. yds. of macadam and 30,000 lin. ft. cement curb and gutter. G. W. Graham, City Engr.

St. Louis, Mo.—Contracts are stated to have been awarded on Dec. 12 as follows by the Bd. of Pub. Improv.: In the City Hall, for elevators to the Otis Elevator Co., $11,116; for the lighting apparatus to the Westinghouse Electrical Mfg. Co., $12,750, and for engines to the Chase Engine Mfg. Co., $13,453; at the Insane Asylum, for electrical apparatus, the Frank Adams Electrical Co., $5,689, and for engines to Brownell & Co., of Dayton, O., $3,330.

Danville, Ky.—A. T. Maltby, of Chicago, Ill., is reported to be here for the purpose of estimating the cost of a municipal electric plant. The citizens will soon vote on the issue of bonds for same.

Kansas City, Mo.—The Kansas City Electric Light Co. is stated to have secured the contract for lighting the city with arc lights of 2,000 c. p. at $65 per light per yr.

Norman, Okla. Ter.—The Norman Lighting Co. is reported incorporated, with a capital of $15,000, by Jas. Chenoweth, of Oklahoma City, and Henry Ulen, Jr., and Saml. Perratt, of Indianapolis, Ind.

Newkirk, Okla. Ter.—The City Council is stated to have granted the Newkirk Gas & Mineral Co. a franchise to construct and operate a gas plant.

Kaufmann, Tex.—The Kaufmann Electric Light Co., of Kaufmann, has been incorporated, with a capital of $25,000. Incorporators: M. A. Joy, S. E. Noble and W. S. Catlin.

Terrell, Tex.—The Terrell Electric Light Co., of Terrell, has been incorporated; capital, $25,000. Incorporators: S. E. Noble, M. M. Raley and M. A. Joy.

Lexington, Ky.—H. T. Duncan, Mayor, writes that the only bid received Dec. 23 for lighting the streets by electricity for 5 years was from the Lexington St. Ry. Co. at $78.50 per light per yr. for all night lighting.

Lewisburg, Tenn.—The citizens are reported to have voted Dec. 17 to issue $5,000 bonds to purchase an electric light plant.

St. Joseph, Mo.—An ordinance has been introduced in Council to grant a franchise to John I. Zeidler, John I. Rinaker, Jr., and John Murphy to operate a hot water heating and electric lighting plant here.

Aberdeen, S. D.—It is reported that the Aberdeen Gas Co. contemplates the purchase of a new electric light plant, to cost $30,000, if granted a new franchise.

Havre, Mont.—See "Water."

Beaumont, Tex.—See "Sewerage and Sewage Disposal."

Owen Sound, Ont.—Bids will be received Dec. 29 by A. J. Spencer, Town Treas., for $39,000 bonds, proceeds to be used for extending gas light plant; also $36,000 bonds for extending electric light plant.

ELECTRIC RAILWAYS.

Weston, Mass.—The Selectmen are stated to have granted the Newton St. Ry. Co. a franchise to construct a line over North Ave. from Waltham to Lincoln, a distance of about 2½ miles.

Methuen, Mass.—The Lawrence & Methuen St. Ry. Co. is stated to have purchased a site on the Howe road in Methuen, on which a power house will be constructed.

Manchester, N. H.—The Aldermen have granted permission to the Manchester St. R. R. to extend its tracks in various parts of the city and make other improvements. J. Brodie Smith, Mgr.

Taunton, Mass.—The Taunton, Assonet & Fall River Electric Ry. Co. has been recommended a franchise to run its cars to the east side of Taunton River, the line to be built in 11 months.

Sandwich, Mass.—The Sandwich, Hyannis & Chatham St. Ry. Co. has been incorporated to extend the Middleboro, Wareham & Buzzard's Bay Ry. into the heart of Cape Cod. The new line will be 45 miles long, extending from Sandwich station to a point near the Chatham light. Directors: Horace B. Parker, of Newton; Fletcher Clark, of Sandwich, and others.

Sandisfield, Mass.—The Selectmen are stated to have granted a franchise to the Winsted-Lee Trolley Co.

Littleton, Mass.—The Town Trus. are stated to have granted a franchise to the Lowell & Fitchburg St. Ry. Co.

Spencerport, N. Y.—The Albion Ry. Co. is stated to have secured right of way through Spencerport and Middleport.

Troy, N. Y.—The Forest Park Ry. Co., of Troy, has been incorporated, with a capital of $20,000, to build and operate an electric railway, 2 miles long, from Pawling Ave. to the town of Brunswick. Directors: Jos. A. Leggett, Arthur G. Sherry, and others, all of Troy.

Elmira, N. Y.—The Elmira & Waverly Electric R. R. Co. is stated to have secured the entire right of way for its line from Elmira to Waverly, and work on its construction will probably soon commence. H. B. Rhymer, Pres.; John M. Diven, Secy.

Irvington, N. J.—The Council has passed on second reading the ordinance granting a franchise to the Essex Cross Ry. Co.

Atlantic City, N. J.—The Atlantic City & Suburban Traction Co. is stated to have secured a franchise to extend its line through Egg Harbor Township.

Weehawken, N. J.—The New York Central R. R. is reported to have contracted with the General Electric Co. and Westinghouse, Church, Kerr & Co. for the installation of steam engines and electric alternating current generators at its Weehawken station. The company is reported to be expending about $50,000 on its electrical plant at this point.

Mt. Holly, N. J.—The People's Traction Co. is stated to have petitioned the County Bd. of Freeholders for a franchise to construct an electric railway between Mt. Holly and Burlington.

New York, N. Y.—The Mayor has signed the ordinances passed last week granting tunnel franchises to the Pennsylvania R. R. Co. and the New York & Jersey Tunnel Co.

New Martinsville, W. Va.—Homer McKinley, of Salem, W. Va., is reported interested in the construction of an electric railway to connect Salem, Clarksburg and probably New Martinsville.

Rockford, Ill.—It is stated that the Southeastern Wisconsin Electric Ry. Co. will probably construct a line to connect the Rockford, Beloit & Janesville line with Green Bay. G. W. Knox, of Chicago, is reported interested.

Byesville, O.—The City Council is stated to have granted a franchise to the Consolidated Ry. Co. of Cambridge

Genesco, Ill.—The Council is stated to have granted a franchise to the Kewanee, Cambridge & Geneseo Ry. Co.

Battle Creek, Mich.—The City Council is stated to have granted a franchise to the Jackson & Battle Creek Interurban Ry. Co.

Toledo, O.—The Toledo, Fostoria & Findlay Ry. Co. is reported to be preparing to extend its line. A new power house will be constructed at some point between Toledo and Fostoria. W. Nusbaum, Ch. Engr., Cincinnati.

Evansville, Ind.—Chas. Laval, of Evansville, is reported interested in the construction of an electric railway from Evansville to Henderson.

The Evansville & Newburg Interurban Ry. Co. will probably be extended to Rockport, a distance of 23 miles. G. Muhlhausen, Supt., Evansville.

New Albany, Ind.—The City Council is stated to have granted a franchise to the New Albany St. Ry. Co.

Indianapolis, Ind.—Chas. L. Henry is reported interested in the construction of an electric railway from Indianapolis through Rushville to Connersville.

Moorhead, Minn.—The Council is stated to have granted a franchise to Attorney Morrill, of Fargo, N. D.

Duluth, Minn.—A. C. Volk & Co. are stated to have petitioned the Council for a franchise to construct an electric railway in West Duluth, about 6 miles in length.

Toledo, O.—The Toledo, Port Clinton and Lakeside Ry. Co. is reported formed, with a capital of $10,000, to construct an electric railway with terminus at Toledo and Lakeside; length of proposed line 50 miles. Incorporators: H. R. Klauser, L. E. Flory, and others.

Creston, Ia.—The Collins Construction Co., of Chicago, Ill., is stated to have secured the contract for constructing the railway for the Creston Electric Light, Ry. & Power Co. from Creston to Winterset, the road to be completed by Jan., 1904.

St. Louis, Mo.—The Elevated Electric Ry. Co., of St. Louis, is reported incorporated, with $100,000 capital, by John Dwyer, Chas. Erd, and others, to build and operate a double track elevated street railway.

Bonner Springs, Kan.—The Iola Electric R. R. Co. is stated to have secured a franchise to extend its line to Bonner Springs.

Paris, Ky.—The Bourbon Fiscal Court is stated to have granted Claude M. Thomas, C. C. Clark and Webb Bratton a franchise to build an electric line from Paris along the Paris, North Middletown, Flat Rock, Plum Lick and Cane Ridge turnpikes.

Jackson, Miss.—A company is reported formed, with a capital of $200,000, to construct a belt road around the town, and through the suburbs. J. B. Harris, Pres., J. J. Coman, Secy.

Nashville, Tenn.—Engineers representing Ford, Bacon & Davis, of New York, N. Y., are stated to have arrived in Nashville to take up the work of rebuilding and re-equipping the Nashville St. Ry. The work will require 1½ years and will cost $1,500,000.

Purcell, Ind. Ter.—The Purcell & Lexington St. Ry. Co. has been incorporated, capital $100,000, to build and operate an electric railway between Purcell and Lexington, Okla. Ter. Wm. T. James, Thos. C. Woods and J. F. Sharp, are the incorporators.

Omaha, Neb.—The entire street railway system of Omaha and South Omaha, the Omaha and Council Bluffs bridge which operates the street railways of Council Bluffs and the Lake Manawa & Courtland Beach suburban lines are reported to have consolidated. The consolidated lines comprise 200 miles of track. The capital of the new company will be $6,000,000, and Frank Murphy, present head of the Omaha system, will be president of the combined companies. General office to be located in Omaha. It is reported that about 200 miles of suburban electric lines will be constructed in Eastern Nebraska and Western Iowa. Seligman & Co., Bankers, of New York, N. Y., will finance the new company.

RAILROADS.

Windsor Locks, Conn.—The Windsor Locks R. R. Co. has been incorporated, with a capital of $40,000, to construct a railroad about 4 miles in length from East Granby to Windsor Locks. Incorporators: Chas. E. Perkins, Hartford; W. W. Viets, East Granby; L. P. Bissell, of Suffield, and others.

New Berlin, N. Y.—The Mohawk & Hudson Valley R. R. Co. is reported to have been formed to construct an extension of the Unadilla Valley R. R. from New Berlin to Oneonta, a distance of 33 miles; capital, $500,000. Directors: Fred. F. Culver, Granville Whittlesey, Chas. S. Bartow, and others, all of N. Y. City.

Philadelphia, Pa.—The Select Council has passed an ordinance authorizing the construction of a southern terminal in Delaware Ave. by the Rapid Transit Co. and granting the company the privilege of constructing a loop from Broad and Market Sts. to Chestnut or Walnut, and east in either of these streets to 5th and Arch, returning to Broad St.

The Council on Dec. 22 passed an ordinance granting the Pennsylvania R. R. Co. permission to construct an elevated road for freight in West Philadelphia. W. H. Brown, Ch. Engr., Philadelphia.

Erie, Pa.—It is stated that the Erie & Pittsburg R. R. will construct a new line to Erie, Pa., from Thornton Junction, a distance of 20 miles. This road is reported to be controlled by the Pennsylvania Co. Thos. Rodd, Ch. Engr., Pittsburg.

Summit, N. J.—It is stated that surveys have been made for an extension of the New Orange Four Junction R. R., from New Orange to Summit, 5 miles. D. F. Dankel, Supt., New Orange.

Cincinnati, O.—Local press reports state that 28 crossings on the Pennsylvania R. R. will be abolished by either elevating the tracks over the streets or constructing viaducts over the tracks at 14 different points. The plans contemplate the extension of some streets, the closing of others, the purchase and condemnation of property, lowering the grade of streets, and constructing 7 miles of elevated railway track. W. H. Brown, Ch. Engr., Philadelphia.

Burnsville, W. Va.—Later press reports state that Gooch, Rinehart & Dennis, of Staunton, Va., have secured the contract for constructing 71 miles of railroad for the Wabash R. R. Co. from Sandy Bend to Burnsville; cost reported to be $2,500,000.

Chicago, Ill.—Calumet & Southeastern R. R. Co., of Chicago, has been incorporated, with a capital of $100,000, to construct a railroad from Calumet River in Cook County southerly to the Ohio River. Incorporators: W. S. Dye, B. L. Bacon, C. S. Barber, and others, all of Chicago.

Evansville, Ind.—John R. Walsh is reported interested in the construction of a railroad from Evansville to Terre Haute, a distance of 108 miles.

Roann, Ind.—The Wabash & Rochester R. R. Co. is stated to have secured a right of way through Roann.

Austin, Tex.—The Austin & Lockhart R. R. Co. has been incorporated, with a capital of $35,000, to construct a railroad from Austin to Lockhart, a distance of 35 miles. Incorporators: J. C. Kerbey and Wilbur P. Allen, of Austin; W. R. Davis, of Creedmoor, and others.

Hempstead, Tex.—The Velasco, Brazos & Northern Ry. Co. is stated to have decided to amend its charter, so as to extend the line from Hempstead to a point in Grimes County on the Santa Fe Road. The amendment will make the road 114 miles long.

Cleburne, Tex.—S. A. Robertson, of Orange, Tex., is stated to have secured the contract for constructing a line for the Trinity & Brazos Valley Ry. Co. from Cleburne to Mexia, a distance of about 70 miles, including grading, bridging and track-laying. B. Thompson, Ch. Engr., Hillsboro.

Jefferson City, Mo.—The White River Ry. Co., of Arkansas, has filed in the office of the Secy. of State articles of incorporation, with a capital of $3,810,000, of which $1,365,000 is to be used in Missouri. The line is to be extended from the State line to Carthage to connect with the Lexington & Southern Division of the Missouri Pacific, the length in Missouri to be 124 miles. This road will give the Missouri Pacific new lines from Kansas City and St. Louis south into Ark. and Tex.

Bowling Green, Ky.—It is reported that the Louisville and Nashville R. R. Co. will expend about $300,000 in improvements at Bowling Green. R. Montfort, Ch. Engr., Louisville.

St. Louis, Mo.—The Dirs. of the Terminal Assoc. are stated to have voted to increase the capital stock from $12,000,000 to $50,000,000, for the purpose of building an elevated loop over the levee.

Leslie, Ark.—The Leslie & Southern R. R. has been incorporated, with a capital of $3,000,000, to construct a railroad from Leslie to Little Rock, a distance of 120 miles. Incorporators: J. T. W. Tiller and Alex. C. Hull, of Little Rock; S. W. Lee, of Harrison, and others.

Los Angeles, Cal.—The Eastern Ry. Co., of New Mexico, has been incorporated, to construct a railroad from a point at or near Rio Puerto on the Santa Fe Pacific in Valencia County, N. M., to a point of connection with the Pecos Valley & Northeastern Ry. at or near Texico, near the eastern New Mexico boundary; length of proposed line, 265 miles. Principal office to be at Los Angeles. E. P. Ripley, of Chicago, Ill., Pres. Santa Fe R. R., is reported interested.

Crescent Mills, Cal.—A company is reported formed, with a capital of $1,000,000, to construct a railroad 25 miles in length, from a point on Feather River along Indian Creek to Crescent Mills. Directors: Henry H. Yard, of Belmar, N. J.; John Taresh and Carleton Gray, of Oroville, Cal.

Basin, Mont.—The Basin & Elliston Ry. Co. has been incorporated, with a capital of $300,000, to build and operate a railroad between Basin and Elliston with several branches to the principal mines in the vicinity.

Digby, N. S.—It is stated that the Digby & Sydney Ry. Co. will construct a line from Digby through Digby, Annapolis, Queens, Lunenburg, Halifax, Guysboro and Antigonish Counties to Sydney. A. J. S. Copp, Digby, is reported interested.

PUBLIC BUILDINGS.

Athol, Mass.—The plans of Geo. H. Clemence, of Worcester, are stated to have been accepted for 2-story brick town house to be erected here.

Winsted, Conn.—The contract for erecting the new Methodist Church is stated to have been awarded to E. B. Parson, of Winsted, for $32,500.

Worcester, Mass.—The City Council on Dec. 22 is stated to have authorized a loan of $300,000 for new buildings at the City Hospital, and $100,000 to build a new central police station.

New York, N. Y.—Plans have been filed for a Carnegie Library to be erected at 190 Amsterdam Ave., to cost $67,000. Architects, Carrere & Hastings, 28 E. 41st St.

Bids will be received Jan. 5 by Homer Folks, Comr. of Pub. Charities, for furnishing material and erecting a pavilion at City Hospital, Blackwell's Island.

Bids will be received Jan. 5 by Homer Folks, Comr. of Pub. Charities, for alterations to building to be known as Hospital for Convalescents, Metropolitan Hospital, Blackwell's Island.

Philadelphia, Pa.—The Dept. of Charities & Correction on Dec. 18 awarded to Henderson & Co., 1215 Filbert St., the contract for erecting 6 consumptive pavilions at the Philadelphia Hospital, for $108,894.

Stearns & Castor, Stephen Girard Bldg., are reported to be preparing plans for a 2-story stone edifice for the City Mission & Church Extension Society, to be erected at 8th and Porter Sts. Rev. C. M. Boswell, Supt.

The Fin. Com. of Councils has recommended appropriations of $150,000 for a new smallpox hospital and $100,000 for a hospital for insane.

Baltimore, Md.—Henry Walters is reported to have offered to erect and present to Baltimore another Free Bath House, at a cost of $25,000.

Syracuse, N. Y.—The County Clk. writes that it is proposed to erect a new court house for Onondaga County, to cost about $1,000,000, and that bids for the erection will be wanted in Jan. Archimedes Russell, 321 The Bastable, is the architect.

New York, N. Y.—Plans are stated to have been filed for alterations to the 5-story br. hospital at 596 Lexington Ave., to cost $25,000. Owner and architect, R. Hoe, 504 Grand St.

Bath, N. Y.—The Steuben Co. Superv. are stated to have appropriated $25,000 for the erection of a court house, at Corning.

Middletown, N. Y.—Flahive & Krowl, of Elmira, have secured the contract for plumbing improvements and reconstruction, at the Middletown State Hospital, for $14,190.

Utica, N. Y.—The contract for plumbing Wards 1 to 12, Utica State Hospital, is stated to have been awarded to the Burleson Hardware Co., of Suspension Bridge, for $8,194.

Philadelphia, Pa.—It is stated that plans are being prepared for enlarging the University Hospital, to cost $700,000.

Scranton, Pa.—C. J. Gillespie, Secy. of the Scranton Poor District, writes that bids opened Dec. 19 for erecting a group of buildings for the Almshouse at Hillside Home, have been rejected. The bids ranged from $175,000 to $189,000.

Brooklyn, N. Y.—The lowest bidder Dec. 24 for repairs and alterations to interior of Borough Hall, was W. & I. Lamb, 99 Nassau St., for $16,625.

Allegheny, Pa.—The plans of Thos. W. Boyd & Co., 409 Market St., are stated to have been accepted for an edifice for the Reformed Church of the Ascension; cost, $20,000.

New York, N. Y.—See "Miscellaneous."

Richmond, Va.—Howard H. Holt, Engr. in Charge for P. Thornton Marye, Archt., writes in regard to Virginia State Penitentiary, that contract for general construction of cell building has been let, but contracts for plumbing, heating, ventilating, lighting and power plant not yet let.

Milwaukee, Wis.—L. R. Stollberg & Co., 451 3d St., are stated to have secured the contract for plumbing the county hospital for $5,704.

Columbus, O.—Plans are stated to have been prepared by Frank L. Packard, Hayden Bldg., for an auditorium to be built to the present Eastwood Congregational Church, at 21st and Broad Sts., to cost about $40,000. Rev. J. C. Jackson, Pastor.

Boone, Ia.—The Bd. of Superv. is stated to have under consideration the erection of a building at the county farm, to cost $15,000.

Chicago, Ill.—Bids are wanted Dec. 31 for erecting 3 fire engine houses at 41 Court and Wilcox Ave. F. W. Blocki, Comr. of Pub. Wks.

Marine City, Mich.—Press reports state that the contract will be let in Jan. for erecting a $30,000 church for the Holy Cross Congregation. Address Rev. P. J. Tearns.

Toledo, O.—Bids wil be received Jan. 15 by the Bd. of Police Comrs. for the plumbing required in the Smallpox Hospital now being erected. Architect, E. O. Fallis, "The Nasby." Chas. H. Durlan, Secy. Police Bd.

Fond du Lac, Wis.—G. Jorgenson, of Green Bay, is stated to have secured the contract for erecting the Carnegie Library, for $32,992.

Des Moines, Ia.—The plans of Proudfoot & Bird, Crocker Bldg., are stated to have been accepted for the Iowa Building to be erected at St. Louis, Mo., on the grounds of the Louisiana Purchase Exposition; cost, $44,000.

St. Louis, Mo.—M. P. Stevens, Secy. Dir. of Wks. of St. Louis Purchase Expo., writes that Henry W. Schlueter, Marquette Bldg., Chicago, Ill., has secured the contract for erecting the Transportation Bldg., for $692,000.

Lake Charles, La.—Bids are wanted Jan. 6 for erecting a city hall and jail. Architect, W. L. Stevens, Crowley, La. S. O. Shattuck, City Clk.

Louisville, Ky.—Local press reports state that the Bldg. Com. of the Kentucky Exhibit Assoc. has extended the time for the Kentucky Archts. to submit plans and specifications for the Kentucky Bldg. at the World's Fair, from Jan. 15 to Feb. 1.

The General Council has appropriated $100,000 with which a site for the Carnegie Library will be purchased. As soon as the deed to the property is sent to Mr. Carnegie he will send to the city $250,000 for the erection of building.

St. Louis, Mo.—The Second Baptist Congregation is reported to be planning to erect a $25,000 church on King's Highway, near McPherson Ave. Luther E. Smith, Treas.

Beaumont, Tex.—See "Sewerage and Sewage Disposal."

Henderson, Ky.—Mundo & McGraw, of Henderson, are stated to have secured the contract for erecting the Carnegie Library, for $19,000.

Santa Rosa, Cal.—The Bd. of Library Trus. is stated to have awarded the contract for erecting the Santa Rosa Free Public Library, at 4th and E. Sts., to Wm. Peacock, of San Francisco, for $19,489.

BUSINESS BUILDINGS.

Hartford, Conn.—Isaac A. Allen, Jr., 901 Main St., is stated to have prepared plans for a building on Pearl St. for the Hartford Electric Light Co. The building will be 5 stories high and measure 48x32 ft.

The Prospect Casino at Farmington and Prospect Aves. is reported destroyed by fire Dec. 18.

Long Island City, L. I., N. Y.—The terminal of the Long Island R. R. at Long Island City, which was built in 1891, at a cost of about $200,000, was destroyed by fire Dec. 18th. W. F. Potter is Gen. Supt., Long Island City.

Philadelphia, Pa.—The Pennsylvania R. R. Co. (Div. Supt., Thos. Gucker, Philadelphia) is stated to have decided to erect a freight depot at 52d St. It will be a 2-story building and measure 30.4x138.6 ft. Architects, Armstrong & Printzenhoff.

Troy, N. Y.—It is stated that a 7-story hotel will be erected at 1st and River Sts., to cost $260,000. F. S. Robinson Contracting & Operating Co., of New York, is reported interested.

Rochester, N. Y.—The Rochester Hotel Co. is stated to have been formed, to erect a 9-story hotel on Main St. East, to cost $110,000. Henry D. Quimby, 100 Powers Bldg., is interested.

Clayton, N. Y.—Plans are stated to have been completed by Benson & Brockway, of Syracuse, for a 4-story addition to the Manatanck Clubhouse, at Prospect Park, near Clayton, to cost $100,000.

New Brunswick, N. J.—It is stated that work will soon commence on the erection of the Pennsylvania R. R. depot at Albany St. and Easton Ave., to cost $50,000.

Newark, N. J.—Permits have been issued for the erection of the following buildings: A brick storage and stable structure at Plane and James Sts. for L. Bamberger & Co., to cost $52,000—Architect, Cecil Hughes; a 2-story brick freight depot at Broad and Cross Sts. for the Lackawanna R. R., to cost $50,000, and a 3-story brick depot at Broad St., Morris an Essex R. R. Ave.

Bradford, Pa.—The Odd Fellows' Block is reported to have been destroyed by fire on Dec. 23.

Wilkinsburg, Pa.—The plans of A. Dudgeon & Son, of Wilkinsburg, are stated to have been accepted for a store and apartment house for H. B. Ford, of Punxsutawney, to cost $22,000.

Lynchburg, Va.—Frye & Chesterman, 213 9th St., are stated to have prepared plans for a hotel to be erected on Main St. by J. A. Morrison.

Harrisonburg, Va.—It is stated that the First National Bank will erect a 5-story building on the site of the present structure, to cost about $50,000.

Charleston, S. C.—H. T. Zacharias, 179 Meeting St., and L. F. Sloan are stated to have secured the contract for remodeling the Commercial Club House, for $25,800.

Jacksonville, Fla.—It is stated that a 3-story brick and stone opera house will be erected on Duval and Main Sts. A. G. Rhodes is reported interested.

Des Moines, Ia.—Huber Mfg. Co., of Richmond, Ind., is reported interested in the erection of a 6-story warehouse, 88x132 ft., at 2d and Vine Sts.

Parkersburg, W. Va.—It is stated that J. W. Dils will erect a $25,000 business building at 6th and Market Sts.

Dixon, Ill.—Morrison H. Vail, 1439 Unity Bldg., Chicago, is reported to be preparing plans for a building for the Odd Fellows, to cost $15,000.

Milwaukee, Wis.—Plans for a 4-story brick addition to the building of Stumpf & Langhoff, Grove St. and National Ave., are reported as being prepared.

The Kosciusko Assoc. of Milwaukee has been formed, with a capital of $20,000, to erect a hall.

Minneapolis, Minn.—The warehouse of the W. A. Nott Co., 111 and 113 1st Ave. S., is reported destroyed by fire Dec. 19.

Elgin, Ill.—A press report states that the Chicago, Milwaukee & St. Paul R. R. Co. will erect a $75,000 depot at Elgin. D. J. Whittemore, Ch. Engr., Chicago.

Flint, Mich.—It is stated that the Knights of the Loyal Guard will let contracts Feb. 1 for erecting a 3-story office building. F. H. Rankin, Secy.

Wichita, Kan.—It is stated that a 3-story brick and stone warehouse will be erected at Douglas Ave. and Wichita St., to cost about $15,000. Schwartz Bros. are reported interested.

Dennison, Tex.—Bids are wanted Jan. 17 for erecting the Houston and Texas Central roundhouse. C. C. Calvert, Agent.

Wichita, Kan.—It is stated that J. R. Meade will erect a $15,000 business building.

Knoxville, Tenn.—It is stated that John W. Green will erect a 5-story business building on W. Jackson Ave., to be occupied by C. M. McClung & Co.

Beaumont, Tex.—The Oaks Hotel Co. is reported incorporated, with a capital of $80,000, to erect a hotel.

New Orleans, La.—Plans are stated to have been prepared for a 12-story brick building to be erected at Canal and Chartres Sts., for A. Lehmann & Co.

Denver, Col.—It is stated that the Tivoli Union Brewing Co. will build a malthouse, to cost $75,000, on 10th between Larimer and Market Sts.

Denver, Colo.—The mill building of C. D. McPhee and J. J. McGinnity, Lumber Dealers, which was recently burned, will be rebuilt. It will be 4 stories high, 125x115 ft.

Seattle, Wash.—C. D. Stimson and A. W. Engle are reported interested in the erection of a hotel at Union St. and 4th Ave. The building will measure 120x115 ft. and cost about $50,000. Architects, Cutter, Malmbren & Wager, Exchange Bldg., Spokane.

Oakland, Cal.—It is stated that a 3 or 4-story building, 75x150 ft., will be erected on Franklin and 15th Sts. for the Sunset Telephone Co.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Broad and Marketfield Sts, 6-story br and stone office building, c, $80,000; o, The Maritime Assoc of the Port of N Y; a, Frank Freeman.

Division and Attorney Sts, 6-story tenemt and store, 3, $45,000; o & b, Saml Greenstein; a, G F. Pelham.

26 and 28 Leroy St, 6-story br tenemt and stores, c, $30,000; o, Irving Judis; a, Bernstein & Bernstein.

131 W 24th St, 6-story br warehouse, c, $30,000; o. Emma H Cannon; a, Percy Griffin.

125 5th Ave, 11-story br and stone loft and store building, c, $132,000; o, Herman Bergdorf; a, Alfred Zucker.

172 5th Ave, alterations to 5-story br store building, c, $30,000; o, H C Lytton; a, Alfred Zucker.

DWELLINGS.

Bryn Mawr, Pa.—Lindley Johnson, Harrison Bldg., Philadelphia, is reported to have been commissioned by Horatio Lloyd to prepare plans for a $25,000 stone residence, to be built at Bryn Mawr.

Pittsburg, Pa.—Ellsworth Denn, 331 4th St., is stated to have been selected to prepare plans for 12 colonial brick 12-room houses for John Flte, to cost $18,000 each.

Appleton, Wis.—Capt. N. M. Edwards will erect a 3-story flat, at a cost of $15,000.

Chicago, Ill.—Plans are stated to have been filed by Colling & Morris for 3-story apartments at 565-8 50th Pl.

San Francisco, Cal.—Albert Sutton, Safe Deposit Bldg., is stated to have prepared plans for a 5-story apartment house to be erected on Pine and Hyde Sts. for E. T. Osborn; cost, $125,000.

Plans are stated to have been prepared by Cunningham & Politeo, Academy of Science Bldg., for a 6-story brick apartment house to be erected at Pine and Taylor Sts., to cost $60,000. Montell Taylor is reported interested.

SCHOOLS.

Quincy, Mass.—The lowest bid opened on Dec. 15 by Comr. of Pub. Wks. Chas. F. Knowlton, for erecting a 10-room school at Quincy Point, is stated to have been submitted by Geo. Howard, at $40,598.

Boston, Mass.—Bids will be received Dec. 31 by the Schoolhouse Comrs. for erecting a primary school at Horace and Byron Sts., exclusive of heating, plumbing and electrical work. Whitman & Hood, Archts., 62 Devonshire St. Bids will also be received Dec. 29 for ventilating and heating the primary school at Huntington Ave. and Kenwood Road. Wheelwright & Haven, Archts., Colonial Bldg. Also at the same time for installing a plumbing system in Norman St. school. Everett & Mead, Archts., 60 Devonshire St. R. Clipston Sturgis, Chmn. Schoolhouse Comrs.

G. W. Harvey, the lowest bidder, at $123,000, for the erection of the school at Huntington Ave. and Kenwood Road, has been permitted to withdraw his bid, and the School House Comrs. have awarded the contract to the next lowest bidder, Stephen Brennan, 1119 Tremont St., for $127,609. Architects, Wheelwright & Haven.

Glens Falls, N. Y.—The High School is reported to have been destroyed by fire on Dec. 17.

Braddock, Pa.—The Geo. Hogg Co., of Braddock, is stated to have secured the contract for erecting the 1st Ward School; cost, $100,000.

Monessen, Pa.—It is stated a school will be erected here, to cost $50,000.

New York, N. Y.—A permit has been issued for a 4-story brick school to be erected on 126th St. and 2d Ave., to cost $130,000. Archt., C. B. J. Snyder, 59th St. and Park Ave.

Bids will be received Jan. 5 by C. B. J. Snyder, Supt. of School Bldgs., for installing ventilating and heating apparatus in school No. 89, on Lenox Ave.

Washington, Pa.—The citizens are stated to have voted to issue $23,000 bonds for the erection of a school.

Washington, D. C.—The Bd. of Educ. is reported to be considering the erection of a building for the Business High School, to cost about $175,000.

Dallas, Tex.—The Dallas Commercial College is reported as having plans prepared for a 3-story building, to cost about $15,000.

Lawton, Okla. Ter.—The School Bd. is stated to have selected the plans of F. H. Grubb for the proposed High School, to cost about $25,000, and those of J. A. Craine for the Ward School, to cost $15,000.

Beaumont, Tex.—See "Sewerage and Sewage Disposal."

Colorado Springs, Col.—It is stated that a high school will be erected at Grant Ave. and Bway, to cost $200,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Philadelphia, Pa.—The Finance Com. of Council has recommended an appropriation of $693,850 for street cleaning and $516,700 for the removal and disposal of garbage and dead animals.

Marietta, O.—The Dixon Crematory Co., of Dayton, is stated to have secured the contract for erecting a crematory at Marietta, to cost $15,000.

Ft. Dodge, Ia.—The International Waste Utilization Co. is stated to have presented to Council a proposition providing for the construction of a plant for the disposal of garbage.

GOVERNMENT WORK.

Buffalo, N. Y.—Bids will be received at the U. S. Engr. Office, Buffalo, until Jan. 22 for channel and basin excavation in Lake Erie entrance to Black Rock Harbor and Erie Basin at Buffalo, as advertised in The Engineering Record.

New York, N. Y.—The U. S. Senate is ststed to have passed a bill providing for the removal of a rock in the North River; it will cost from $25,000 to $45,000.

Charleston, S. C.—The following bids were opened Dec. 20 by M. T. Endicott, Chief of Bureau of Yds. & Docks, Washington, for constructing at Navy Yard *A*, joiner shop, *a*, same according to bidder's own proposal; *B*, machine shop, *b*, same according to bidder's proposal: L. P. Hazen & Co., Cincinnati—*A*, $114,692; *B*, $124,224. A. B. Stannard, New York—*A*, $122,000; *a* and *b*, $240,000; *B*, $129,500. N. Y. Continental-Jewell-Filtration Co., N. Y. City—*A*, $97,545. Snare & Triest, N. Y. City—*A*, $114,800; *B*, $128,900. G. W. Waring, Columbia, S. C.—*A*, $119,221; *B*, $124,313. Congress Constn. Co., Chicago—*A*, $116,000; *B*, $132,000. Penn Bridge Co., Beaver Falls, Pa.—*A*, $109,790; *B*, $118,644. Grant Wilkins, Atlanta—*A*, $115,000; *a*, $107,700; *B*, $135,000; *b*, $120,000.

Milwaukee, Wis.—The following bids were opened Dec. 18 by Maj. J. G. Warren, Corps of Engineers, U. S. A., for constructing a concrete superstructure on the breakwater and on the North Harbor pier—A, Gillen & Gillen, Racine; B, The Lydon & Drews Co., Chicago; C, Samuel O. Dixon, Milwaukee; D, Chas. Forrestal, Milwaukee; E, Wm. H. Gillen, Milwaukee; F, Hausler & Lutz Towing & Dock Co., Chicago; E is lowest bidder for breakwater, amount $125,825:

	For Breakwater.					
Bidders.	Removing old work, 2,450 lin. ft.	Norway pine, 75 M. ft.	Bolts & spikes 10,000 lbs.	Concrete blks. 4,500 cu. yds	Concrete, 7,000 cu. yds.	Riprap, 3,000 tons.
A.	$8.50	$50.00	6c.	$10.25	$10.00	$1.50
B.	31.00	65.00	5c.	10.00	10.00	2.65
C.	28.00	60.00	5c.	9.20	9.20	2.50
D.	19.85	50.00	5c.	6.50	6.50	1.00
E.	7.00	40.00	5c.	9.25	8.50	1.35
F.	14.00	35.00	5c.	8.50	7.00	1.25

For North Harbor Pier.

	B	C	E	F
Removing old work, 1,050 lin. ft.	$31.00	$28.00	$7.00	$12.00
Norway pine, 60.29 M ft.	65.00	60.00	40.00	35.00
White oak, 13.73 M ft.	85.00	80.00	60.00	60.00
Norway sheet piles, 277.2 M ft.	55.00	50.00	40.00	50.00
Round piles, 7,890 lin. ft.	.40	.35	.35	.30
Wire spikes, 3,908 lbs.	.05	.04	.04	.05
Bolts and spikes, 6,000 lbs.	.05	.05	.05	.05
Screw bolts, 25,775 lbs.	.12	.10	.05	.05
Broken stone, 800 cu. yds.	2.25	2.00	1.75	1.50
Concrete blocks, 1,900 cu. yds.	10.00	9.20	9.25	8.50
Concrete in place, 3,700 cu. yds.	10.00	9.20	8.50	7.00
Totals	$117,427	$106,891	$76,605	$76,795

Brooklyn, N. Y.—A permit has been issued for a 2-story brick school to be erected on Albany Ave. and Maple St., to cost $90,000. Archt., C. B. J. Snyder, N. Y. City.

Madison, Wis.—T. W. Jennings, of the University, is stated to have about completed plans for a chemistry building for the University, to be located at Mary St. and University Ave.

Stryker, O.—The High School is reported destroyed by fire Dec. 9.

Versailles, Ind.—It is stated $30,000 bonds will be issued for a new school.

Cedar Falls, Ia.—The Bd. of Trus. is stated to have accepted plans for a gymnasium for the Iowa State Normal School, to cost $60,000.

Marion, Ind.—It is stated that a contract will be awarded about Jan. 1 for the erection of a high school. Architect, Hiram Elder, Custer Blk.

Milwaukee, Wis.—Bids will be received Jan. 24 by the Bd. of Pub. Wks. for erecting an 18-room school, including ventilating, steam heating, plumbing and an approved smoke-consuming apparatus; estimated cost, $75,000. Chas. J. Poetsch, Chmn. Bd. of Pub. Wks.

Akron, O.—Buchtel College is reported considering the erection of a chemical laboratory, to cost about $40,000.

Milwaukee, Wis.—Bids are wanted Dec. 31 for erecting a school on 14th and Galena Sts., including ventilating and steam heating. Chas. J. Poetsch, Chmn. Comrs. of Pub. Wks.

Emporia, Kan.—Latimer & Benning, of Kansas City, are stated to have secured the contract for erecting the public building here, for $34,657.

Chilocoo, Okla. Ter.—The only bid received on Dec. 11 for erecting the stone dormitory at Chilocoo Indian School, is stated to have been submitted by Geo. E. Hooper, of Arkansas City, Kan., for $24,200.

Chattanooga, Tenn.—Bids are wanted Jan. 22 for erecting, heating, plumbing and gas piping brick hospital building at new Military Post in Chickamauga Park. Address Capt. H. J. Slocum, Cav. Q. M.

White Eagle, Okla. Ter.—Bids are wanted Jan. 10 for furnishing material and constructing a bridge over the Red Rock Creek at the Otoe Agency; length of bridge 144 ft., 64-ft. main span, to be of steel. John Jensen, Indian Agent.

Mobile, Ala.—The following bids for building locks and dams Nos. 1, 2 and 3, Warrior and Tombigee Rivers, Ala., were received by Capt. Spencer Cosby, Corps Engrs., U. S. A., Dec. 23: The New York Continental Jewell Filtration Co., 15 Broad St., N. Y., $791,218; the Union Development & Construction Co., Ltd., of New Orleans, La., $813,528.

MISCELLANEOUS.

Providence, R. I.—The Council on Dec. 15 passed a resolution providing for the purchase of property on Plainfield St. and Sunset Ave., at a cost of $44,000 for park purposes.

The contract for cement, bids opened Dec. 23, has been awarded as follows: To Fredk. E. Shaw, 5,000 bbls. of Portland cement, and the H. R. Horton Co., 7,000 bbls. natural cement. Both parties of Providence.

Boston, Mass.—The following bids were opened Dec. 16 by the Boston Transit Comn. for the construction of Section D, East Boston tunnel:

Bidders and Addresses.	5,000 cu. yds. earth excav.	1,300 cu. yds. concrete	40 tons steel.	1,600 sq. yds. Port. cem. coating.	1,600 sq. yds. pitch or asph. coating.	1,800 sq. yds. block paving relaid.	Totals.
T. F. Welch W. Roxbury	$5.00	$10.00	$4.00	$2.00	$1.00	$0.75	$44,310
Metropolitan Contg. Co., Boston	5.25	9.75	30.00	0.79	0.50	1.00	43,989
E. W. Everson & Co., Boston	4.50	11.20	40.00	0.45	0.40	1.00	41,820
Jones & Meehan, Boston	4.25	11.40	20.00	0.50	0.30	1.25	40,400
McGawley & Coughlan, Dorchester	4.50	9.00	20.00	0.65	0.50	0.72	38,136
Patrick McGovern, Roxbury	2.90	12.50	25.00	0.50	0.25	0.75	34,300
H. P. Nawn, Roxbury*	3.50	10.00	8.00	0.65	0.30	0.60	33,420

*Awarded contract.

New York, N. Y.—Bids will be received Jan. 2 by McDougall Hawkes, Comr. of Docks, for furnishing and delivering about 10,000 bbls. of Portland cement. Bids will be received Jan. 8 by the Park Bd. for laying out Thomas Jefferson Park; also on same date for furnishing material and erecting a pavilion in Wm. H. Seward Park. Wm. R. Willcox, Chmn. Comrs. of Parks.

New York, N. Y.—Bids will be received Dec. 30 by Thos. Sturgis, Fire Comr., for furnishing material for constructing and delivering fire pumps for a new fireboat.

Brooklyn, N. Y.—Bids are wanted Dec. 29 (extension of date) for furnishing and erecting wrought iron picket fence along Shore Road and iron gates in New Lots and Linton Parks, for furnishing and delivering 6,600 cu. yds. of Hudson River road gravel in parks and parkways as required, for furnishing and delivering 6,000 cu. yds. of crushed trap rock and 3,000 cu. yds. of trap rock screenings on parkways, all in the Boro. of Brooklyn; for furnishing and delivering 7,550 cu. yds. of blue limestone and 6,700 cu. yds. of blue limestone screenings on parks and parkways in the Boros. of Brooklyn and Queens. Wm. R. Willcox, Chmn. Park Comrs., N. Y. City.

Jersey City, N. J.—The Board of Finance on Dec. 17 passed the resolution placing $60,000 at the disposal of the Street & Water Bd. to pay for the additional land to be purchased to enlarge River View Park, on Ogden Ave.

Philadelphia, Pa.—The Finance Com. of Council has recommended an appropriation of $100,000 for sand for the filtration plant.

Brooklyn, N. Y.—The only bidder Dec. 24 for 42,000 cu. yds. of dredging in Gowanus Canal, etc., was the Morris & Cummings Dredging Co., 17 State St., at 71 cts. per yd., which is considered too high.

Augusta, Ga.—The Governor is stated to have approved the bill authorizing the construction of a dam across Savannah River, above Augusta.

Lorain, O.—It is stated that the Baltimore & Ohio R. R. Co. will make extensive improvements to its docks in Lorain. Engineers are preparing plans for the work.

Cincinnati, O.—It is stated that about $60,000 will be expended on improvements at the Zoological Garden.

Laporte, Ind.—The contract for straightening part of Kankakee River, between Laporte and Starke Counties, is stated to have been awarded by the Kankakee Reclamation Co. to Pollard & Goff, of Champaign, Ill., and John McAndrews, of Bradley, Ill., for about $81,000.

Memphis, Tenn.—H. N. Phsrr, of Memphis, Ch. Engr. of the St. Francis Levee Bd. of Ark., writes that it is proposed to build a levee at Walnut Bend, Ark., on the Mississippi River, to cost $90,000. Work will be done during next season. Capt. E. W. Lucas, Corps Engrs. U. S. A., of Memphis, will be engineer in charge. He also states that it is proposed to construct 2 miles of revetment protection for the levee at Kemps Bend, just below Baton Rouge, La., and this work will probably be started next season, and will cost about $200,000. Capt. Chas. S. Bromwell, Corps Engrs. U. S. A., 3232 Prytania St., New Orleans, La., will have charge of this work, and should be addressed for further information.

NEW INDUSTRIAL PLANTS.

The John Zunner Health Beer Co., 10 Booth's Block, New Britain, Conn., will erect a 2 and 3-story brewery, 84 ft. square, to have an annual capacity of 25,000 to 50,000 bbls.

The Siluria Cotton Mill Co., McGowan Building, Birmingham, Ala., expects to erect a 2-story mill about 250x75 ft., to contain 10,000 spindles. The capacity of the power plant, when completed, will be 600 H.-P., and at present will probably consist of the high-pressure side of a cross compound horizontal engine direct connected to a 450-Kw. generator. T. C. Thompson, Pres.; Brevard D. Miller, Secy. & Treas.

August Tiesse, 801 N. Second St., Clinton, Ia., is interested in the erection of a 30,000-bbl. brewery.

James D. Shelby, Junction City, Ky., wishes to correspond with makers of machinery for canning and broom factories.

Oscar Krebs, Ottawa, O., will install a 5-ton foundry.

Spencer Kellogg, 375-381 Ellicott Square, Buffalo, N. Y., will erect a linseed-oil plant having a yearly output of 300,000 bbls. and 100,000 tons of linseed-oil cake. The plant will be driven electrically.

The Bittner Fire Clay & Brick Co., New Castle, Pa., expects to erect a plant having a daily capacity of 40,000 at Volant, Pa. The capacity of the power plant will be 200 H.-P.

Kaltenbach & Griess, Cleveland, O., are consulting engineers for the new plant to be erected by the Interstate Engineering Co., of that city.

Neil C. Sullivan, Longmont, Colo., writes that the Havemeyers will build a 600 or 1,200-ton beet-sugar plant. The site has been bought and beets contracted for.

BUSINESS NOTES.

The Waterloo, Ia., Gasoline Engine Co. is to be reincorporated with an increase of capital stock from $40,000 to $150,000. The new arrangement will include the consolidation of the company with the Davis Gasoline Engine Co. into the Waterloo Motor Works, which will make automobiles, and stationary, portable and pumping gasoline engines.

The Maiden Creek Portland Cement Co., principal office at 15 Exchange Place, Jersey City, N. J., has been incorporated with a capital of $1,000,000 by K. K. McLaren, Raymond Newman and H. S. Gould.

The firm of Snare & Triest, 39 Cortlandt St., New York, contracting engineers, has been incorporated with a capital of $600,000 for the purpose of increasing facilities for handling its business. The directors are Frederick Snare, W. G. Triest and H. M. Dunn.

The Ball Engine Co., Erie, Pa., reports the following among recent sales: 125 H.-P. for the Osgood, Ind., Light Co.; 100 H.-P. for the American Car Co., St. Louis, and 200 H.-P. for the Arkansas & Texas Consolidated Ice & Coal Co., Marshall, Tex.

The American Blower Co., Detroit, reports a number of large orders on its books, among which it mentions one from the Geo. H. Hammond Co., Chicago, for sixteen large steel-plate fans; three from the Lehigh Valley Coal Co., New York, for forced draft fans for Centralia and Wilkesbarre, Pa.; induced draft apparatus for the Corinth, N. Y., mill of the International Paper Co.; Princeton, N. J., University, and the Binghamton, N. Y., Electric Light & Power Co.

The Pittsburg Coal Co. has given an order for six 150-H.-P. tubular boilers for its various mines, to the Pittsburg, Pa., Gage & Supply Co. The Penfield, Pa., Coal Co. has also placed an order with this company for a 40-H.-P. Chandler & Taylor engine and a 50-H.-P. horizontal tubular boiler.

The Union Railway Co. is about to build a large sub-station at West Farms, New York City, for which it has purchased from the Westinghouse Electric & Mfg. Co. three 1,000-Kw., 3-phase rotary converters, with starting motors, self-cooling, oil-insulated transformers and A. C. and D. C. switchboards. Transmission will be at 6,300 volts and 3,000 alternations. The A. C. switchboard will be equipped with the new Westinghouse, Type C, oil-break, electrically operated switches, which are being installed in the Bayard Street station of the Metropolitan St. Ry. Co. of New York.

The New England Structural Co. has moved its Boston office from Post Office Square to the eleventh floor of the new building at 110 State St., Boston.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Dec. 30. Brooklyn, N. Y. .... Dec. 20
Dec. 30. New York, N. Y. .... Dec. 20
Dec. 30. Long Island City, N. Y. .... Dec. 20
Dec. 30. Searcy, Ark. .... Dec. 20
Dec. 31. Baltimore, Md. .... Dec. 27
Jan. 1. Julesburg, Colo. .... Dec. 27
Jan. 1. El Reno, Okla. Ter. .... Dec. 20
Jan. 1. Sacramento, Cal. .... Nov. 22
Jan. 2. Long Island City, N. Y. .... Dec. 27
Jan. 2. Kansas City, Mo. .... Dec. 6
Adv., Eng. Record, Dec. 6 to 20.
Jan. 3. Milwaukee, Wis. .... Dec. 27
Jan. 3. Pomona, Cal. .... Dec. 20
Jan. 5. Wessington Springs, S. D. .... Dec. 27
Jan. 5. South St. Paul, Minn. .... Dec. 20
Jan. 6. Centralia, Ill. .... Dec. 27
Jan. 6. Ardmore, Ind. Ter. .... Dec. 20
Jan. 7. Centerville, Miss. .... Dec. 20
Jan. 9. Lakewood, O. .... Dec. 20
Jan. 12. South Brooklyn, O. .... Dec. 27
Jan. 12. South McAlester, Ind. Ter. .... Dec. 27
Jan. 15. St. Paul, Minn. .... Dec. 20
Jan. 20. Evans, Colo. .... Dec. 27
Jan. 30. Havre, Mont. .... Dec. 27
—— Meters, Schenectady, N. Y. .... Dec. 13

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 31. Brooklyn, N. Y. .... Dec. 20
Jan. 2. Cincinnati, O. .... Dec. 13
Jan. 3. Pumping Station, Washington, D. C. .... Nov. 15
Adv., Eng. Record, Nov. 15, Dec. 6.
Jan. 5. Lawton, Okla. Ter. .... Dec. 13
Jan. 7. Fernandina, Fla. .... Dec. 13
Jan. 6. New Britain, Conn. .... Dec. 20
Adv., Eng. Record, Dec. 20, 27.
Jan. 6. Columbus, O. .... Dec. 13
Adv., Eng. Record, Dec. 13 to 27.
Jan. 8. Cleveland, O. .... Dec. 20
Jan. 9. Lakewood, O. .... Dec. 20
Jan. 16. Clay Center, Kan. .... Dec. 20
Jan. — Walnut, Ill. .... Dec. 13
Feb. 2. New Orleans, La. .... Nov. 29
Adv., Eng. Record, Nov. 29 to Dec. 27.
Feb. — Dixon, Ill. .... Dec. 13

BRIDGES.

Dec. 30. Huntington, Ind. .... Dec. 20
Dec. 30. Georgetown, Colo. .... Nov. 29
Dec. 31. Terre Haute, Ind. .... Dec. 13
Jan. 1. Rome, N. Y. .... Dec. 13
Jan. 5. Newton, Ia. .... Dec. 27
Jan. 5. Montezuma, Ia. .... Dec. 6
Jan. 5. Cumberland, Md. .... Nov. 29
Jan. 6. Stockton, Cal. .... Dec. 13
Jan. 6. Grand Junction, Colo. .... Dec. 13
Jan. 7. Olivet, S. D. .... Dec. 13
Jan. 7. Colfax, Wash. .... Dec. 13
Jan. 7. Webster, S. D. .... Nov. 29
Jan. 10. White Eagle, Okla. Ter. .... Dec. 27
Jan. 12. Scranton, Pa. .... Dec. 20
Jan. 12. Tacoma, Wash. .... Dec. 20
Jan. — Peoria, Ill. .... Dec. 13

PAVING AND ROADMAKING.

Dec. 30. St. Louis, Mo. .... Dec. 20
Dec. 30. St. Augustine, Fla. .... Dec. 6
Jan. 3. Madison, Wis. .... Dec. 13
Jan. 5. Cincinnati, O. .... Dec. 27
Jan. 5. Toledo, O. .... Dec. 13
Jan. 6. Cleveland, O. .... Dec. 20
Jan. 6. Cincinnati, O. .... Dec. 13
Jan. 10. Ft. Myer, Va. .... Dec. 13
Adv., Eng. Record, Dec. 13 to 27.
Jan. 15. Washington, Ia. .... Dec. 27
Jan. 15. Ft. Collins, Colo. .... Dec. 27
Jan. 19. Toledo, O. .... Dec. 27
Jan. 19. Cincinnati, O. .... Dec. 27
Feb. 14. Lafayette, Ind. .... Dec. 27

POWER, GAS AND ELECTRICITY.

Dec. 30. Searcy, Ark. .... Dec. 20
Jan. 1. Effingham, Ill. .... Dec. 20
Jan. 3. Abilene, Tex. .... Dec. 13
Jan. 5. Winona, Minn. .... Dec. 20
Adv. Eng. Record, Dec. 20.
Jan. 10. Crystal Falls, Mich. .... Dec. 27
Adv., Eng. Record, Dec. 27.
Jan. 12. Hot Springs, Ark. .... Dec. 13
Jan. 15. Rome, Ga. .... Oct. 11
Jan. 30. Havre, Mont. .... Dec. 27
Jan. — South Norwalk, Conn. .... Dec. 13
Feb. 12. Guayaquil, Ecuador .... Dec. 20
Mar. 4. Franchise, Manila, P. I. .... Nov. 15

GOVERNMENT WORK.

Dec. 29. Mobile, Ala. .... Dec. 6
Adv., Eng. Record, Dec. 6 to 27.
Dec. 29. Ft. Banks, Mass. .... Dec. 6
Dec. 30. Annapolis, Md. .... Dec. 20
Dec. 31. Haines, Alaska .... Dec. 20
Dec. 31. Ft. Terry, N. Y. .... Dec. 20
Jan. 2. Jackson, Miss. .... Dec. 20
Jan. 2. Boston, Mass. .... Dec. 6
Jan. 3. Richmond, Va. .... Dec. 6
Adv., Eng. Record, Dec. 6 to 27.
Jan. 3. Elevator, Helena, Mont. .... Dec. 6
Jan. 3. Wall, Philadelphia, Pa. .... Dec. 6
Jan. 5. Ft. Screven, Tybee Is., Ga. .... Dec. 20
Jan. 5. Boston, Mass. .... Dec. 6
Jan. 6. Ft. Townsend, Wash. .... Dec. 20
Jan. 6. St. Louis, Mo. .... Dec. 6
Jan. 7. Newport, R. I. .... Dec. 20
Jan. 7. Hospital (Ft. Greble), Newport R. I. .... Dec. 13
Adv., Eng. Record, Dec. 13 to 27.
Jan. 8. Mobile, Ala. .... Dec. 6
Jan. 9. Plattsburg Barracks, N. Y. .... Dec. 20
Jan. 9. Portland, Ore. .... Dec. 20
Jan. 10. White Eagle, Okla. Ter. .... Dec. 27
Jan. 10. New Orleans, La. .... Dec. 20
Jan. 10. New York, N. Y. .... Dec. 20
Jan. 12. Mobile, Ala. .... Dec. 20
Jan. 12. Washington, D. C. .... Dec. 13
Adv., Eng. Record, Dec. 13, 20.
Jan. 13. Superior, Wis. .... Dec. 20
Jan. 14. Steel towboat, Memphis, Tenn. .... Dec. 20
Adv., Eng. Record, Dec. 20, 27.
Jan. 14. Helena, Mont. .... Dec. 6
Adv., Eng Record, Dec. 6, 13.
Jan. 15. Duluth, Minn. .... Dec. 20
Adv., Eng. Record, Dec. 20, 27.
Jan. 15. Los Angeles, Cal. .... Dec. 20
Jan. 15. Chemawa, Ore. .... Dec. 20
Jan. 15. Newport, R. I. .... Dec. 13
Adv., Eng. Record, Dec. 13 to 27.
Jan. 15. Norfolk, Neb. .... Dec. 6
Jan. 15. Machinery for dredge, Wash'ngton, D.C. .... Nov. 29
Adv., Eng. Record, Nov. 29 to Dec. 13.
Jan. 17. Charleston, S. C. .... Dec. 20
Jan. 17. Bldg., Philadelphia, Pa. .... Dec. 20
Jan. 22. Chattanooga, Tenn. .... Dec. 27
Jan. 22. Buffalo, N. Y. .... Dec. 27
Adv., Eng. Record, Dec. 27.
Jan. 22. Dredging, Boston, Mass. .... Dec. 20
Adv., Eng. Record, Dec. 20, 27.
Feb. 7. Dry dock, Philadelphia, Pa. .... Dec. 20
Mar. 14. Dry dock, Cavite, P. I. .... Dec. 20

BUILDINGS.

Dec. 29. School, Boston, Mass. .... Dec. 27
Dec. 29. School, New York, N. Y. .... Dec. 20
Dec. 29. School, Brooklyn, N. Y. .... Dec. 20
Dec. 29. Htg. school, Long Island City, N. Y. .... Dec. 20
Dec. 29. Jail, Marion, Ind. .... Dec. 6
Dec. 30. School, St. Henry, O. .... Dec. 20
Dec. 30. School, Ft. Wadsworth, N. Y. .... Dec. 20
Dec. 30. School, Brooklyn, N. Y. .... Dec. 20
Dec. 30. Wiring school, Long Is. City, N. Y. .... Dec. 20
Dec. 30. Htg. pub. bldg., Victoria, B. C. .... Dec. 20
Dec. 30. Mason temple plans, Washington, D.C. .... Oct. 11
Dec. 31. Engine House, Chicago, Ill. .... Dec. 27
Dec. 31. School, Boston, Mass. .... Dec. 27
Dec. 31. Hospital, New York, N. Y. .... Dec. 27
Dec. 31. Milwaukee, Wis. .... Dec. 27
Dec. 31. Pub. bldg. plans, Camden, N. J. .... Dec. 20
Dec. 31. Church, Huntington, Ind. .... Dec. 13
Jan. 1. School, Marion, Ind. .... Dec. 27
Jan. 1. Schools, Huntington, W. Va. .... Dec. 13
Jan. 2. Bus. bldg., St. Marys, O. .... Dec. 20
Jan. 5. School, New York, N. Y. .... Dec. 27
Jan. 5. Pub. Bldg., New York, N. Y. .... Dec. 27
Jan. 6. Pub. Bldgs., Lake Charles, La. .... Dec. 27
Jan. 7. Jail, Morristown, Tenn. .... Dec. 6
Jan. 8. Pavilion, New York, N. Y. .... Dec. 27
Jan. 12. School, Columbus, O. .... Dec. 20
Jan. 12. Church, Chepstow, Ont. .... Dec. 13
Jan. 14. Court House, Hichman, Ky. .... Dec. 20
Jan. 15. Hospital, Toledo, O. .... Dec. 27
Jan. 15. School plans, Beaumont, Tex. .... Dec. 20
Jan. 15. Library, Winnipeg, Man. .... Dec. 13
Jan. 15. Library plans, Binghamton, N. Y. .... Nov. 15
Jan. 17. Roundhouse, Dennison, Tex. .... Dec. 27
Jan. 20. Bus. bldg, Flint, Mich. .... Dec. 20
Jan. 23. Jail, Grand Junction, Colo. .... Dec. 13
Jan. 24. School, Milwaukee, Wis. .... Dec. 27
Jan. 30. School, Geneseo, N. Y. .... Dec. 13
Jan. 31. Church, Scotchbridge, O. .... Nov. 29
Jan. — Church, Marine City, Mich. .... Dec. 27
Feb. 1. Office Bldg., Flint, Mich. .... Dec. 27
Feb. 1. Pub. Bldg. Plans, Louisville, Ky. .... Dec. 27
Feb. 1. School, Dickinson, N. Y. .... Dec. 6
Feb. 2. City Hall, Houston, Tex. .... Dec. 13
Feb. 28. Pub. bldg plans, Columbus, O. .... Dec. 20

MISCELLANEOUS.

Dec. 29. Sand, Brooklyn, N. Y. .... Dec. 27
Dec. 30. Fire pumps, New York, N. Y. .... Dec. 27
Jan. 1. Boston, Mass. .... Dec. 20
Jan. 2. Cement, New York, N. Y. .... Dec. 27
Jan. 2. Breakwater, Sandy Cove, N. S. .... Dec. 20
Jan. 2. El. R. R. Franchise, Vallejo, Cal. .... Nov. 22
Jan. 8. Park, New York, N. Y. .... Dec. 27
Jan. 8. El. ry. franchise, Oroville, Cal. .... Dec. 20
Jan. 14. Dredging, Chicago, Ill. .... Nov. 22
Mar. 4. St. Ry. franchise, Manila, P. I. .... Nov. 15
—— R. R. work, Cincinnati, O. .... Dec. 20